SUDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF GRADUATE STUDIES

THE PROCESS OF PLANNING& SCHEDULING IN CONSTRUCTION PROJECTS IN SUDAN

(Towards optimum applications).

عملية التخطيط والجدولة في مشروعات التشييد بالسودان

(نحو التطبيقات المثلى)

FOR PARTIAL FULFILMENT FOR M.Sc DEGREE IN CONSTRUCTION MANAGEMENT

CENTER OF ENGINEERING AND TECHNICAL STUDIES

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بسم الله الرحمن الرحيم

الآيـــــة

اللهُ نُورُ(السَّمَاوَاتِ وَالأَرْضِ مَثَلُ نُورِهِ كَمِشْكَاةٍ فِيهَا
مِصْبَاحٌ الْمِصْبَاحُ فِي زُجَاجَةٍ الزُّجَاجَةُ كَأَنَّهَا كَوْكَبٌ
يُوقَدُ مِن شَجَرَةٍ مُّبَارَكَةٍ زَيْتُونَةٍ لاَّ شَرْقِيَّةٍ وَلاَ غَرْبِيَّةٍ
يَكَادُ زَيْتُهَا يُضِيءُ وَلَوْ لَمْ تَمْسَسْهُ نَارٌ نُّورٌ عَلَى نُورٍ
يَهْدِي اللهُ لِنُورِهِ مَن يَشَاءُ وَيَضْرِبُ اللهُ الأَمْثَالَ لِلنَّاسِ
وَاللهُ بِكُلِّ شَيْءٍ عَلِيمٌ)

صدق الله العظيم

سورة النور : آية 35

Dedication

To my family

Relative

and

Friends

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First of all thanks to" ALLAH", I deeply indebted to my supervisor Dr . Salah Eldain Abdul-Aziz Ajban for his supervision, guidance, support and help. And I would like to thank everybody who contributed to the success of this work.

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Abstract:

The primary objective of this research is scientific knowledge to the process of planning, scheduling and their application in construction projects in Sudan and see the obstacles impeding the implementation of this concept and know how to scientific planning and sound the ability to apply it and work done in a satisfactory manner.

Attention to planning and scheduling in construction industry project in Sudan requires attention to projects achievement in scientific and study methods, that must be from the start to form a preliminary idea and point and acknowledge all factors effect to the project performance and putting a clear picture for implementation and ability of controlling and monitoring of the execution based on planned time table designed by planned engineer s/he put all factors effect to project such as time factor as a key factor as well as quality and cost, resource utilization effectiveness. During the execution generate the updating time table and resource leveling and preparing budget to best uses of available resources.

The research aims to highlight the potential for the massive planning process and scheduling of construction projects in terms of take advantage of all resources available to complete work image pathological all parties and the advancement of this industry in our beloved country and develop an understanding of the engineer to further job performed in any field and know that any project is the work of a collective because team work and mutual understanding leads to better result in addition to out of the circle that the time program is only in the bidding stage in many companies it is just to see the beginning and end of project and the lack of studies as required.

ملخص البحث :

إن الهدف الأساسي من هذا البحث هو المعرفة العلمية لعملية التخطيط والجدولة ومدى تطبيقها في مشاريع التشييد في السودان ومعرفة المعوقات التي تعوق تطبيق هذا المفهوم ومعرفة كيفية وضع تخطيط علمي وسليم والمقدرة على تطبيقه والعمل به بصوره مرضيه .

الاهتمام بعملية التخطيط والجدولة في مشاريع التشييد في السودان يتطلب الاهتمام بتنفيذ المشاريع بطرق علميه مدروسة و يجب أن نضع فكرة و نقاط ابتدائية و معرفة كل العوامل المؤثرة على أداء المشروع ووضع تصور واضح للتنفيذ و إمكانية المتابعة و المراقبة اعتماداً على البرنامج الزمني الموضوع بواسطة مهندس التخطيط الذي يضع في اعتباره كل العوامل المؤثرة مثل عامل الزمن كعامل أساسي بالإضافة لعاملي الجودة و التكلفة، فاعلية استخدام الموارد كما أنه أثناء التنفيذ يجب الاهتمام بعملية تحديث البرنامج الزمني وعمل موازنة لموارد المشروع بالإضافة لتجهيز ميزانيات المشروع لاستخدام أمثل للموارد المتاحة.

يهدف البحث لإلقاء الضوء للإمكانيات الهائلة لعملية التخطيط والجدولة في مشاريع التشييد من حيث الاستفادة من كل الموارد المتاحة لإتمام العمل بالصورة المرضية لكل الأطراف والنهوض بهذه الصناعة في بلادنا الحبيبة و تطوير فهم المهندس لأبعد من الوظيفة التي يؤديها في أي مجال ومعرفة أن أي مشروع هو عمل جماعي لأن العمل الجماعي والفهم المتبادل يؤدى لأفضل النتائج بالإضافة للخروج من دائرة أن البرنامج الزمني يكون فقط في مرحلة العطاء آت في كثير من الشركات وهو فقط لمعرفة بداية ونهاية المشروع وعدم دراسته بالصورة المطلوبة.

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CHAPTER ONE

RESEARCH COMPONENTS

1.1 : INTRODUCTION

1.2 : RESEARCH CONTENTS

1.1: Introduction:

The effective planning and control of construction projects requires the application of systematic and logical methods and tried and tested techniques aimed at ensuring successful project outcomes for the client, the contractor and all other project participants. Control is not possible without a plan, and without a programme there is no effective means of exercising control.

Successful projects cannot happen in vacuum, however, and no-one can effectively plan and control a construction project without understanding the culture and methodologies of the industry that organizes and carries out the work, and the impact of the various procurement strategies open to the client.

Construction is a large and complex industry comprising many types and sizes of organizations and a diverse range of professional and other represent bodies. Clients, professional practices, contractors and specialist firms all have their own "agenda" and allegiances .

Construction Industry in Sudan Started Very Simple and then developed in an Increasing pattern and becomes now one of the biggest industries in Sudan. The concern with it increases as a result of the development in all life types and communication with external world. Theses make the private and public sectors concern with new construction techniques that issued in the world and the possibility of applying them in Sudan regarding local conditions.

The view of developing of construction industry is different between first and third world countries in many things such as quality, safety …etc; recently a boom is happened in construction industry in Sudan after the investment of foreign companies and increasing of awareness of construction modern techniques particularly in the existence of large projects in Sudan. (1)

1.2: Research Contents:

1.2.1: Scope of research:

The increasing demands for construction industry products in Sudan rather than other industries necessitates intensive focusing on important rules of planning and scheduling process, and accordingly using of standardized methods to accomplish the missions challenging the industry. Taking right decisions in suitable times for any problems facing the execution of the project with scientific and right methods is as important as one of the industry objectives is to use and manage resources efficiently.

1.2.2: Research Problem:

The research problems could be summarized in the following statements:-

1. From my personal experiences in the field of execution and planning there are no clear adoptions for the process of planning & scheduling.
2. There is no previous planning for project and consequently no leveling for the project resources and therefore problems may arise during execution phase as a result of this shortage.
3. There is no adherence to establishing perfect time scheduling which always result in many problems impacting the contractor, engineer and the owner.

1.2.3: Research Hypothesis:

1. Attention to the process of planning and scheduling to form a preliminary idea and point to put all factors effect to this process and putting a clear picture for implementation from the start before contracting might lead to high degree of completion and achieving the project objectives.
2. Controlling and monitoring the execution phase based on planned time table give chances to catch the expected problems and consequently search for speeding solutions.
3. Establishing the process of planning and scheduling perfectly and in clear bases make practical and true leveling of resources and preparing budget to best uses of available resources.
4. To reached successful planning and scheduling might concern with necessary time to start and finish project in addition to acknowledge to different division of project budget.

1.2.4: Research Objectives:

This research aims to issue some guidelines towards improving local practice of construction industry such as:-

1. Encouraging planning and scheduling process and focusing on practical application and suitable methods of execution.
2. Execution of projects in scientific professional basis.
3. Detecting the reasons behind the incompliance with the pre-set plans.
4. The procedure to be used to maintain optimum application when considering planning and scheduling in order to achieve better results.
5. Establishing systems for controlling the schedules beside the quality of works.

1.2.5: Research methodology:

The procedure used for purposes of this research depend on analysis for all problems facing the process of planning and scheduling in construction industry in Sudan by take the opinion of number of students and many planning department in many companies by using questioner. Methodology followed in this research depends on two parts as follows:-

1. Establishing a theoretical part from relevant references in the scope of the research. This composed of literature review about local and foreign practice and researches carried in the field.
2. Collection of data using scientific ways for establishing sampling and research population. Tabulation, analysis of collected data and then presenting the reached results which shall be subjected to thorough interpretation with respect and in the light of the theoretical part. General recommendations shall be established where the application of them could add positively to the output of the profession and could help in minimizing the negative impact of the common problems.

CHAPTER TWO

PROGRAMMING TECHNIQUES,CONSTRUCTION PLANNING AND MANAGEMENT TOOL

2.1: Introduction.

2.2: Project Cycle.

2.3: Construction Planning Process.

2.4: Programming Techniques.

2.5: S Curve.

2.6: Earned Value.

Chapter 2: Programming Techniques & Management Control

2.1 Introduction:

Without planning it is difficult to envisage the successful conclusion of any project or the effective control of time, money or resources. Planning is also essential in order to deal with construction risks and devise safe working methods. This is true through all stages of the process from inception through the design, tendering, construction and commissioning stages of a project.

2.2: Project Cycle:

Construction planning is fundamental and challenging activity in management and execution of construction projects. It involves the choice of technology, the definition of work tasks, the estimation of the required resources and durations for individual tasks, and the identification of any interactions among the different work tasks. Good construction plan is basis for developing the budget and scheduling for work

developing the construction plan is 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 necessary to make organizational decisions about the relation ships between project participants and even which organization to include in project for example , the extent to which sub_ contractors well be used on project is often determined during construction planning Forming construction plan is highly challenging task as **SHERLOCK HOLMES** noted:

Most people if you describe a train of event of them will tell you what the result would be. They can put those events together in their minds, and argue from them that something will come to pass. There are few people, however, who, if you told them a result, would be able to evolve from their own inner consciousness what the steps were which led up to that result.

A project is ‘’ series of activities aimed at bringing about clearly specified objectives with in defined time period and with a defined budget”. In reality, this simple definition covers an enormous variety of project types , in terms of size, aims , focus and method, never the less, there are many basic similarities.

The ‘project cycle’ is a way of viewing the main elements that projects have in common, and how they relate to each other in sequence. The precise formulation of the cycle and its phases varies from one agency to another, but the basic components are shown in (figure 2.1) below.(10)

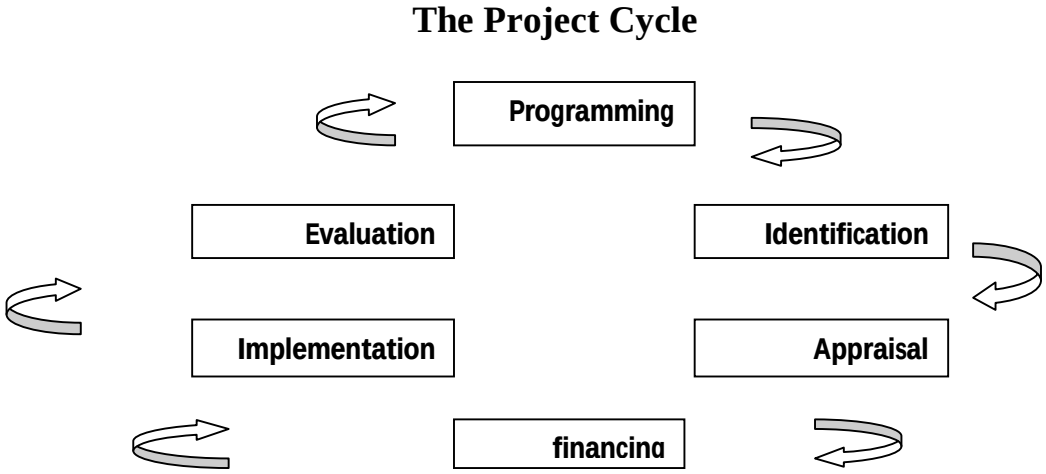


Figure (2.1): the project cycle

2.2.1: Programming:

The establishment of general guide lines and principles for cooperation agreement of pectoral thematic focus and outlining of broad ideas for project and programs.

2.2.2: Identification:

With in the programmed framework, problems, needs and interests of possible stakeholders are analyzed, ideas for projects and other actions are identified and screened.

2.2.3: Appraisal (or preparation):

All significant aspects of the idea are studied, taking into account stakeholders’ views relevance to problems, feasibility and other issues. Logical or results-based management frameworks and activity and implementation schedules. Are developed and the required inputs are calculated. The outcome is decision to take the project forward, or not.

2.2.4: Financing:

A decision is taken by the relevant parties about whether or not funds the project, based on the appraisal. Some project cycle refer to this stage as ’negotiation’ or’ approval’ and it may involve both the implementing agency and other stakeholders. (Note that financing is not always a separate stage and financial decisions may be taken at different points in the cycle).

2.2.5: Implementation:

The greed resources are used to carry out the planned activities and achieve objectives. Progress is assessed through monitoring to enable adjustment to changing circumstances. at the end of implementation, a decision should be made about whether to close or extend the project.

2.2.6: Evaluation:

This assessment of the projects achievement and impact examines the relevance and fulfillment of objectives, efficiency, effectiveness, impact and sustainability. It leads to a decision to continue, change or stop a project. And its conclusions are taken into account when planning and implementing similar projects.

2.3: Construction Planning Process:

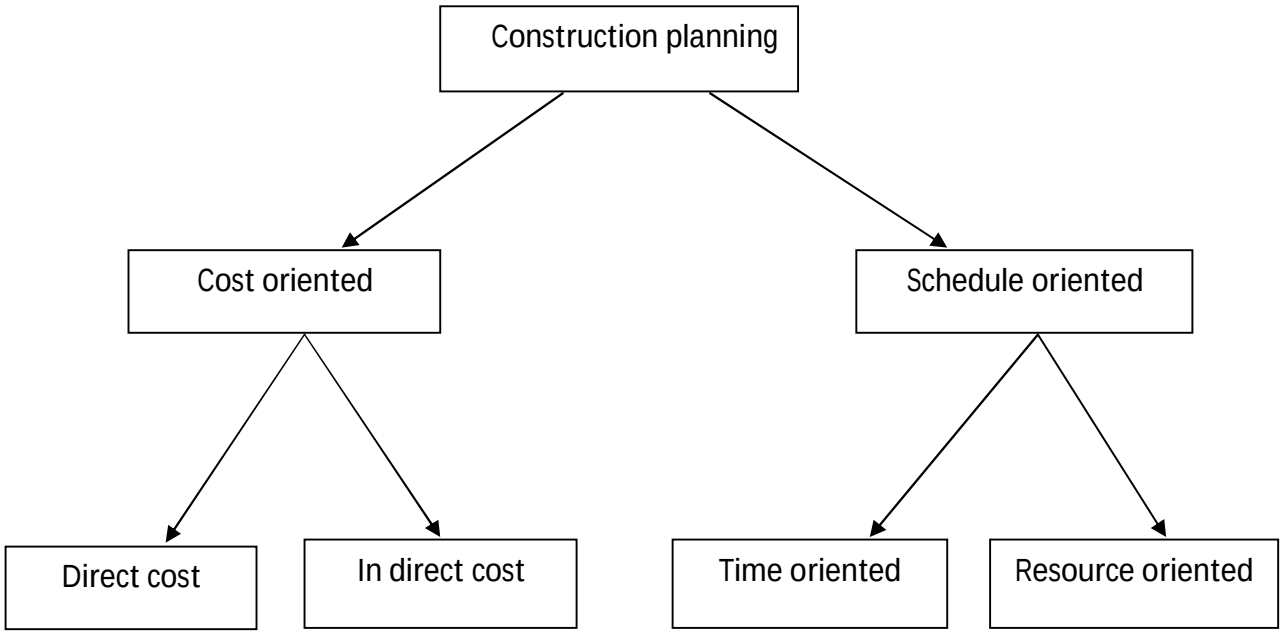


Figure (2.2): Alternative Emphases in construction planning

Construction planning is not an activity which is restricted to the period after the award of contract for construction, It should be and essential activity during the facility design, Also if problems arise during construction, re planning is required.(8)

2.3.1: The Design and Construction Process:

In the planning of facilities, it is important to recognize the close relationship between design and construction. These processes can best be viewed as an integrated system. Broadly speaking, design is a process of creating the description of a new facility, usually represented by detailed plans and specification, construction planning is a process of identifying activities and resources required to make the design a physical reality. Hence construction is the implementation of design envisioned by architects and engineers. In both design and construction, numerous operational tasks must be performed with a variety of precedence and other relationships among the different tasks. Several characteristics are unique to the planning of constructed facilities and should be kept in mind even at the very early stage of the project life cycle. These include the following:

2.3.1.1: Nearly every facility is custom designed and constructed, and often requires a long time to complete.

2.3.1.2: Both the design and construction of a facility must satisfy the conditions peculiar to a specific site.

2.3.1.3: Because each project is site specific, its execution is influenced by natural, social and other locational conditions such as weather, labor supply, local building codes, etc.

2.3.1.4: Since the service life of a facility is long, the anticipation of future requirements is inherently difficult.

2.3.1.5: Because of technological complexity and market demands, changes of design plans during construction are not uncommon. (7)

2.3.2: Labor, Material and equipment utilization:

Good project management in construction must vigorously pursue the efficient utilization of labor, material and equipment. Improvement of labor productivity should be major and continual concern of those who are responsible for cost control of constructed facilities. Material handling, which includes procurement, inventory.

Shop fabrication and field servicing, require special attention for cost reduction. The use of new equipment and innovative methods has made possible wholesale changes in construction technologies in recent decades.(3)

2.3.2.1: Labors Productivity:

Productivity in construction is often broadly defined as output per labor hour. Since labor constitutes a large part of the construction cost and the quantity of labor hours in performing a task in construction is more susceptible to the influence of management than materials or capital, this productivity measure is often referred to as labor productivity. How ever, it is important to note that labor productivity is a measure of the overall effectiveness of an operating system in utilizing labor, equipment and capital to convert labor efforts into useful output, and is not a measure of the capabilities of labor alone. For example, by investing in a piece of new equipment to perform certain tasks in construction, output maybe increased for the same number of labor hours, thus resulting in higher labor productivity.(3)

2.3.2.2: Materials Management:

Materials management is an important element in project planning and control materials represent a major expense in construction, so minimizing procurement purchase costs presents important opportunities for reducing costs. Poor materials management can also result in large and avoidable costs during construction.(3)

2.3.2.3: Construction Equipments:

The selection of the appropriate type and size of construction equipment often affects the required amount of time and effort and thus the job – site productivity of a project. It is there fore important for site managers and construction planners to be familiar with the characteristics of the major types of equipment most commonly used in construction.(3)

2.3.3: Cost Estimation:

Cost associated with constructed facilities:

The cost of a constructed facility to the owner includes both the initial capital cost and subsequent operation and maintenance costs. Each of these major cost categories consists of a number of cost components.

The capital cost for a construction projects includes the expenses related to initial establishment of the facility:

- Land acquisition, including assembly, holding and improvement.
- Planning and feasibility studies.
- Architectural and engineering design.
- Construction, including materials, equipment and labor.
- Field supervision of construction.
- Construction financing.
- Insurance and taxes during construction.
- Owner's general office over head.
- Equipment and furnishings not include in construction.
- Inspection and testing.(4)

2.3.4: Quality Control and Safety During Construction:

Quality control and safety represent increasingly important concerns for project managers. Defect or failures in constructed facilities can result in very large costs. Even with minor defects, re – construction may be required and facility operations imperial. In creased cost and delays is the result. In the worst case, failures may cause personal injuries or fatalities. Accidents during the construction process can similarly result in personal injuries and large costs. Indirect costs of insurance, inspection and regulation are increasing rapidly due to these increased direct costs. Good project managers try to ensure that the job is done right the first time and that no major accidents occur on the project.**(5)**

2.3.5: Organization and use of Project Information:

As a project proceeds, the types and extent of the information used by the various organizations involved will change. A listing of the most important information sets would include:

- Cash flow and procurement accounts for each organization.
- Intermediate analysis results during planning and design.
- Design documents, including drawings and specifications.
- Construction schedules and cost estimates.
- Quality control and assurance records.

- Chronological files of project correspondence and memorandum.
- Construction field activity and inspection logs.
- Legal contracts and regulatory documents.(6)

2.4: Programming techniques:

A variety of programming techniques are available to the client's project manager or the contractor's planner and these can be used according to the type and complexity of the project concerned. The following will be considered to:

- Bar charts.
- Arrow diagrams.
- Precedence diagrams.
- Line of balance.
- Time-chain diagram.

The technique adopted in any particular case is largely a matter of personal preference but the recipient of the of the information needs to be considered as programmes based on overly-complex techniques may be counter-productive to effective communication.(1)

Table 2:1 planning programs

Planning stage	**Type of program**
Design	Project master schedule
Tender	Pre-tender programme
Pre-contract	Master programme
	Target programme
	Subcontractor's programme
	Procurement programme
Contract	Stage programme
	Short-term programme
	As-built programme

Table (2.1): planning process

2.4.1: Bar charts:

2.4.1.1: Introduction:

Henry Gantt first introduced bar charts for ship building projects in the early 1900s by popularizing the graphical presentation of work versus time. Gantt belonged to the scientific management school of thinking of the late nineteenth and early twentieth centuries. Gantt charts were the first scientific attempt to consider work scheduling against time. And limitations in the power and flexibility of bar charts results in the adoption of more sophisticated techniques in the 1950s and 1960s, in particular net work analysis using arrow and later precedence diagrams.(1),(3)

2.2.1.2: Consideration of Bar chart:

In this type of chart, the time duration of an activity is represented by the horizontal line. The length of the time proportioned to the time duration of the activity. Since several activities are represented on the same chart a rectangular frame work is chosen. The activities are listed from top to bottom on the extreme left hand side of the farm work. An activity duration flows from left to right. It is illustrated in fig (2.2), which is mean for the following project.(2)

ACTIVITY	DEPENDS ON	DURATION(days)
A	-	2
B	A	3
C	A	1
D	B	2
E	B&C	1
F	D&E	3
G	F	2

Table (2.2)

ACTIVITY	UNIT OF TIME (DAY)											
	1	2	3	4	5	6	7	8	9	10	11	12
A												
B												
C												
D												
E												
F												
G												

Table (2.3) corresponding net work of the project(2)

2.4.1.3: Advantages of Bar Chart:

1/ It is simple to draw, easy to understand and can be drawn quickly.

2/ Applicable at all stages of the planning process: project planning, pre-tender, and pre-contract and contract planning.

3/ The progress achieve at site expressed in terms of percentage.

4/ It may be used for depicting the resource requirements of a construction project.

5/ It provides a visual representation of the entire project which shows exactly where each of the above activity is supposed to start and finish.

6/ the bar chart programme can be used to form the basis of financial forecasting for both the client and the contractor.(2)

2.4.1.4: Limitations of Bar Chart:

The bar chart is an in adequate management tool and suffers because of the following limitations:

1\ Inability to depict interdependencies of activities.

2\ Absence of critical and non critical activities.

3\ No cost optimization.

4\ No controlling and monitoring and updating.

5\ No resource leveling\ smoothing.

6\ No reflection of uncertainties on time.(2)

MASTER PROGRAMME

ID	Task Name	Duration	June				July				August				Sep			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Mobilization	2w																
2	Excavation	3w																
3	Piling	2w																
4	**Pile Caps\ Grand B**	**20d**																
5	Cut-off piles &Binding	1w																
6	Formwork & rebar	2w																
7	Concrete	2w																
8	**Structural Steel**	**20d**																
9	Erect steel frame	3w																
10	Holorib floors	2w																
11	Roofing	3w																
12	**Floor slab**	**25d**																
13	Sub-base &blinding	2w																
14	Formwork & concrete	4w																

Table (2.4): master program(1)

Steps of example solution:

- Decide on the most appropriate time-scale for the programme. Months on the major scale and weeks on the minor scale are usually best for most programmes.
- Insert summary tasks and add durations (weeks are generally best) to the activities by calculation or from experience.
- Add logic to the programme by linking relevant activities to one another.think about which activities must come first, which must follow and which may happen at the same time.

Further features are easily added such as holiday periods, key milestone(events), resources and cost information.(1)

2.4.2: Network analysis – The Critical Path Method (CPM):

2.4.2.1 : Principles of networks

The Critical Path Method is presented in the form of an arrow diagram. The distinguishing feature of these diagrams is that the arrow represents the activity and the circle or node between the arrow is the event. By numbering the events, the arrow activities can be identified. This is usually done in numerical order starting at the beginning of the network and progressing to the end, ensuring that the number at the tail of the arrow is smaller than that at the head.(1)

Each activity is given a duration, and the earliest and latest event times of the activity can be calculated by making forward and backward passes through the network. These times are recorded in the node or event circles. From this information, a schedule can be produced which will facilitate calculation of the total or spare time for each activity. Dummy activity, which usually have no duration or value, can be introduced to indicate dependencies not shown by the arrow activities.

2.4.2.2: Advantages of networks:

- Through the discipline of CPM, the user can achieve better planning due to the logical approach undertaken during the development of the construction sequence.
- Identification of critical operations on which effort and resources can be applied aids the contractor’s management.

- CPM allows the planner to express his ideas in graphical form.
- The planner has the facility to assign priorities for labour, plant, material and subcontractor resources to each operation on the network.
- Bar chart analysis ids understanding at site management level for both the contractor and client.
- The effect of changes and variations can be evaluated and time-cost optimization analysis undertaken.
- Cash flow assessments and valuation forecasting information may be output in graphical format and readily updated during the project.(1)

2.4.2.3: Disadvantages of networks:

- The development of a network sequence using arrows joined at node points is cumbersome and does not easily facilitate concurrent activities being shown.
- Activities can be split into stages or sections to overcome this problem but this does not convincingly represent to overcome this problem but this does not convincingly represent the situation on the project.
- Often in practice several activities are scheduled to start just after the preceding one, so there is a complex concurrency but with a delay at the beginning.
- In these situations precedence diagrams offer much more flexibility.

The resurgence in the use of CPM in the late 1980s was mainly due to the introduction of the personal computer and developments in user-friendly project planning software. Now, linked bar charts are more popular for most project but, for the larger schemes, CPM still has an important part to to play, especially with advent of cheaper software and hardware. There is a little doubt that networks are here to stay, albeit that developments in project management software using precedence and linked bar chart presentation format are largely preferred to arrow diagram techniques.(1)

Example:

In a project consisting of eleven activities, the restrictions determined are as under.

A → B, A → C, A → D, B → E, C → F, C → G, D → H, E → I, F → J, G → K, H → K

Solution : (A → B means A is restriction on start of B)

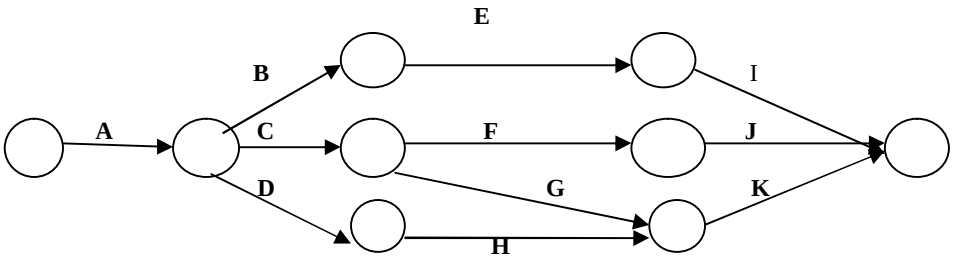


Fig 2.1: net work shape

2.2.3: Precedence diagrams:

Precedence diagrams follow the same logical procedures as arrow networks except that the activities and their dependencies are drawn differently. The precedence diagram consists of a series of boxes interlinked with lines. The box or node represents the activity and the linking arrow indicates the relationships of the activities to one another. The box contains an activity label or name and duration.

There is space for the earliest start and finish times of the activity and a reference number may also be included if required.

Both the boxes and the lines may be given a time value. The time given in the box represents the duration of the activity, while any time on the line or arrow adds a dependency which might be a lead or a lag as required. Precedence diagrams do not require dummies to preserve the logic of the relationships and each node is ascribed a unique activity number.(1)

The relationships which can be included are:

- Finish to start.
- Start to start.
- Finish to finish.
- Start to finish.

This makes the precedence display easier to follow and permits the introduction of time constraints on the logical links without the need to include dummies ladders.

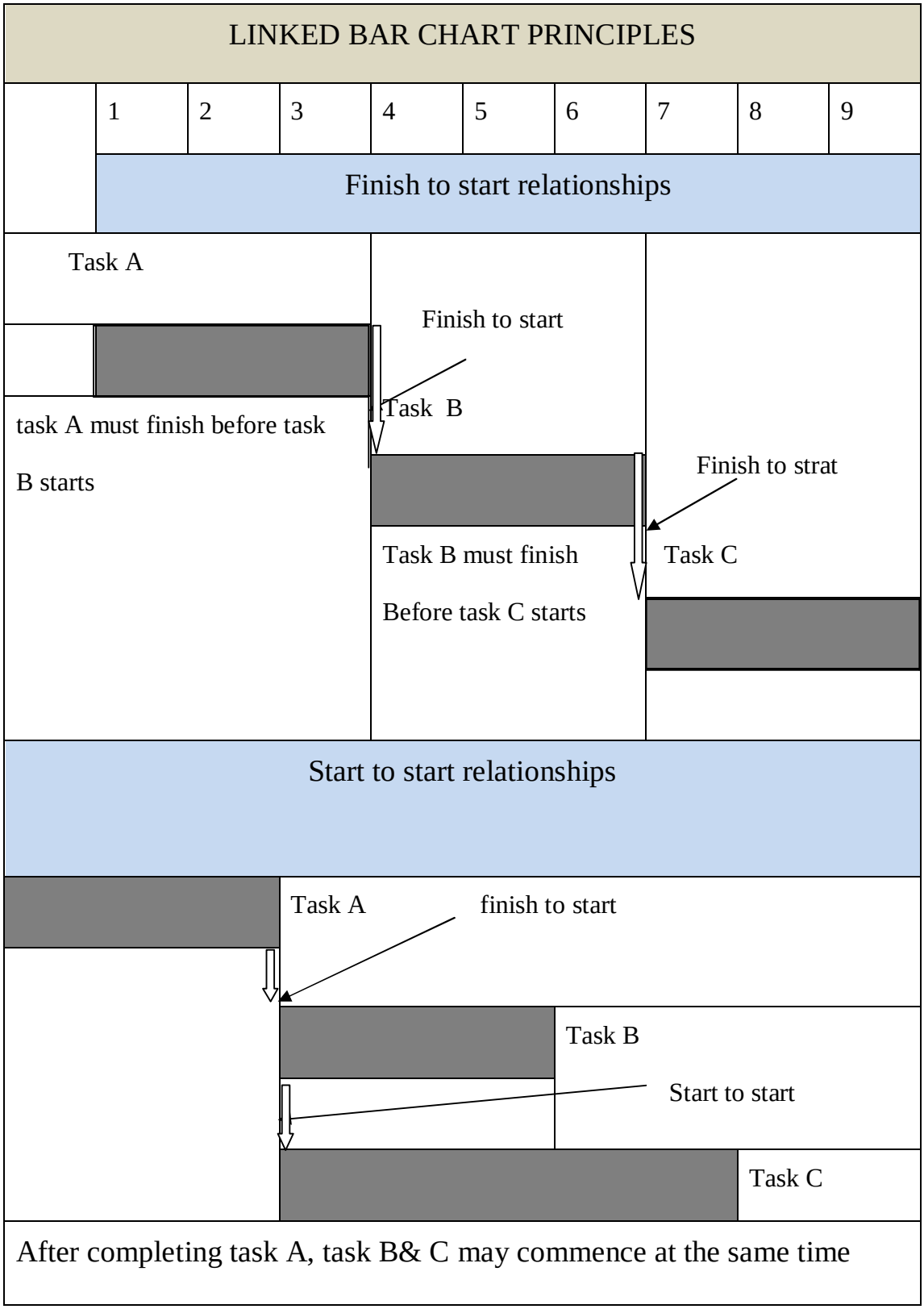
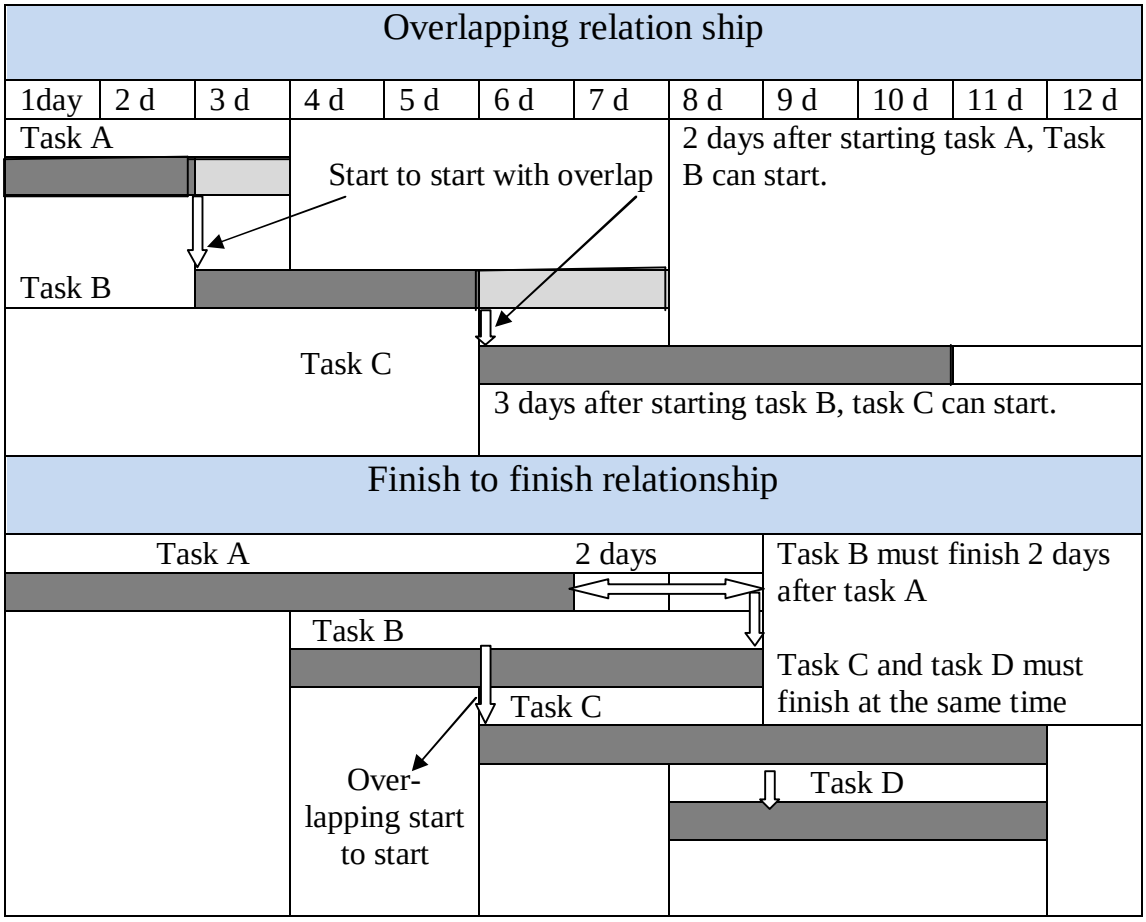


Figure (2.3) :relation ship diagram



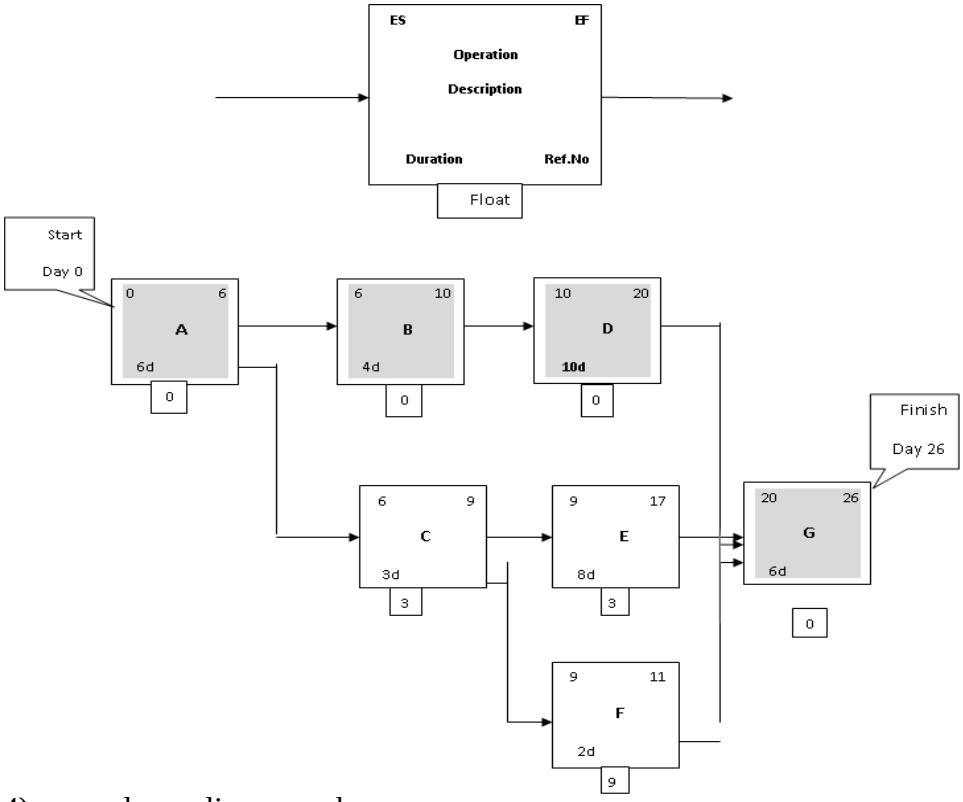


Fig (2.4): precedence diagrams shape

Figure (2.2) depicts the notation used in the in the precedence format, together with an example illustrating their basic principles of 21nalyzing a precedence sequence with the forward and backward calculations required to establish the critical path.

It is important to understand clearly the relationships between arrow diagrams, precedence diagrams and bar charts so that they can readily be related to the construction process at site level. Using precedence diagrams, dummies are eliminated and the resulting 'number crunching' analysis becomes relatively more simplified. The total float for each activity can be readily calculated from the diagram by deducting the earliest start time from the latest finish time in the corners of the activity box less the activity duration.(1)

Practical applications:

- **Step 1**

Draw the initial network precedence diagram .

- **Step 2**

Analyse the precedence diagram indicating float and critical operation in order to achieve an overall completion date (26 days). The objective of the exercise is to produce a cumulative project value forecast based on the earliest start situation.

- **Step 3**

Draw an earliest start bar chart showing the critical operation listed first in the sequence. The analysis indicates that the start to start periods (overlaps) on the first three site operations are critical to achieving the overall completion date of 26 days. This has been highlighted on the bar chart by linking the critical operation.

- **Step 4**

Allocate monetary values to the bar lines on the bar chart in order to produce the cumulative weekly value forecast.

- **Step 5**

Draw the value –time forecast presented both graphically and in tabular.

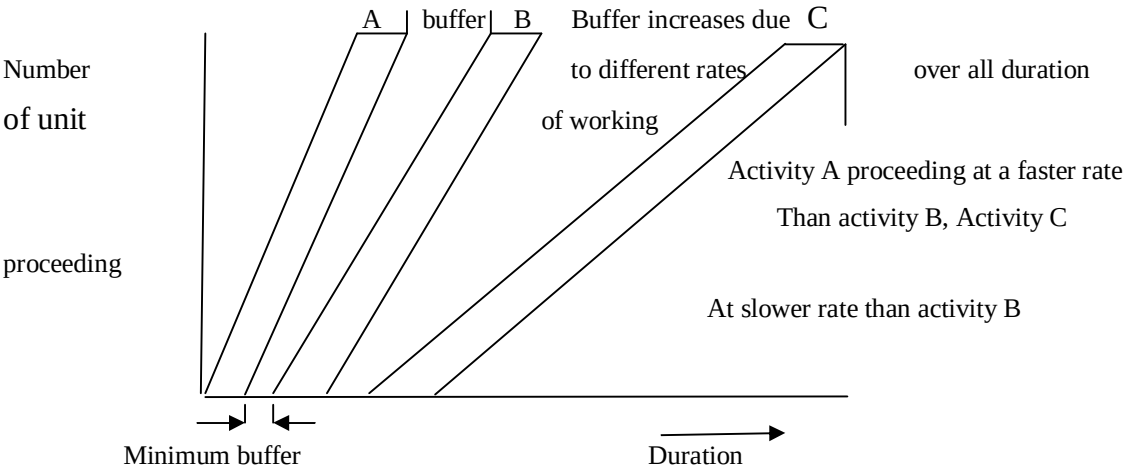
The cumulative value forecast based on a realistic and achievable programme, enables the planning process to be integrated with the project monthly cost-value reporting procedures.

2.2.4: Line of balance (elemental trend analysis):

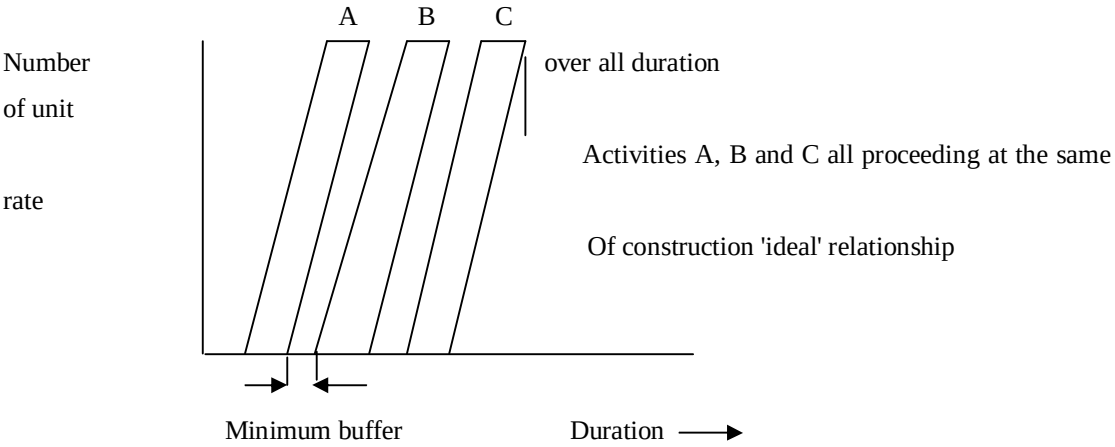
A line of balance diagram comprises a series of inclined lines which represent the rate of working between repetitive operations in a construction sequence. Line of balance is a visual display of the rate of working of different activities on programme. The ideal line of balance display shows all balance lines running parallel to each other, but in practice this is often difficult to achieve.

The application of line of balance to construction was pioneered by Lumsden(1965) and became recognized as the best planning method for repetitive work such as housing. It is not unusual to see bar chart displays incorporating a line of balance diagram to illustrate the programming of any repetitive sections of the works.

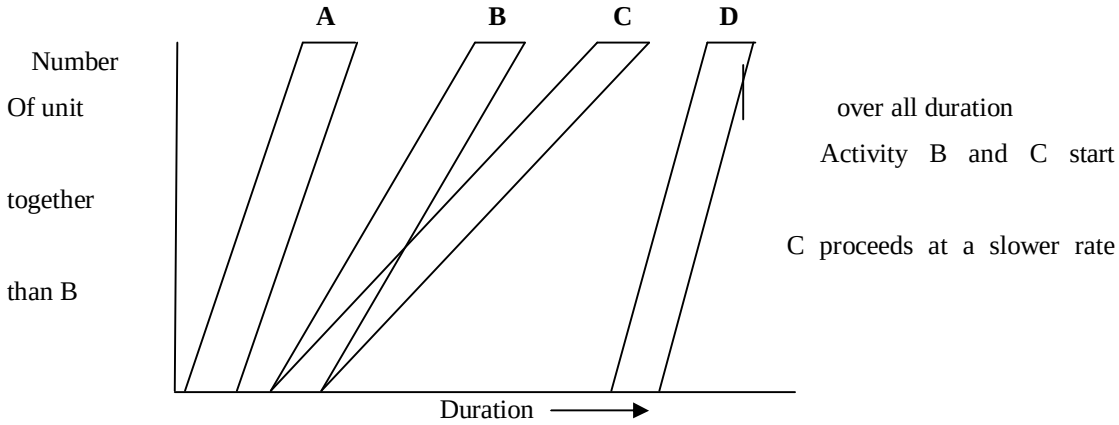
Line of balance is a visual display of the rate of working of different activities on a programme. The ideal line of balance display shows all balance lines running parallel to each other, but in practice this is often difficult to achieve.(1)



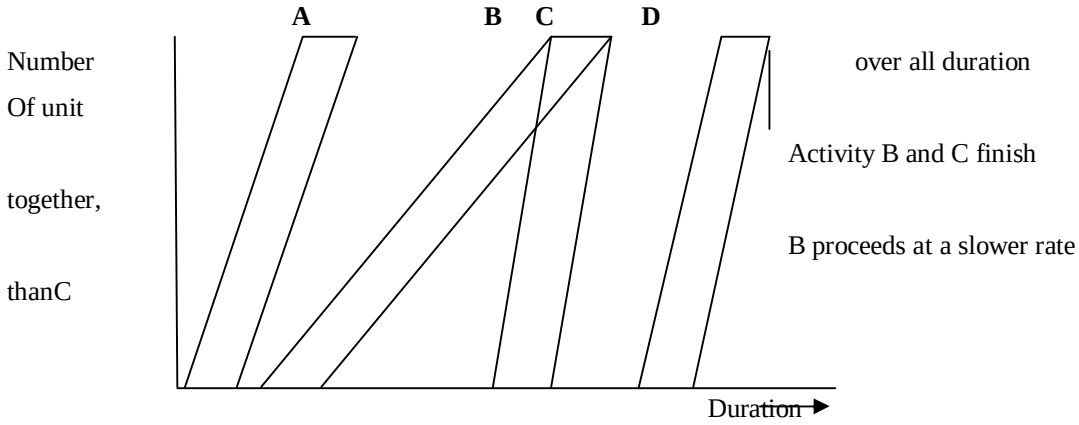
Fig(2.5): Line of balance diagram – non parallel working



Fig(2.6): Line of balance diagram – ideal relationship



Fig(2.7): Line of balance diagram – operations B and C commencing together



Fig(2.8): Line of balance diagram – operations B and C finishing together

2.2.5: Time-chainage diagrams:

Time-chainge diagrams have been widely applied on major road-works projects and in the development of the motorway system in the UK for many years. Time-chainge diagrams, like their close cousin the line of balance, are only applicable for limited types of project and therefore are not as widely appreciated in the industry as bar charts and network techniques. Nevertheless, the technique has distinct attributes and advantages on projects where it is important to depict:

- The order of activities or operations.
- Where activities are happening locationally.
- How activities must progress in relation to direction and distance.
- Time, key dates and holidays, etc.

Time-chainage form of presentation the time dependencies between activities to be shows, together with their order and direction of progress along the job. These diagrams are most usefully employed as a planning tool on projects such as motorways and major highway works, pipelines, railway track work, tunneling, etc

Projects of this nature can be viewed as mainly linear in nature. In other works, construction starts at one point and proceeds in orderly fashion towards another location. This would be typified on highway project by activities such as fencing, drainage, road surfacing and road markings.

To some extent this type of work calls for a different planning technique because bar charts would not be useful in giving locational information, and precedence / arrow diagrams would not reflect the time – location relationship which clearly exists on such projects.

Various types of time-change reprsentations are possible, but basically the diagram comprises two axes, time and distance, with the various activities shown as lines or bars on the chart. Linear activities are represented with a line or bar which is positioned on the chart to show its commencing and completion changes, and is inclined in the direction of progress at an angle consistent with the anticipated duration of the operation. A static activity, such as a bridge on motorway, is represented by a line or thin bar positioned at a particular location or chainage, with the duration of the activity expressed by the length of line or bar. Activity labels are annotated on the respective line or bar to distinguish one operation from another.

Developing a time-chain diagram

Drawing a time-chain diagram is not as easy as it looks and a good deal of practice is required. Consider the following steps:

- **Step 1**

Consult the project layout drawings and note the chain position. Main chain on a highway project are at 1000 m intervals.

- **Step 2**

Draw an outline time-chain diagram with time along one axis and distance or chain along the other, using either the horizontal or vertical formate. Add main holiday periods allowing 2 weeks for Christmas and 1 week for easter.

- **Step3**

List main programme activities or operations in approximate construction sequence. Include activities for site set-up or mobilization and clear site at the end. Estimate the duration of each programme activity in weeks.

- **Step 4**

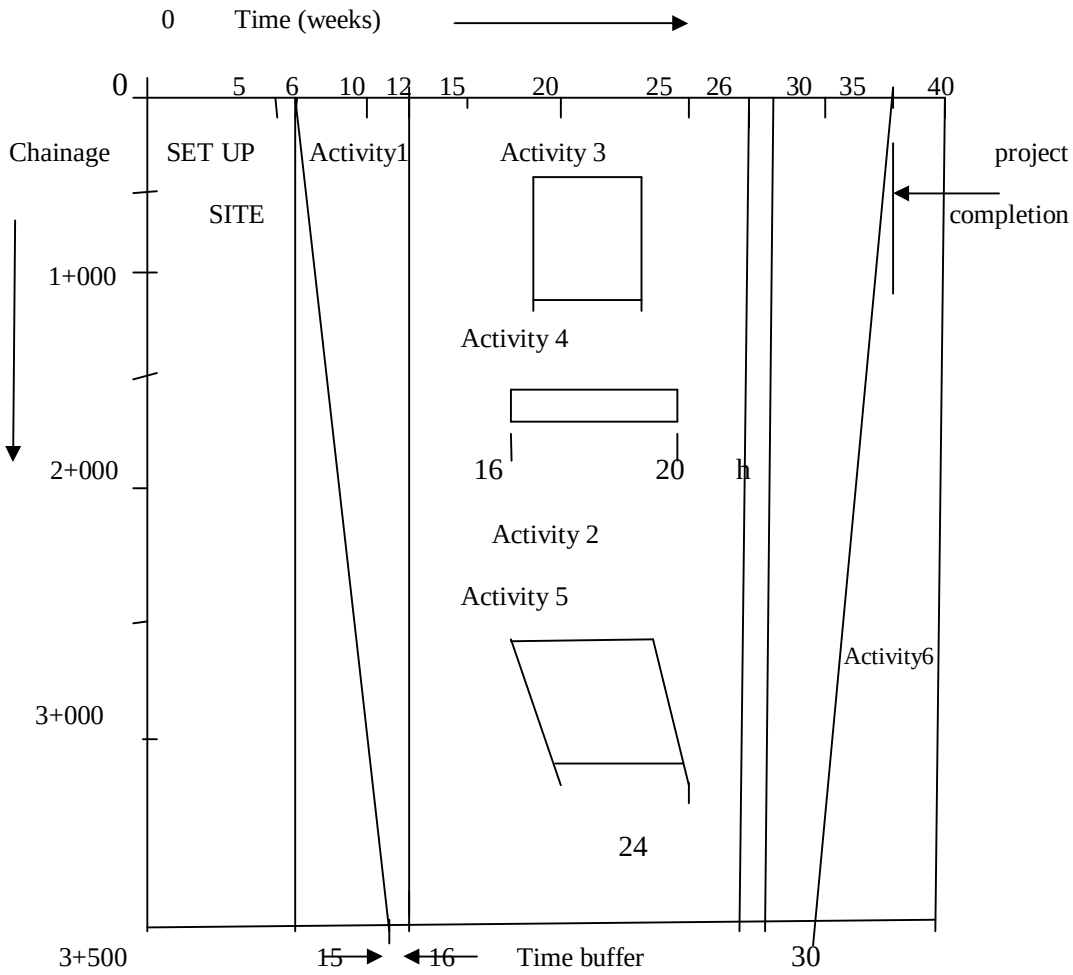
Fill in the site 'set-up' and 'clear site' activities on the time-chainge diagram. Using your preferred format, plot the appropriate number of weeks over the entire length (chainage) of the project.

- **Step 5**

Decide in turn where and when each activity will take place. For linear activities (e.g. drainage), start at the appropriate location (chainage) and week number and draw a line for correct distance (chainage) and time (weeks). For static activities (e.g bridgeworks), draw a thin box at the appropriate chainage with a length representing the activity duration.

- **Step 6**

Complete all activities on the list. It is sometimes helpful to produce an outline bar chart programme to help clarify the correct time-chain display.(1)



Fig(2.9): Time-chain diagram vertical format(1)

2.2.6: S- curve:

2.2.6.1: Introduction:

The S-curve is a powerful project management control tool. The first time most project managers become aware of the existence of S-curves is when they are requested by the client or senior management to include one in their next progress report. The following explains what the mysterious S-curve is, why it is an important project management tool, and how to generate one.(9)

An S-curve is defined as:

"A display of cumulative costs, labor hours or other quantities plotted against time. The name derives from the S-like shape of the curve, flatter at the beginning and end and steeper in the middle, which is typical of most projects. The beginning represents a slow, deliberate but accelerating start, while the end represents a deceleration as the work runs out

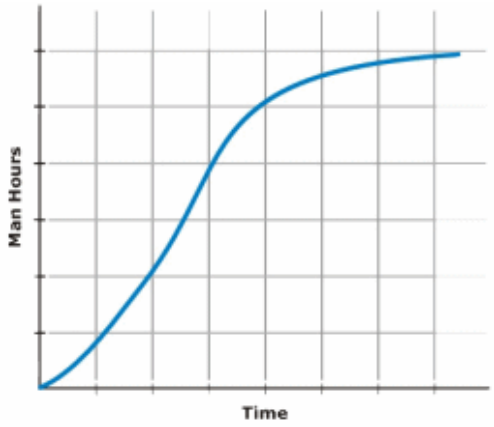
2.2.6.2: Types of S-curves:

There are a variety of S-curves that are applicable to project management applications, including:

- Man Hours versus Time S-curve
- Costs versus Time S-curve
- Baseline S-curve
- Actual S-curve
- Target S-curve
- Value and Percentage S-curves

2.2.6.2.1: Man Hours versus Time S-curve:

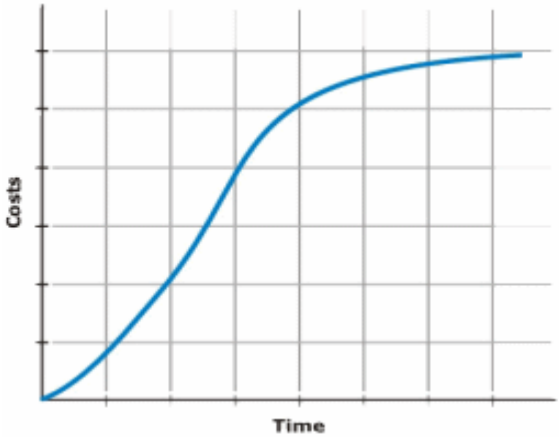
The *Man Hours versus Time S-curve* is appropriate for projects that are labor intensive. It shows cumulative man hours expended over time for the duration of the project. As man-hours are a product of manpower and working hours, these may be adjusted together or individually in an attempt to keep the project on schedule. Projects may require additional man-hours to finish on time due to low productivity, delays and disruptions, rework, variations, etc



Fig(2.10): Man Hours versus Time S-curve

2.2.6.2.2: Cost versus Time S-curve:

The Costs versus Time S-curve is appropriate for projects that contain labor and non-labor (e.g. material supply / hire / subcontract) tasks. It shows cumulative costs expended over time for the duration of the project, and may be used to assist in the calculation of the project's cash flow, and cost to complete.

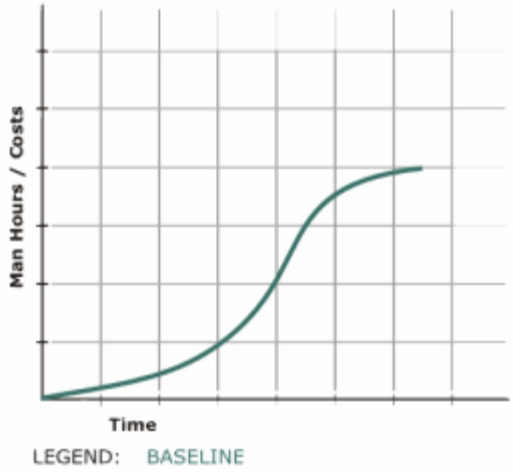


Fig(2.11): Costs versus Time S-curve

Progress Tracking

2.2.6.2.3: Baseline S-curve:

Prior to project commencement, a schedule is prepared outlining the proposed allocation of resources and the timing of tasks necessary to complete the project within a set time frame and budget. This schedule is referred to as the Baseline Schedule. From this schedule, a Baseline S-curve is generated. This S-curve reflects the planned progress of the project. If the project requirements change prior to commencement (e.g. change of scope, delayed start), the Baseline Schedule may require revision to reflect the changed requirements.



Fig(2.12): Baseline S-curve

2.2.6.2.4: Target S-curve:

Following project commencement, modification of the Baseline Schedule is usually required. Changes are continually made to the Production Schedule (which is originally the same as the Baseline Schedule). The production schedule reflects the actual progress of the project to date, and any revisions made to tasks yet to commence or not yet completed. From this schedule, a Target S-curve may be generated. This S-curve reflects the ideal progress of the project if all tasks are completed as currently scheduled. In an ideal world, the Target S-curve will meet the Baseline S-curve at the end of the project (On Time, On Budget) or finish below and to the left of the Baseline S-curve (Early, Under Budget). In reality, it is not

uncommon for the Target S-curve to finish above and to the right of the Baseline S-curve (Late, Over Budget).

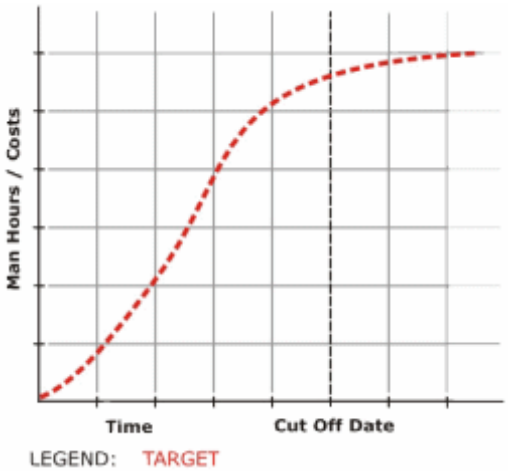


Fig (2.13): Target S-curve

2.2.6.2.5: Actual S-curve :

The production schedule is updated on a regular basis throughout the duration of the project. These updates include the revision of percentage complete for each task to date. Using this information, an Actual S-curve may be generated. This S-curve reflects the actual progress of the project to date, and may be compared with the Baseline and Target S-curves to determine how the project is progressing. During the project, the Actual S-curve will terminate at the Cut Off Date. This is the date the Production Schedule was last updated. At the completion of the project, the Actual S-curve will meet the Target S-curve.

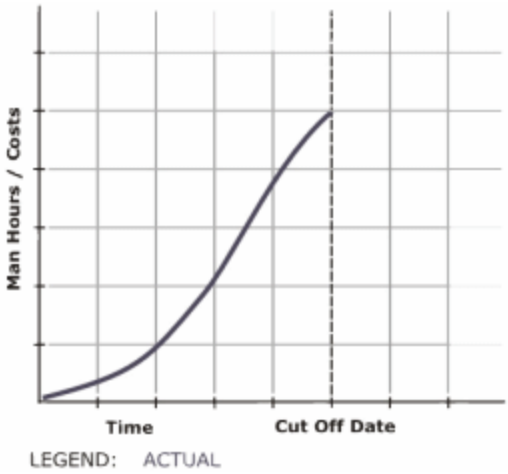


Fig (2.14): Actual S-curve

2.2.6.3 : Value and percentage S-curves:

S-curves may be graphed as absolute values (i.e. Man Hours or Costs) versus Time, or as percentage values versus Time. Value S-curves are useful for determining Man Hours or Costs expended to date, and Man Hours or Costs to complete. Percentage S-curves are useful for calculating the project's actual percentage complete against target and baseline percentage complete, and for calculating the project's percentage growth (or contraction).

Using S-curves

Why Use an S-curve?

S-curves are an important project management tool. They allow the progress of a project to be tracked visually over time, and form a historical record of what has happened to date. Analyses of S-curves allow project managers to quickly identify project growth, slippage, and potential problems that could adversely impact the project if no remedial action is taken.

2.2.6.4: Determining Growth:

Comparison of the Baseline and Target S-curves quickly reveals if the project has grown (Target S-curve finishes above Baseline S-curve) or contracted (Target S-curve finishes below Baseline S-curve) in scope. A change in the project's scopes implies a re-allocation of resources (increase or decrease), and the very possible requirement to raise contract variations. If the resources are fixed, then the duration of the project will increase (finish later) or decrease (finish earlier), possibly leading to the need to submit an extension of time claim.

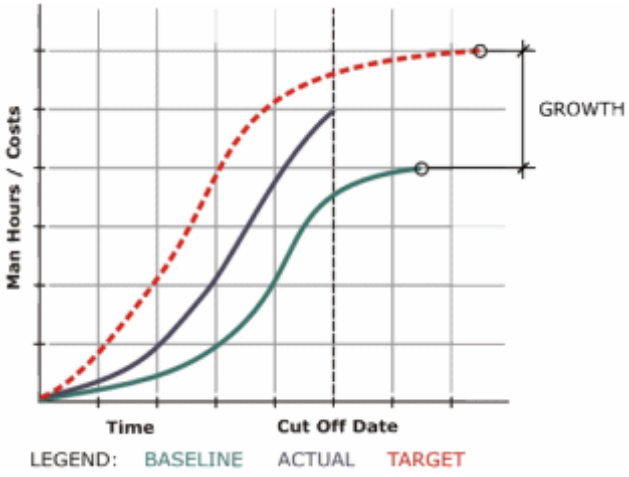


Fig (2.15) : Calculating Project Growth using S-curves

2.2.6.5: Determining Slippage:

Slippage is defined as:

"The amount of time a task has been delayed from its original baseline schedule. The slippage is the difference between the scheduled start or finish date for a task and the baseline start or finish date. Slippage can occur when a baseline plan is set and the actual dates subsequently entered for tasks are later than the baseline dates or the actual durations are longer than the baseline schedule durations"

Comparison of the Baseline S-curve and Target S-curve quickly reveals any project slippage (i.e. the Target S-curve finishes to the right of the Baseline S-curve). Additional resources will need to be allocated or additional hours worked in order to eliminate (or at least reduce) the slippage. An extension of time claim may need to be submitted if the slippage cannot be eliminated or reduced to an acceptable level.

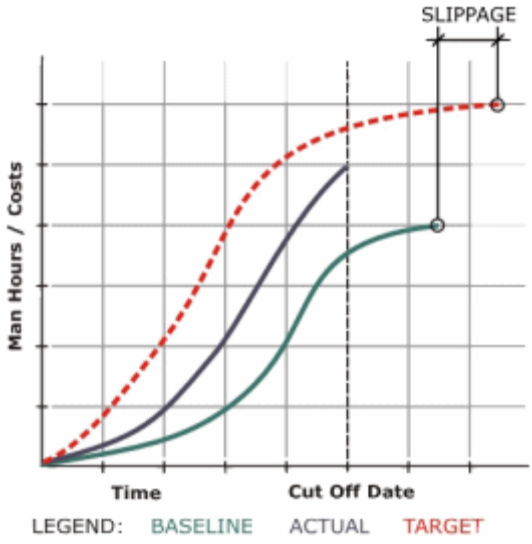


Fig (2.16): Calculating Project Slippage using S-curves

2.2.6.6: Determining progress:

Comparison of the Target S-curve and Actual S-curve reveals the progress of the project over time. In most cases, the Actual S-curve will sit below the Target S-curve for the majority of the project (due to many factors, including delays in updating the production schedule). Only towards the end of the project will the curves converge and finally meet. The Actual S-curve can never finish above the Target S-curve. If the Actual S-curve sits above the Target S-curve at the Cut Off Date, the Production

Schedule should be examined to determine if the project is truly ahead of schedule, or if the Production Schedule contains unrealistic percentage complete values for ongoing tasks.(9)

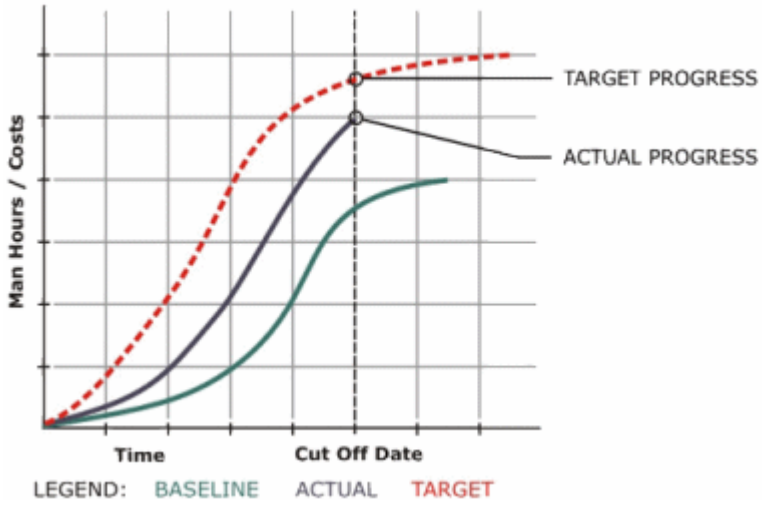


Fig (2.17): Calculating Project Progress using S-curve

the project will finish late and over budget compared to the baseline schedule. Progress to date(i.e. the Cut Off Date) is behind schedule compared to the production schedule. Detailed analysis of the project is required to determine why the project will be completed late and over budget. Project growth and\ or slippage may be due to a number of factors, including underestimation of effort in the baseline schedule, low productivity, rework, variations (approved or not), etc.

the S-curve is an important but often overlooked and misunderstood project management tool. A variety of S-curves exist, the most common being Man Hours versus Time, and Cost versus Time. By creating a Baseline Schedule, a Baseline S-curve can be generated. Baseline S-curves provide a basis on which to compare a project's actual status to its planned status. They may also assist in the planning of manpower and financial resources required to complete the project. A production schedule allows actual and Target S-curves to be generated. These allow the progress of a project to be monitored, and quickly reveal any divergence from the Baseline Schedule. S-curves may also be used to determine project growth, slippage and progress to date.

2.2.6.7: Earned value:

Earned value is value assigned to work wish was accomplish during a particular time period. This value can be stated in any appropriate measurable unit such as hours or dollars.

Earned value management (EVM) the basic concept of EVM is more than unique project management process or technique it is an umbrella term for 32 guide lines that define a set of requirements that a contract of management system must meet. The objective of an (EVM) are to :

- Relate time phased budget to specific contract tasks and/or statements of work.
- Relate technical, schedule, and cost performance.
- Provide valid, timely, and all data/ information for proactive project management analysis and action.
- Supply managers with practical level of summarization for effective decision making.

The 32 guidelines are divided in to five sections which are discussed below:

1/ organization.

2/ planning, scheduling and budgeting.

3/ accounting considerations.

4/ EVMS analysis and EVMS management reports.

5/ Revisions and data maintenance.

2.2.6.7 : Summary

There is more to planning a project than meets the eye and a great deal more involve than simply producing a programme. Both the client's representative or project manager and the contractor will have many issues to think about if the project is to be successfully completed.

There is no strict rule as to which programming technique should be employed. This needs to be considered in the light of the size and complexity of the project in hand, any personal preferences and whether there are any stipulations in the contract documentation

Bar Chart are the easiest to use but they can give misleading results because there is no strict logic imposed on the programme. It may be better to use linked bar chartsor arrow or precedence diagrams to overcome this problem. How ever,for repetitive work such as housing projects, line of balance may be preferred, or for road works, tunneling or repetitive civil engineering work, time-chainge diagrams could be the best application to use.

When using project management software packages, it is usually advisable to draw out the programme on paper first. This helps to establish the correct logic and avoid the possibility of getting in a tangle when working at the computer screen-which is particularly likely to happen when making the logical links between activities as it not always possible to see the whole picture on screen.

CHAPTER THREE

DATA COLLECTION ANALYSIS & TEST OF HYPOTHESIS

3.1: Introduction.

3.2: Project Methodology.

3.3: Data Analysis And Testing

Chapter 3: Data Collection, Analysis & Test of Hypothesis:

3.1: Introduction :

This chapter containing detailed explanation for method proceeding after in this research in which containing detailing to pattern after to definition Study data relied to primary sources and included data collection by questionnaire as the volume of the sample (55) questionnaire Collected from a sample containing contractors and consultants in the employment sector public and private in building and construction.

3.2: Methodology:

• The researcher analyzed the data using the Statistical Package for Social Sciences (summarized (SPSS)).

• The study used in the analysis methodology of descriptive analysis to limitation the general characteristics in terms of employment, the labor sector, and years of experience..... etc. This has been done in the form of frequency tables and graphs

• The use of the ratio T test (T test) to see differences of statistical significance of the sample data.

3.2.1: The ratio of T: (v) value:

There are multiple uses for (v) value test, if it can be used to sample mean comparing with moral community mean) (One - sample- t-test) and compare to the mean of two independent samples or linked sample(pair samples).

3.2.2: Statistical moral (statistical significance (p-level)

The significance of the statistical result of what is the estimated value of the degree of "community representation": -

Moral possibility expresses of error possibility in a representation of the community sample when decision making. In many of the sciences are taken at a 5% value of the moral limits, if the possibility of moral value is less than 5% (or less than the value specified by the researcher) The statistical test is considered morally or say that to there is a statistically significant and if it is greater than 5% shall be statistical test was not significant, or is said to be no difference was not significant.

3.2.3: Cross tabulation: tables using cross tables to summarize the relationship between two moral variables.

3.2.4: Chi - square Test (χ^2)

Chi-square test is one of the most common and widely used tests in applied research, a test data suitable for taxonomic or numerical.

The uses of chi- square distribution to test whether the morally different for viewing repetition for the expected repetition if we assume the existence of a probabilistic distribution of the community, or in other words, to ascertain whether the differences were statistically significant between the observed repetition to the number of responses of individuals or sections of the sample in the variable and the expected repetition.

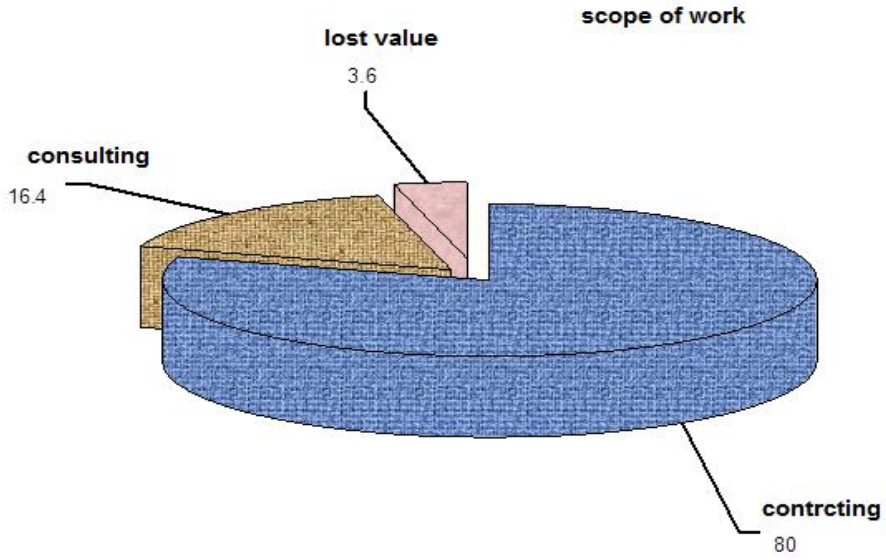
3.3.1 :First Section: analysis of basic data:

Scope of work:

Statement	Repetition	Percentage
Contracting	44	80
Consulting	9	16.4
Lost value	2	2
Total	55	100

Table (3.1): scope of work

From above table show that 80% from population in sample belongs to contracting company.



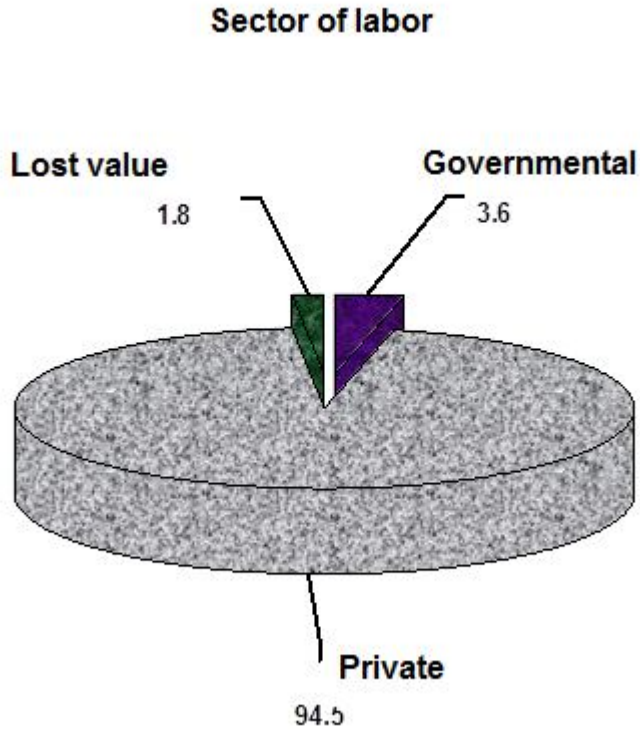
Fig(3.1): scope of work

Sector of labor

Statement	Repetition	Percentage
governmental	2	3.6
private	52	94.5
Lost value	1	1.8
Total	55	100

Table (3.2): sector of labour

From above table the high degree percentage of sector of labor 94.5% from private sector.



Fig(3.2): sector of labor

Years of experience :

Statement	Repetition	Percentage
Less than 5 years	14	25.5
From 5 to 10 years	13	23.6
Greater than 10 years	26	47.3
Lost value	2	3.6
Total	55	100

Table (3.3): years of experience

From above table the population whom years of experience of them is greater than 10 years is 47.3% from sample and this is the highest degree.

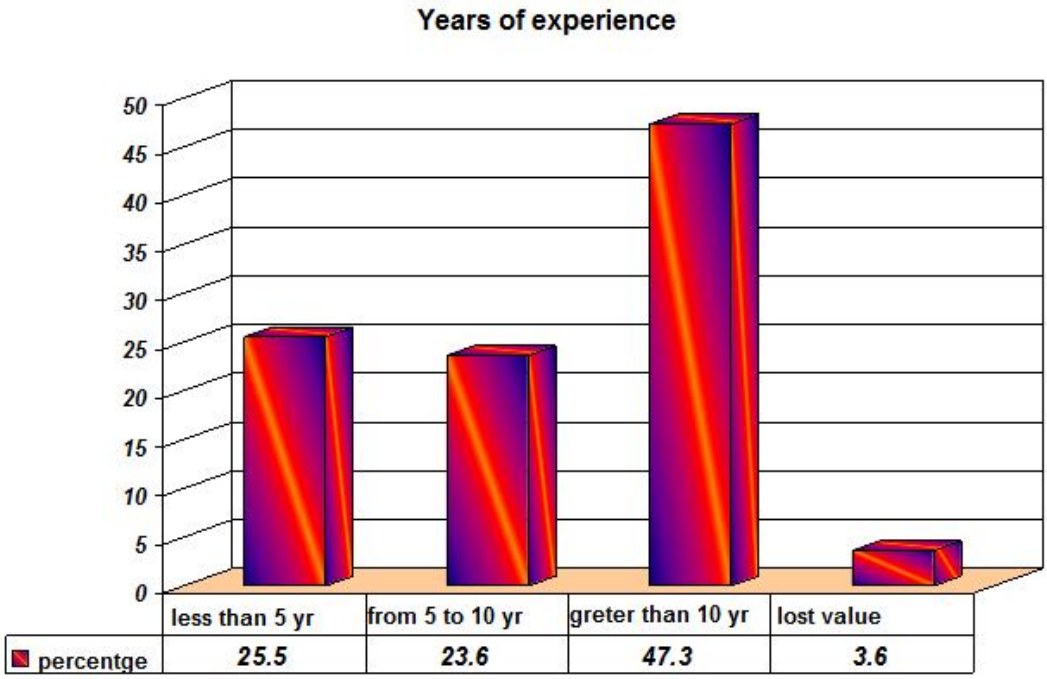


Fig (3.3): years of experience

Job description

Statement	Repetition	Percentage
Quantity and purchases civil engineer.	8	14.5
Site engineer	7	12.7
Architectural design engineer	4	7.3
Quality engineer	3	5.5
Contract and project manager	20	36.4
Planning and monitoring engineer	4	7.3
Consultant resident engineer	5	9.1
Training Eng.	4	7.3
Total	55	100

Table (3.4): job description

From above table the persons whom the highest degree in the sample 36.4% is contract and project manager.

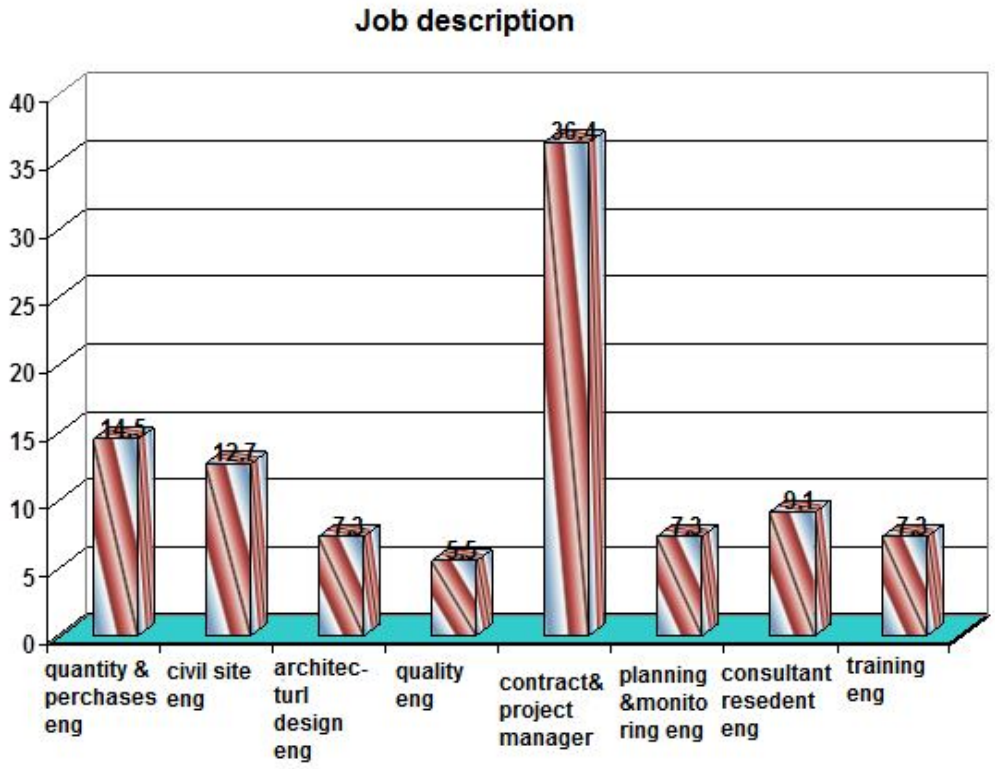


Fig (3.4): job description

3.3.2: Second section: cross table's analysis:

Construction Industry In Sudan is Considered as the most important attractive industry, the degree of:

Construction Industry In Sudan is Considered as the most important attractive industry, the degree of:	Repetition	Percent -age	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
High	23	41.8	50.0	30.8	46.2
Mean	26	47.3	42.9	53.8	46.2
Low	6	10.9	7.1	15.4	7.7
Total	55	100.0	100.0	100.0	100.0

Table (3.5): Construction Industry In Sudan is Considered as the most important attractive industry

From above table, we find that 50.0 % whom the experience less than 5 years believe that Construction Industry In Sudan is Considered as the most important attractive industry significantly .

Construction industry in Sudan is considered as the most important attractive

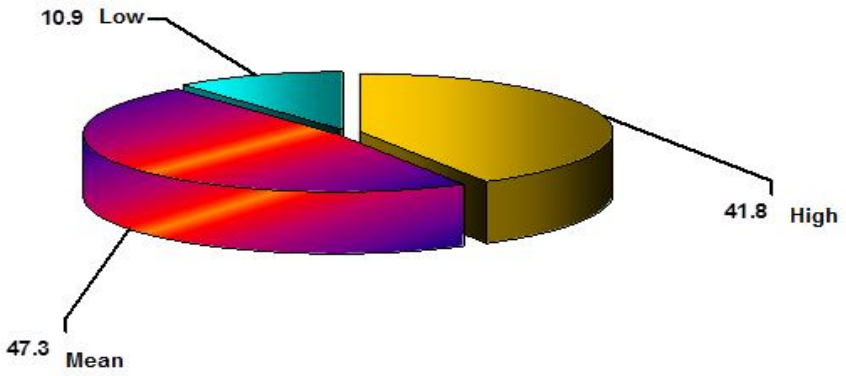


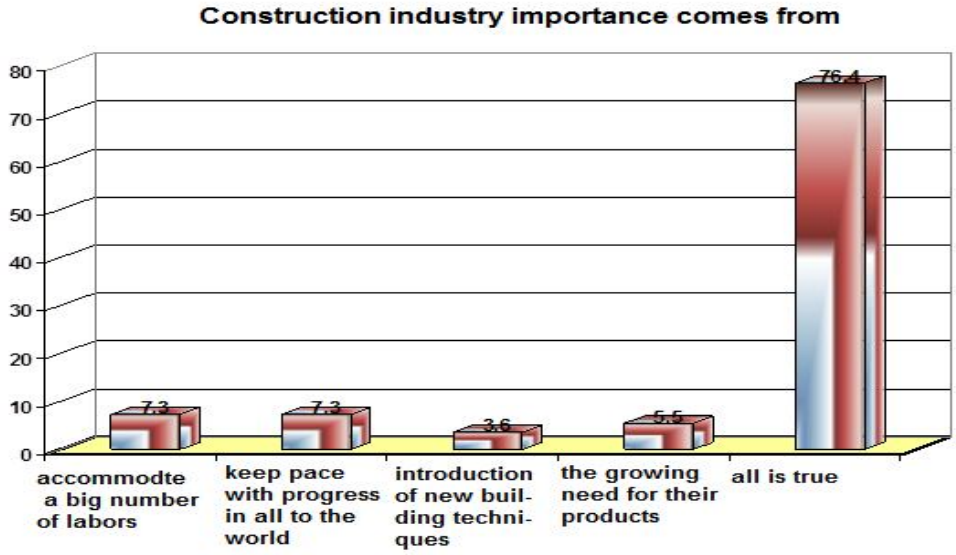
Fig (3.5): Construction Industry In Sudan is Considered as the most important attractive industry within range for (high-mean-low)

Construction industry importance comes from:

Construction industry importance comes from	Repetition	Percent-age	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
Accommodation a big number of labors.	4	7.3	0.0	15.4	7.7
Keep pace with progress in all to the world.	4	7.3	14.3	7.7	3.8
Introduction of new building techniques.	2	3.6	7.1	0.0	3.8
The growing need for their products.	3	5.5	0.0	0.0	11.5
Each tower is true	42	76.4	78.6	76.9	73.1
Total	55	100.0	100.0	100.0	100.0

Table (3.6): construction industry importance

From above table high percentage of sample persons with different years of experience we find that, the importance of construction management comes from all above factors.



Fig(3.6) : construction industry importance

The construction industry is considered as a service industry

The construction industry is a service industry.	Repetition	Percent-age	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
I very much agree	23	41.8	50.0	69.2	36.0
Agree	26	47.3	42.9	23.1	44.0
Don’t agree	6	10.9	7.1	7.7	20.0
Total	55	100.0	100.0	100.0	100.0

Table (3.7): construction industry is a service industry

From above table we find that 69.2% of persons whom the year of experience of them between 5 to 10 years strongly agrees for the construction industry is a service industry.

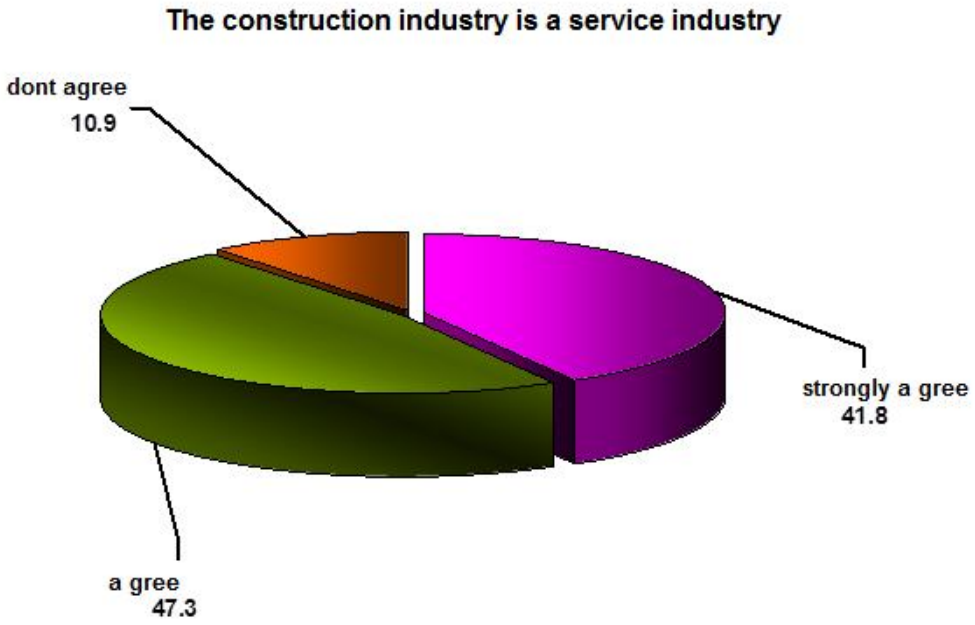


Fig (3.7): the construction industry is considered as a service industry

Explain the construction industry is considered as a service industry

Explain the construction industry is considered as a service industry	Repetition	Percent-age	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
Because they provide important services to the citizen	19	34.5	64.3	46.2	15.4
Because it helps in the development of the country	15	27.3	21.4	30.8	26.9
Because they serve the citizen and the state together	14	25.5	7.1	23.1	38.5
Industry is profitable from the first class	6	10.9	0.0	0.0	19.2
Not only service	1	1.8	7.1	0.0	0.0
Total	55	100.0	100.0	100.0	100.0

Table (3.8): explain the construction industry is considered as a service industry

From the above table we find that 38.5% from sample whom the years of experience of them greater than 10 years find that the reasons the construction industry is considered as a service industry because they serve the citizen and the state together.

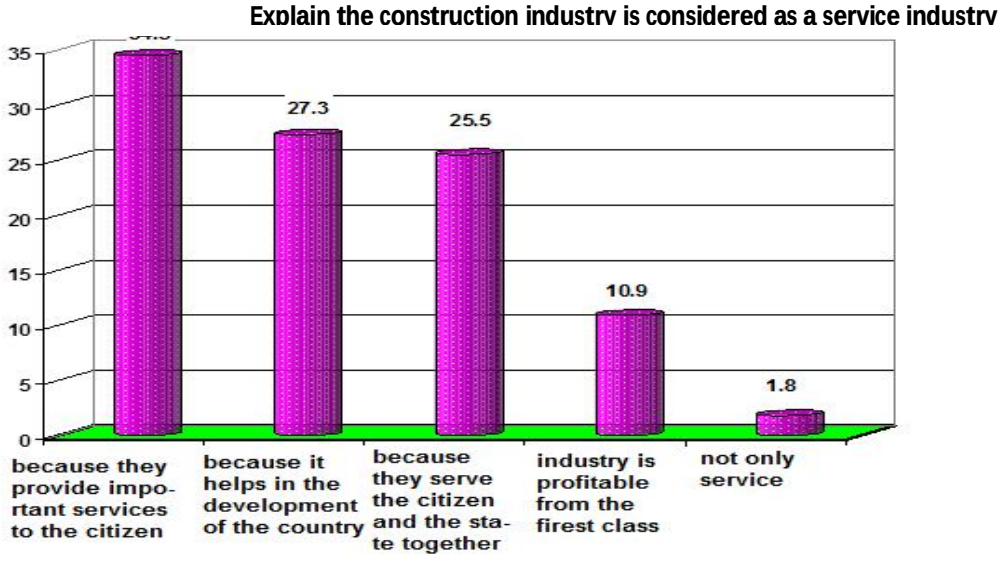


Fig (3.8): explain the construction industry is considered as a service industry

Success or failure of the construction industry in the Sudan we can holding for:

Success or failure of the construction industry in the Sudan we can holding for	Repetition	Percentage	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
Organization laws for construction industry in Sudan.	8	14.5	14.3	23.1	11.5
Mechanisms used in the construction industry	3	5.5	14.3	7.7	
Construction contract	9	16.4	14.3	15.4	15.4
Responsible employees on construction industry whether private sector, general sector or foreign companies	2	3.6	0.0	0.0	7.7
Local labor utilized	2	3.6	0.0	0.0	7.7
Foreign labors	2	3.6	7.1	0.0	3.8
All above is correct	29	52.7	50.0	53.8	53.8
Total	55	100	100	100	100

Table (3.9): success or failure of the construction industry in the Sudan

From above table found that 53.8% from sample whom the year of experience greater than 10 years they find that all the above factors control the success or failure of the construction industry in Sudan we can holding for.

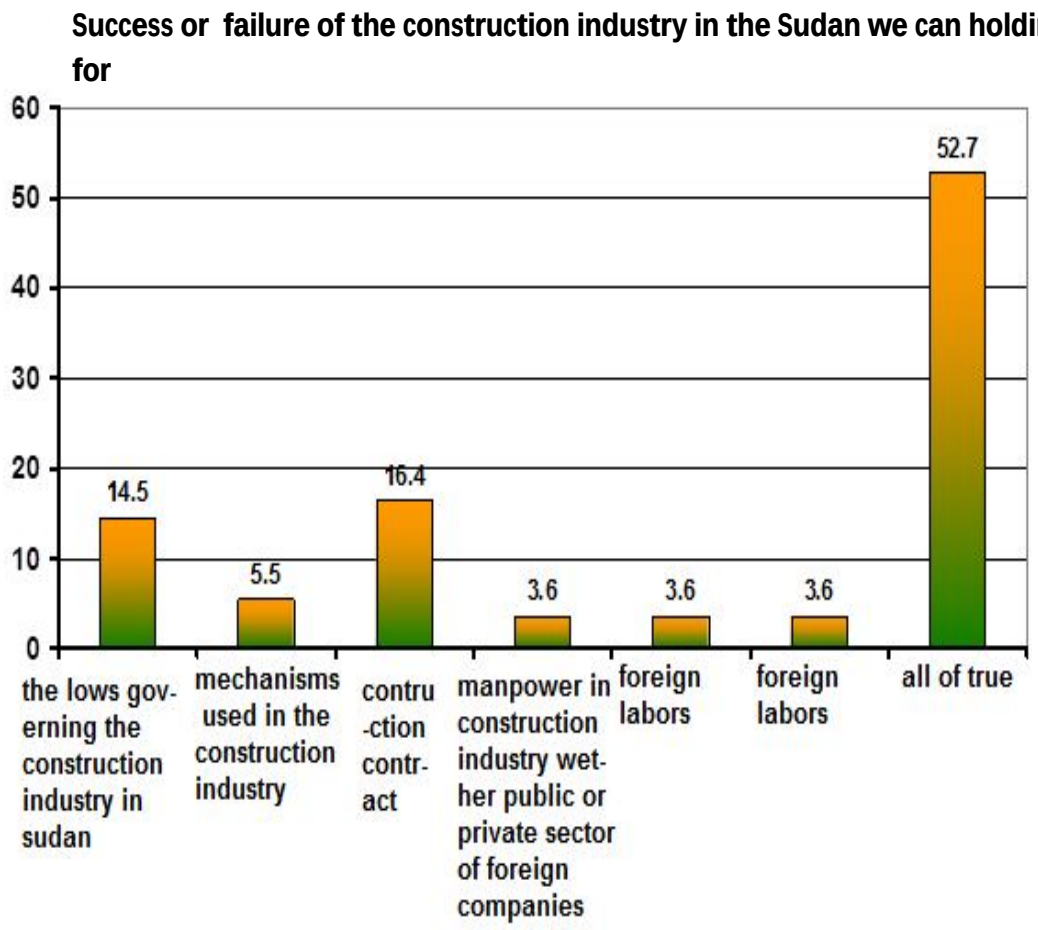


Fig (3.9) : success or failure of the construction industry in the Sudan we can holding for:

Explain of success or failure of the construction industry in the Sudan we can holding for:

explain of success or failure of the construction industry in the Sudan we can holding for:	Repetition	Percent-age	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
The absence of laws and non-payment of government obligations	13	23.6	0.0	38.5	33.3
Mechanisms do not conform to the specifications	10	18.2	28.6	23.1	12.5
Machines and employment of the main causes	5	9.1	14.3	7.7	4.2
Laws & machinery & manpower both types and contracts	18	32.7	35.7	23.1	41.7
Contracts and lack of experience	5	9.1	7.1	7.7	8.3
Mediation and nepotism	2	3.6	14.3	0.0	0.0
Total	55	100.0	100.0	100.0	100.0

Table(3.10): explain of success or failure of the construction industry in Sudan we can holding for:

From above table found that 41.7% from sample whom the years of experience of them greater than 10 years seeing that success or failure of the construction industry in the Sudan holding for Laws & machinery & manpower both types and contracts.

The concept of construction management is applied with:

Concept of construction management is applied with:	Repetition	Percent-age	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
High	4	7.3	7.1	0.0	7.7
Mean	29	52.7	78.6	53.8	42.3
Low	22	40.0	14.3	46.2	50.0
Total	55	100.0	100.0	100.0	100.0

Table (3.11): the concept of construction management projects application

From above table found that 50% from sample whom the years of experience of them greater than 10 years show that the concept of construction management applied with low degree .

construction industry recently has more attention because of the involvement of foreign companies.

construction industry recently has more attention because of the involvement of foreign companies.	Repetition	Percent-age	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
I highly agree	17	30.9	21.4	30.8	30.8
I agree	21	38.2	64.3	23.1	34.6
I don’t agree	17	30.9	14.3	46.2	34.6
Total	55	100.0	100.0	100.0	100.0

Table (3.12): construction industry recently has more attention because of the involvement of foreign companies.

From above table found that 64.3% from sample whom the years of experience of them less than 5 years agree for construction industry recently has more attention because of the involvement of foreign companies.

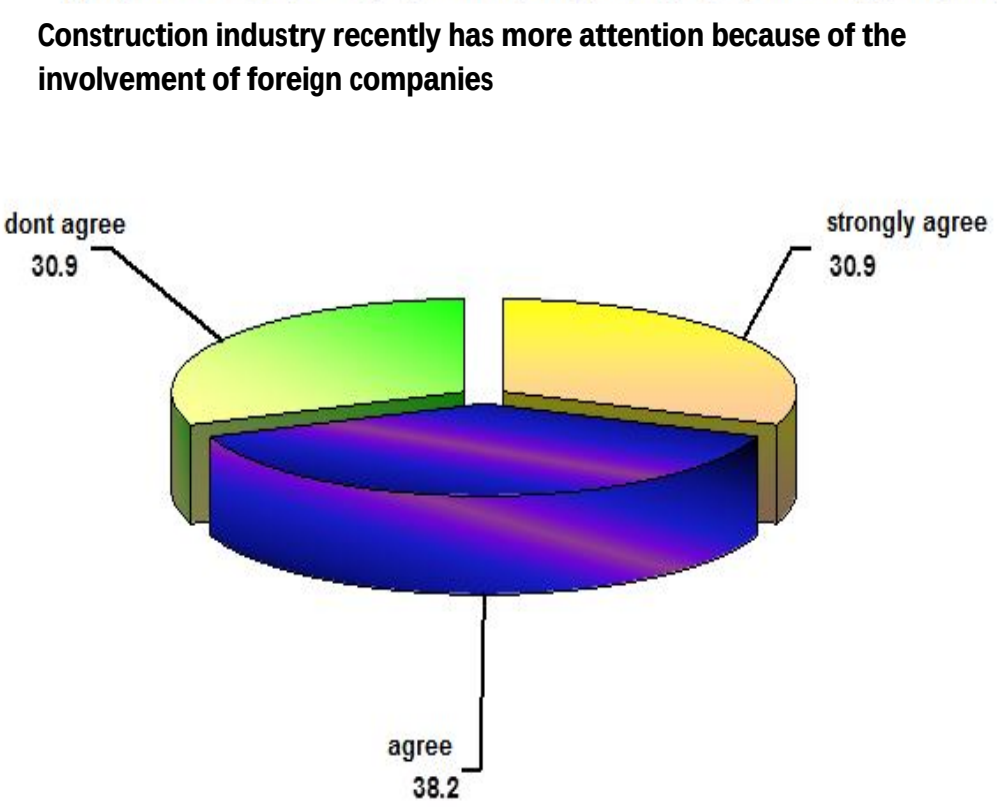


Fig (3.10): construction industry recently has more attention because of the involvement of foreign companies

Explain construction industry recently has more attention because of the involvement of foreign companies

Explain	construction industry recently has more attention because of the involvement of foreign companies		
	I very much agree	I agree	I don’t agree
Attention not only as an industry is the benefit of some parties	5.9	9.5	5.9
Attention result from the economical demand of the country	11.8	0.0	58.8
Experiences and development of the concept of construction management	52.9	47.6	17.6
Quality and control create a competitive environment	17.6	28.6	11.8
The non-organized construction industry in Sudan	11.8	14.3	5.9
Total	100	100	100

Table (3.13): explain construction industry recently has more attention because of the involvement of foreign companies

From above table, we find that 58.8 of respondents do not show the construction industry recently has more attention because of the involvement of foreign companies, but because attention due to demand and the need for the country's economic.

Effect of applying construction management appears for operating companies in the field in :

Effect of applying construction management appears for operating companies in the field in :	Percentage (%)		
	High	Mean	Low
Time	63.6	20.0	16.4
Cost	61.8	30.9	7.3
Quality	67.2	25.5	7.3

Table (3.14): Effect of applying construction management appears for operating companies in the field in :

From above table we find that 67.2% from all sample show that the. Effect of applying construction management appears for operating companies in the field in :

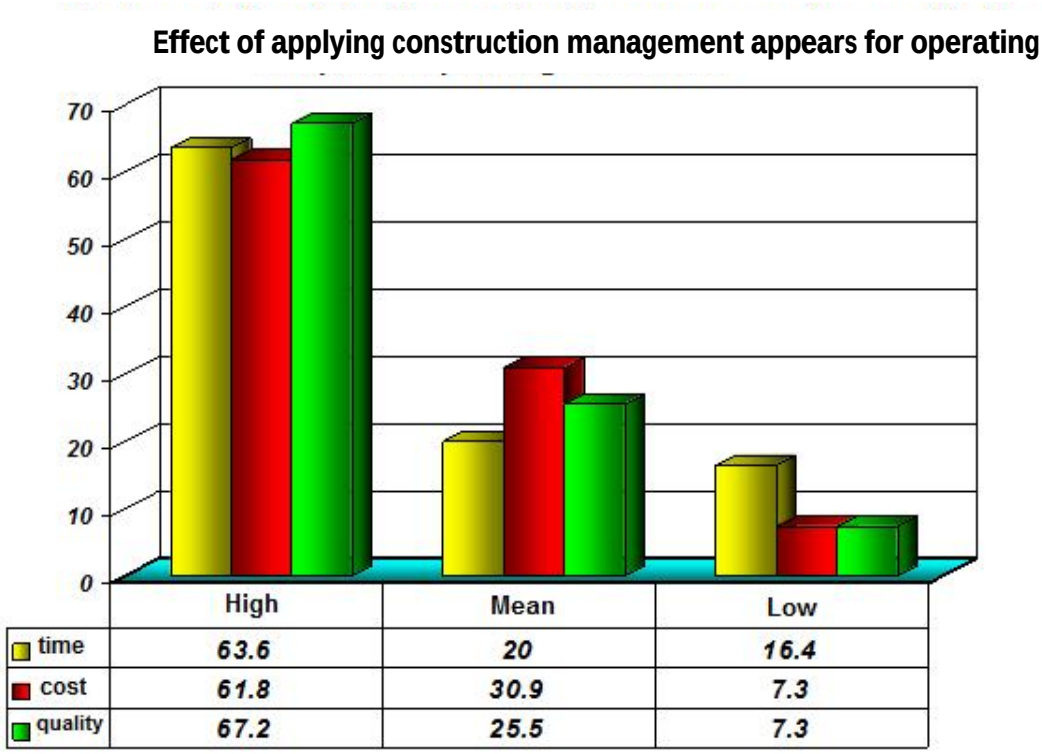


Fig (3.11): Effect of applying construction management appears for operating companies

Construction industry in Sudan, satisfied the users wishes with:

Construction industry in Sudan, satisfied the users wishes with:	Repetition	Percent-age	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
High	12	21.8	35.7	7.7	23.1
Mean	32	58.2	57.1	46.2	61.5
Low	11	20.0	7.1	46.2	15.4
Total	55	100.0	100.0	100.0	100.0

Table (3.15): The construction industry in Sudan, satisfied the users wishes with:

From above table we find that 61.5% from person whom the years of experience greater than 10 years show the construction industry in Sudan, satisfied the users wishes with:

The development of construction industry in Sudan is clear in:

The development of construction industry in Sudan is clear in:	repetition	Percent -age	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
General sector	1	1.8	0.0	0.0	3.8
Private sector	23	41.8	57.1	53.8	26.9
Both general and private	31	56.4	42.9	46.2	69.2
Total	55	100.0	100.0	100.0	100.0

Table (3.16): The development of construction industry in Sudan .

From above table we find that 69.2%from sample whom the years of experience of them is greater than 10 years their opinion is the development of construction industry in Sudan is clear in: both general and private.

The development of construction industry in Sudan is clear in

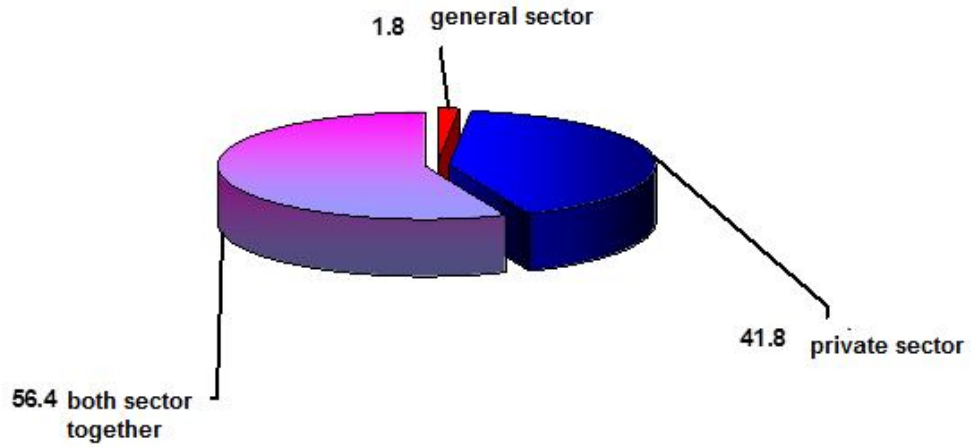


Fig (3.12): the development of construction industry in Sudan is clear in: private and both sector together

competition in the market of constructional industry in Sudan is in a:

competition in the market of constructional industry in Sudan is in a:	Repetition	Percent-age	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
High	15	27.3	42.9	15.4	23.1
Mean	26	47.3	35.7	53.8	50.0
Low	14	25.5	21.4	30.8	26.9
Total	55	100.0	100.0	100.0	100.0

Table (3.17): competition in the market of constructional industry in Sudan is in a:

From above table we find that 53.8% from persons in sample whom the years of experience of them between 5 to 10 year their opinion competition in the market of constructional industry in Sudan is in: mean

Are the rules and inspection affairs put for construction industry in finding new companies fair:

Are the rules and inspection affairs put for construction industry in finding new companies fair:	Repetition	Percent-age	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
High	2	3.6	7.1	0.0	0.0
Mean	17	30.9	50.0	30.8	23.1
Low	18	32.7	14.3	30.8	46.2
Not enough	18	32.7	28.6	38.5	30.8
Total	55	100.0	100.0	100.0	100.0

Table (3.18) Are the rules and inspection affairs put for construction industry in finding new companies fair:

From above table 50% from sample whom the years of experience of them less than 5 years their opinion : Are the rules and inspection affairs put for construction industry in finding new companies fair: mean degree.

Explain Are the rules and inspection affairs put for construction industry in finding new companies fair:

Explain	Are the rules and inspection affairs put for construction industry in finding new companies fair:			
	High	Mean	Low	Not enough
There are no controls or oversight and that I found is weak	0.0	17.6	72.2	61.1
Implementation in order to be properly	100.0	5.9	5.6	11.1
Apply to some companies only	0.0	70.6	11.1	16.7
The lack of effective role of government and lack of experience	0.0	5.9	5.6	11.1
Non-compliance with specifications	0.0	0.00	5.6	0.0
Total	100.0	100.0	100.0	100.0

Table (3.19): Explain Are the rules and inspection affairs put for construction industry in finding new companies fair:

From above table we find that 72.2% from sample their opinion that there are no controls or oversight and that found is weak.

Quality concept in construction management is applied in general and private sector in:

Quality concept in construction management is applied in general and private sector in:	Repetition	Percentage	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
High	6	10.9	14.3	15.4	3.8
Mean	23	41.8	85.7	23.1	26.9
Low	21	38.2	0.0	38.5	61.5
not applied	5	9.1	0.0	23.1	7.7
Total	55	100.0	100.0	100.0	100.0

Table (3.20): Quality concept in construction management is applied in general and private sector in:

From above table we find that 61.5% from sample whom the years of experience of them greater than 10 years their opinion of them is Quality concept in construction management is applied in general and private sector in: weak degree.

how far is risk management concept is applied in construction management:

how far is risk management concept is applied in construction management:	Repetition	Percent-age	Years of experience		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
at high range	7	12.7	21.4	7.7	3.8
in average range	28	50.9	35.7	38.5	69.2
in narrow range	7	12.7	28.6	15.4	3.8
not applied	13	23.7	14.3	38.5	23.1
Security and safety in the construction industry in Sudan(how understood):					
at high range	5	9.1	21.4	7.7	3.8
in average range	11	20.0	35.7	0.0	19.2
in narrow range	31	56.4	28.6	61.5	69.2
not applied	8	14.5	14.3	30.8	7.7
Total	55	100.0	100.0	100.0	100.0

Table (3.21): The concept of risk management, security and safety in the construction industry in Sudan

From above table we find that 69.2% from sample whom the years of experience greater than 10 years their opinion Security and safety in the construction industry in Sudan understood in a narrow range.

As to local experience, the process of planning and scheduling in Sudan aims to :

As to local experience, the process of planning and scheduling in Sudan aims to:	Repetition	Percent -age	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
Apply requirement construction contract.	2	3.6	14.3	0.0	0.0
Follow construction performance through time and cash flows.	4	7.3	7.1	0.0	11.5
Revise works according to previous specified planning and take right decision in suitable time.	1	1.8	7.1	0.0	0.0
All above is correct	48	87.3	71.4	100.0	88.5
Total	55	100.0	100.0	100.0	100.0

Table (3.22): As to local experience, the process of planning and scheduling in Sudan

From above table we find that 100% from sample whom the years of experience from 5 to 10 years show all above is correct.

3.3.3: Third Section: The process of planning& scheduling in construction projects in Sudan:

As the performance of your institute , the effect degree of planning and scheduling in construction projects in terms of:

As the performance of your institute , the effect degree of planning and scheduling in construction projects in terms of:	Percentage (%)				Total
	High	Mean	Low	Not more	
Effect of using time factor	4.5	36.4	5.5	3.6	100.0
Effect of using resources and cash flow.	61.8	30.9	7.3	0.0	100.0
Putting a clear picture for implementation from the start.	30.9	34.5	9.1	3.5	100.0
make responsibilities clear	55.6	31.5	9.3	3.7	100.0

Table (3.23): According to your firm performance be the degree of influence the planning and scheduling in construction projects

From above table we find that 54.5% from sample their opinion of them As the performance of your institute , the effect degree of planning and scheduling in construction projects in terms of: the effectiveness of using the time factor is high.

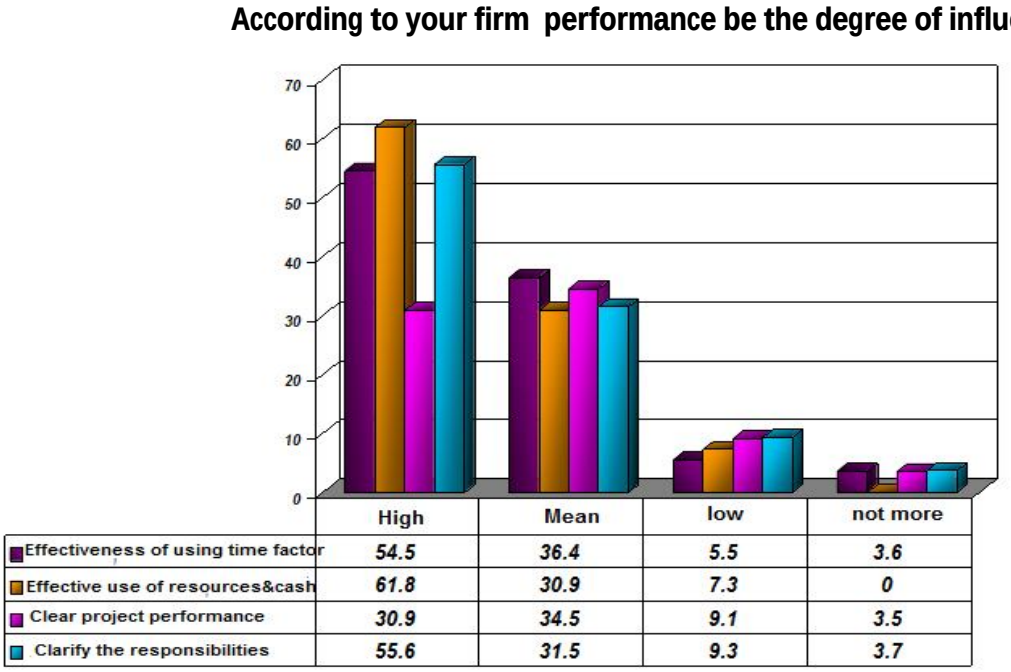


Fig (3.13): the degree of influence the planning and scheduling in construction

used programmes for planning and scheduling projects generally are:

Programmes	Repetition	Percent-age	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
Primavera	31	60.8	58.3%	53.8%	64.0%
M.s project	9	17.6	8.3%	23.1%	20.0%
Excel sheet	9	17.6	16.7%	23.1%	8.0%
Other	4	7.8	16.7%	00.0%	8.0%
Total	53	100%	100%	100%	100%

Table (3.24): used programmes for planning and scheduling projects generally are:

From above table we find that 64% from sample whom the years of experience are greater than 10 years their opinion is primavera is a largest use.

How do you coordinate and follow up between your time table and the main table used by the owner .

how do you coordinate and follow up between your time table and the main table used by the owner .	M Repetition	Percent-age	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
Daily	10	18.2	14.3	23.1	19.2
Weekly	26	47.3	64.3	23.1	46.2
Monthly	14	25.5	14.3	38.5	26.9
At times	5	9.1	7.1	15.4	7.7
how frequent management meetings for negotiating and follow up of the project.					
Daily	1	1.9	0.0	0.0	3.8
Weekly	33	61.1	46.2	69.2	61.5
Monthly	11	20.4	38.5	7.7	19.2
At different time	9	16.7	15.4	23.1	15.4
Total	54	100.0	100.0	100.0	100.0

Table: (3.25): How do you coordinate and follow up between your time table and the main table used by the owner

From above table we find that 64.3% from the sample whom the years of experience less than 5 years their make weekly time table and 69.2% from sample whom the years of experience of them from 5 to 10 years we find how frequent management meetings for negotiating and follow up of the project weekly.

How is planning and follow up carried out in your corporation:

how is planning and follow up carried out in your corporation:	Repetition	Percent-age	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
Specialized department	32	58.2	71.4	53.8	53.8
Par time job	21	38.2	28.6	46.2	38.5
Others	2	3.6	0.0	0.0	7.7
Total	54	100.0	100.0	100.0	100.0
The process of planning through					
Person the Director-General	1	50.0	0.0	0.0	50.0
Official site engineer	1	50.0	0.0	0.0	50.0
Total	2	100.0	0.0	0.0	100.0

Table (3.26): How is the process of planning and follow-up in your firm?

From above table we find that 53.8% from sample whom the years greater than 5 years the follow-up of planning and scheduling in their firm by specialized department.

.

How do you coordinate and follow up time table decided by planning director with projects directors and site engineers.

how do you coordinate and follow up time table decided by planning director with projects directors and site engineers.	Repetition	Percent-age	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
Daily	11	20.0	28.6	23.1	15.4
Weekly	27	49.1	42.9	46.2	53.8
Monthly	8	14.5	7.1	7.7	19.2
At intervals periods	9	16.4	21.4	23.1	11.5
Total	55	100.0	100.0	100.0	100.0

Table (3.27): how do you coordinate and follow up time table decided by planning director with projects directors and site engineers.

From above table we find that 53.8% from sample whom the years of experience is greater than 10 years how do you coordinate and follow up time table decided by planning director with projects directors and site engineers.

How do you need to scheduled materials supply with the preliminary time table and the updating on construction programme.

How do you need to tabulate materials supply with the preliminary time table and the updating on construction programme.	Repetition	Percent -age	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
Daily	11	20.0	21.4	30.8	15.4
Weekly	25	45.5	50.0	38.5	46.2
Monthly	6	10.9	0.0	23.1	11.5
From time to time	6	10.9	7.1	7.7	15.4
When necessary	7	12.7	21.4	0.0	11.5
Total	55	100.0	100.0	100.0	100.0

Table (3.28) : how do you need to tabulate materials supply with the preliminary time table and the updating on construction programme.

From above table we find that 50% from sample whom the years of experience less than 5 years the process material supply for execution contractors with primary schedule and update the implementation program weekly.

It is very important for the planning engineer or project director to form and idea a preliminary points as he at first looked in the project documents to put light plan for suitable planning techniques or methods:

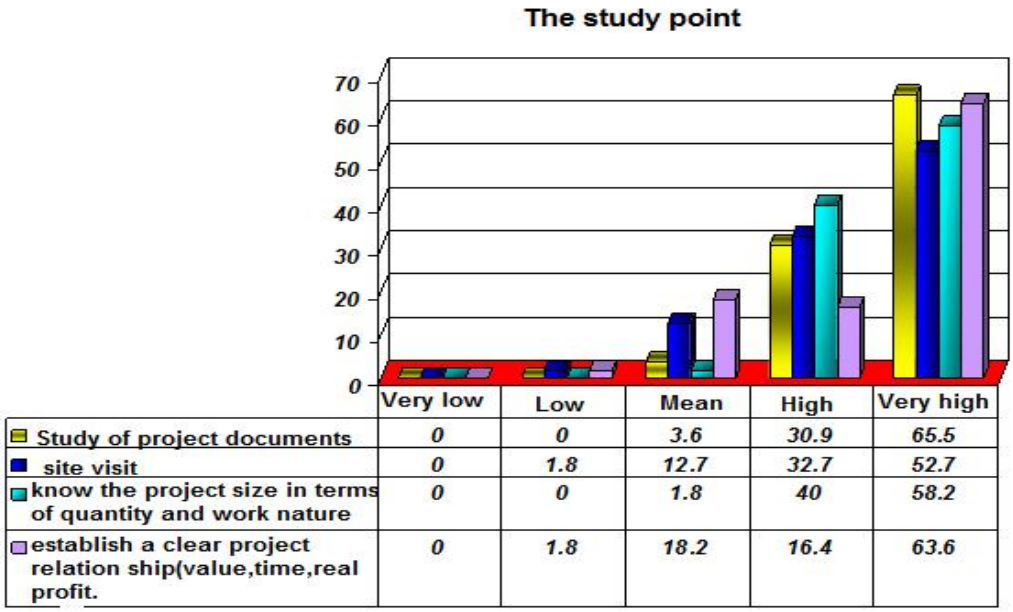
With your experience how do you see the effect of the following points in the concern:

The study points	The degree of importance (%)					Total
	Very low	low	Mean	High	Very high	
Study of all project documents	0.0	0.0	3.6	30.9	65.5	100.0
Site visit	0.0	1.8	12.7	32.7	52.7	100.0
Project size (activities and specification)	0.0	0.0	1.8	40.0	58.2	100.0
Put a clear relationship between project value and achievement time, to put real profitability.	0.0	1.8	18.2	16.4	63.6	100.0

Table (3.29): the study point of project

From above table we find that 65.5% from sample their pinion is the influence of study all project documents very high effect to determine a clear picture of how appropriate planning.

Fig (3.14): the study point



Importance of the process of planning and scheduling of a project is for different factors, please show how important every factors:

Factors	The degree of importance (%)					Total
	Very high	High	Mean	Low	Very low	
The degree of project complexity	34.5	36.4	21.8	3.6	3.6	100.0
Knowledge of start time and finishing of the project.	54.5	36.4	9.1	0.0	0.0	100.0
Knowledge project start and hand over.	41.8	43.6	14.5	0.0	0.0	100.0
Knowledge the necessary time to start and finish to every activity.	38.2	41.8	20.0	0.0	0.0	100.0

Table (3.30) : Importance of the process of planning and scheduling of a project is for different factors, please show how important every factors:

From above table we find that 54.5% from sample their opinion the Importance of the process of planning and scheduling of a project is for different factors, please show how important every factors: very high for Knowledge of start time and finishing of the project..

According to your academic and practical experience in construction projects there are cases when project is delay, the agreed that for the following:

Causes	Degree of delaying					Total
	Very high	High	Mean	Low	Very low	
Complete design of the project is not available.	29.1	27.3	18.2	10.9	14.5	100.0
The large number of change orders in the implementation	41.8	36.4	16.4	5.5	0.0	100.0
differences in Contract documents	10.9	21.8	23.6	21.8	21.8	100.0
no interest for skilled labours utilization	21.8	30.9	21.8	9.1	16.4	100.0
probable accidents on site.	3.6	16.4	27.3	34.5	18.2	100.0
Bad weather	3.6	10.9	21.8	23.6	40.0	100.0
Not proper understanding between three parties (owner, engineer and contractor)	16.4	30.9	23.6	9.1	20.0	100.0
Not concerning for legal affairs from the start.	23.6	25.5	32.7	5.5	12.7	100.0

Table (3.31): according to your academic and practical experience in construction projects there are cases when project is delay

From above table we find that 41.8% from sample show that delay in the implementation of construction projects in Sudan result of the large number of change orders in the implementation.

These are a lot of construction techniques in planning and scheduling, how is the experience in your corporation towards:

These are a lot of construction techniques in planning and scheduling, how is the experience in your corporation towards:	Repetition	Percent-age	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
forecasting contract value curve	15	27.3	14.3	38.5	26.9
cumulative percentage value	6	10.9	14.3	0.0	15.4
bar chart programme	17	30.9	28.6	30.8	34.6
the good guess method	17	30.9	42.9	30.8	23.1
Total	55	100.0	100.0	100.0	100.0

Table (3.32): The techniques that are used in the organization of a forecast of cash flows

From above table 42.9% from persons whom the years of experience of them is less than 5 years the techniques that are used in their firm is the good guess method.

In planning and scheduling process there are different division of project budget.

As for your experience how important is every budget:

Type of leveling	The degree of importance					Total
	Very high	High	Mean	Low	Very low	
(operating budget) Labours – offices – profit – contractors	0.0	83.6	10.9	3.6	1.8	100.0
(annual sales budget). Main contractor budget.	0.0	78.2	18.2	3.6	1.8	100.0
(capital expendure) Cost of operating machines.	0.0	52.7	32.7	5.5	9.1	100.0
(cash flow budget). Expected expendure and reporting company loans	0.0	38.2	34.5	18.2	9.1	100.0
(master budget). Expectation of difference between profits and losses.	0.0	45.5	30.9	14.5	9.1	100.0

Table (3.33): In planning and scheduling process there are different division of project budget.

From above table 83.6% from sample we find that the important of the levelling (operating budget) labour-offices-profit-resources and sub-contractors.

For a practical and true leveling for any project there are factors to put in mind.

As from your experience evaluate what is being done in your corporation.

Factors						Total
	Very high	High	Mean	Low	Very low	
Preparing expectations for a certain budget	38.2	36.4	14.5	7.3	3.6	100.0
Determine Company's policy.	23.6	40.0	21.8	10.9	3.6	100.0
Prepare budget from in puts, necessary quantities for the project compared with preliminary cost with costing and rate of interest.	50.9	30.9	12.7	3.6	1.8	100.0
Revise the expected budget.	38.2	36.4	16.4	7.3	1.8	100.0

Table(3.34): For a practical and true leveling for any project there are factors to put in mind.

From above table 50.9% from sample we find that Prepare budget from in puts, necessary quantities for the project compared with preliminary cost with costing and rate of interest. by very high degree.

In your firm, when you out the real budget to start construction comparing it with contract budget, how due find the difference:

The different may be	Repetition	Percent-age	Years of experience (%)		
			Less than 5 years	From 5 to 10 years	Greater than 10 years
High	4	7.3	0.0	15.4	7.7
Mean	27	49.1	57.1	30.8	53.8
Low	18	32.7	28.6	46.2	26.9
No differences	6	10.9	14.3	7.7	11.5
Total	55	100.0	100.0	100.0	100.0

Table (3.35) : different between real budget to start construction comparing it with contract budget

From above table 57.1% from sample whom the years of experience of them less than 5 years they find that: In your firm, when you out the real budget to start construction comparing it with contract budget, how due find the difference: is mean.

There are many implementation plans in the process of planning and scheduling, as from your experience how far at these plans applied in your institute:

Implementation plans	The extent of the work					Total
	Very high	High	Mean	Low	Very low	
Owner implementation plan (project planning)	29.1	30.9	21.8	10.9	7.3	100.0
Prepare with Tender contractors (pretender planning)	12.7	30.9	36.4	9.1	10.9	100.0
Prepare with main and sub contractors (precontract planning	49.1	27.3	18.2	0.0	5.5	100.0

Table (3.36) : implementation plans

From above table 49.1% from ample they find that the work by main contractor and sub-contractors (pre contract planning)using by very high degree.

All factors effecting the project implementation depend wholly on the planned time and that includes general point, as for your experience defined how the important of this point:

Points	The extent of the work					Total
	Very high	High	Mean	Low	Very low	
Start and finish of the milestones stages of the project.	65.5	27.3	5.5	1.8	0.0	100
Holidays periods	18.2	18.2	32.7	20.0	10.9	100
Preliminary and final handing over of the project.	32.7	52.7	9.1	3.6	1.8	100
Taking over works and materials testing.	49.1	38.2	7.3	1.8	1.8	100

Table (3.37) : All factors effecting the project implementation depend wholly on the planned time

From above table 65.5% from sample they find that Start and finish of the milestones stages of the project. very high.

Write your special comments

The comments	Repetition	Percentage
There are several effects time, economic policies and procedures.	6	10.9
Planning and organization is not interested in Sudan	15	27.3
There are many benefits of this questionnaire in terms of information	10	18.2
Poor implementation planning Thread	6	10.9
Total	37	67.3

Table (3.38): write your special comment

Table: 38

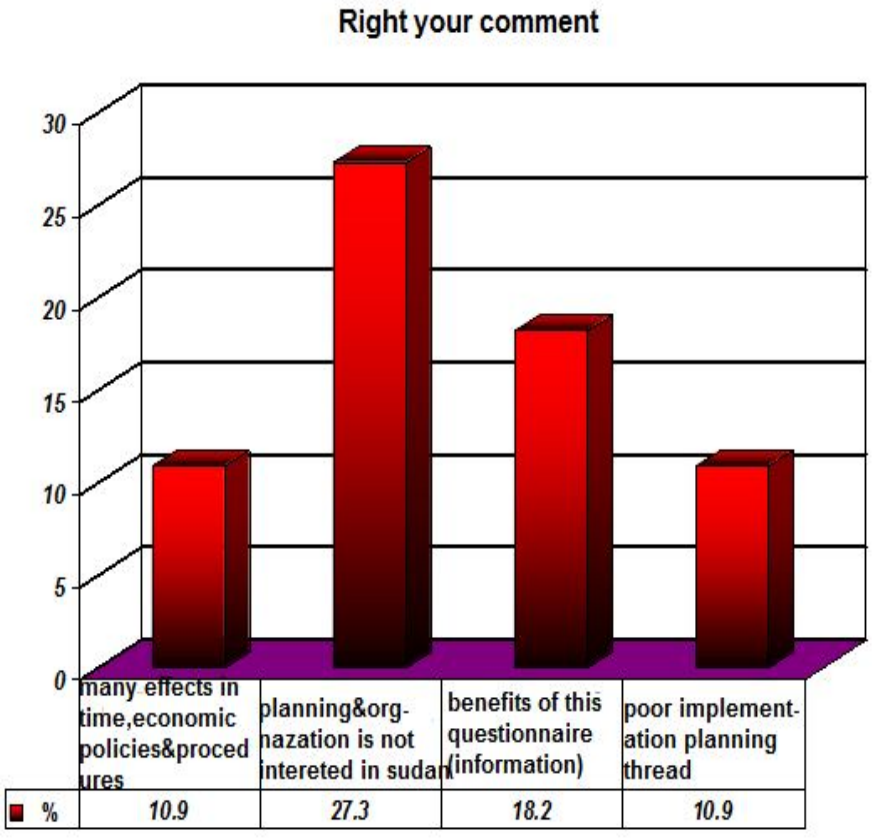


Fig (3.15): right your special comment

3.4: The third topic to prove hypotheses

Satisfaction attributes to respondents:

To know the opinion of respondents is it low, high or middle, use arithmetic and alternative mean comparing, if the alternative mean has been greater than the arithmetic mean the opinion of respondents on the variable is low (denies the hypothesis), if the alternative mean has been less than the arithmetic mean the opinion of respondents on the value is high (confirms the hypothesis), if the alternative mean and arithmetic mean is equal that mean the opinion of respondents on the variable is middle.

The researcher tested the application of the ratio (T test) for one sample to prove the study hypothesis by comparing the alternative with the arithmetic.

3.4.1: First hypotheses:

1. Attention to the process of planning and scheduling to form a preliminary idea and point to put all factors effect to this process and putting a clear picture for implementation from the start before contracting might lead to high degree of completion and achieving the project objectives.

To prove the above hypothesis, the researcher analyzed the ratio T test for one sample

Statement	arithmetic mean	Number of items	Alternative mean	Standard Deviation	(t) value	potential value	level of opinion	Percent-age
First hypotheses	31.69	8	22	3.18	22.34	0.00	high	88.03%

Table (3.39): analyzed the ratio (T) test

from above table we find that the average of respondents opinion about the Attention to the process of planning and scheduling to form a preliminary idea and point to put all factors effect to this process and putting a clear picture for implementation from the start before contracting might lead to high degree of completion and achieving the project objectives.

From above table, we find that the average opinion of respondents about the hypotheses .

was high-reaching (31.69) and it is higher than alternative mean(22), The (T) ratio (22.34) by potential value (0.00) It is the smallest class of moral 5% Which confirms the validity of the above hypothesis and the number of items on the premise (8) The terms of the two tables below shows the details of the terms of the hypothesis.

As the performance of your institute, the effect degree of planning and scheduling in construction projects in terms of:	arithmetic mean	Alternative mean	Standard Deviation	(t) value	potential value
Effective utilization of time factor	3.42	2.5	0.76	8.932	0.00
Effective utilization of resources and cash flows.	3.55	2.5	0.63	12.25	0.00
Establishment a clear picture for project performance from the start.	3.31	2.5	0.86	6.994	0.00
Responsibilities clarification	3.39	2.5	0.81	8.057	0.00

Table (3.40) : details of the terms of the hypothesis(As the performance of your institute, the effect degree of planning and scheduling in construction projects in terms of:

From above table we find that the average opinion of respondents about the firm performance be the degree of influence the planning and scheduling in construction projects is high for all variables (effectiveness of using the time factor by average 3.42 comparing by alternative mean (2.5).

It is very important for the planning engineer or project director to form and idea a preliminary points as he at first looked in the project documents to put light plan for suitable planning techniques or methods: with your experience how do you see the effect of the following points in the concern:	arithmetic mean	Altern-ative mean	Standard Deviation	t value	potential value
Study of all project documents	4.62	3	0.56	21.40	0.00
Site visit	4.36	3	0.78	12.99	0.00
Project size (activities and specification)	4.56	3	0.54	21.65	0.00
Put a clear relationship between project value and achievement time, to put real profitability.	4.42	3	0.85	12.32	0.00

Table(3.41) : effectiveness of using the time factor by average comparing by alternative mean

3.4.2: Second hypotheses:

Controlling and monitoring the execution phase based on planned time table give chances to catch the expected problems and consequently search for speeding solutions.

To prove this hypothesis the researcher analyzes by using chi squire to respondents about as to local experience, the process of planning and scheduling in Sudan aims to:

Objectives	Repetition	percentage	Chi squire	potential value
Apply requirement construction contract.	2	3.6	119.08	0.00
Follow construction performance through time cash flows.	4	7.3		
Revise works according to previous specified planning and take right decision in suitable time.	1	1.8		
All above is correct.	48	87.3		
Total	55	100.0		

Table(3.42) : analyzes by using chi squire to respondents about local experience, the process of planning and scheduling in Sudan aims to.

From above table 87.3% from sample agree for objectives show as to local experience, the process of planning and scheduling in Sudan aims to, and the chi value 119.08 by potential value 0.00 and it is the highest of class of moral 5% which confirms the validity of the hypothesis above.

3.4.3: Third hypotheses:

1. Establishing the process of planning and scheduling perfectly and in clear bases make practical and true leveling of resources and preparing budget to best uses of available resources.

To prove the above hypothesis, the researcher analyzed the ratio T test for one sample

Statement	arithmetic mean	Number of items	الوسط الفرضي	Standard Deviation	t value	potential value	level of opinion	Percent-age
Third hypotheses	19.44	5	15	3.08	10.67	0.00	High	77.76%

Table (3.43) : analyzed the ratio (t) test for process of planning and scheduling perfectly and in clear bases leads to best uses of available resources

From above table we find the average opinion of respondents (Establishing the process of planning and scheduling perfectly and in clear bases leads to best uses of available resources) was high his value (19.44) and it is greater than alternative mean(15), and value of (t) percentage (10.67) by potential value (0.00) It is the smallest class of moral 5% Which confirms the validity of the above hypothesis and the number of items on the premise (8) The terms of the table below shows the details of the terms of the hypothesis.

For a practical and true leveling for any project there are factors to put in mind, as from your experience evaluate what is being done in your corporation.	arithmetic mean	Alternative mean	Standard Deviation	t value	potential value
Preparing expectations for a certain budget.	3.98	3	1.08	6.74	0.00
Determine company's policy	3.69	3	1.07	4.79	0.00
Prepare budget from in puts, necessary quantities for the project compared with preliminary cost with costing and rate of interest.	4.25	3	0.95	9.82	0.00
Revise the expected budget	4.02	3	1.01	7.48	0.00
The needs to schedule the materials supply and execution contractors with primary schedule and update the implementation program	3.49	3	1.29	2.82	0.01

table (3.44): details of the terms of the hypothesis (For a practical and true leveling for any project there are factors to put in mind, as from your experience evaluate what is being done in your corporation.)

3.4.4: Fourth hypotheses:

1. To reached successful planning and scheduling might concern with necessary time to start and finish project in addition to acknowledge to different division of project budget.

To prove the above hypothesis, the researcher analyzed the ratio T test for one sample.

Statement	arithmetic mean	Number of items	الوسط الفرضي	Standard Deviation	t value	potential value	level of opinion	Percent-age
Fourth hypotheses	33.85	9	24.5	3.82	18.17	0.00	High	84.62%

1. Table (3.45): analyzed the ratio T test for To reached successful planning and scheduling might concern with necessary time to start and finish project in addition to acknowledge to different division of project budget.

From above table we find that the average opinion of respondents about (The success of construction industry particularly in large projects depend on the fulfillment of obligations previously stated in the planning and scheduling for the execution process).was high about (33.85) and it is the highest from alternative mean (24.5), the (t) percentage (18.17) by potential value (0.00) It is the smallest class of moral 5% Which confirms the validity of the above hypothesis and the number of items on the premise (9) The terms of the table below shows the details of the terms of the hypothesis

Importance of the process of planning and scheduling of a project is for different factors, please show important every factors	arithmetic mean	Alternative mean	Standard Deviation	t value	potential value
The degree of project complexity	3.95	3	1.03	6.83	0.00
Knowledge of start time and finishing of the project	4.45	3	0.66	16.30	0.00
Knowledge project start and hand over.	4.27	3	0.71	13.37	0.00
Knowledge the necessary time to start and finish to every activity.	4.18	3	0.75	11.72	0.00

Table (3.46): the details of the terms of the hypothesis for Importance of the process of planning and scheduling of a project is for different factors, please show important every factors (in table (3.47)

In planning and scheduling process there are different division of project budget	arithmetic mean	Alternative mean	Standard Deviation	t value	potential value
(operating budget) Labours- offices – profit – contractors.	3.76	2.5	0.61	15.43	0.00
(annual sales budget) Main contractor budget	3.73	2.5	0.59	15.38	0.00
(capital expanders) Cost of operating machines	3.29	2.5	0.94	6.26	0.00
(cash flow budget) Expected expendure and reporting company loans.	3.02	2.5	0.97	3.95	0.00
(master budget) Expectation of difference between profits and losses.	3.76	2.5	0.61	15.43	0.00

Table: 47:prove hypotheses for: In planning and scheduling process there are different division of project budget

CHAPTER FOUR

DISCUSSION & INTERPRETATION OF RESEARCH

4.1: DISCUSSION OF RESEARCH RESULTS.

Chapter four : Discussion & interpretation of research:

Discussion of research results:

* Construction industry in Sudan is considered as the most important attractive industry by high degree and this importance comes from many factors like afford a large labour numbers.

* very much agree the answer of Construction industry is considered as a service industry because they serve the citizen and the state together.

* Success or failure of construction industry in Sudan we can holding for many factors construction contract, local and foreign labors utilized and the organization laws for construction industry in Sudan …etc. because shortage experience in this industry.

* In weak limits the concept of construction management industry applied with project although the increasing interest due to involvement of foreign companies because the few understanding of this industry and concerned with it as just benefits.

* The impact of quality applying by high degree in this industry and that is a result of huge communication with external words create a kind of culture and identification.

* In mean degree the competition in the market of constructional industry in Sudan, it can go forward when it becomes free and fair, hope that in future.

* In weak degree the rule and inspection affairs put for construction industry in finding new companies, lead to many factors like lack of effective rule of government and lack of experience, and we need adequate and clear rule applied for all persons without exception.

* The concepts of risk management, security and safety applied in narrow range. And this is culture problems many engineers thinking about it additional cost and that must be wrong.

* In high degree as the performance the effect degree of planning and scheduling in construction project in terms of effective utilization of resources and cash flow in addition to clarify the responsibilities.

* The coordination and follow up the project schedule and meeting weekly in normal way and we need the specialized department of planning in any company.

* Study of all project documents, site visit and project size in terms of activities quantity and specification of works it is very important for planning engineer in addition to put a clear relationship between project value and achievement time, to put real profitability.

* importance of the process of planning and scheduling of a project is for different factors, the important factors is a knowledge

Of start time and finishing of the project.

*The importance factor of delay in implementation of construction projects in Sudan the large number of change orders through implementation, in addition to it there is no completely design of the project this lead to change orders.

*Very important to make leveling for employment, staff, profit, resources and sub contractors to balancing of output cash flow.

*The beginning and end of milestones period of project made direct affect of the project planned time.

*Finally the comment of people in sample in the questioner say that the planning and organization is not interested in Sudan and there are many benefits of this questionnaire in terms of information.

CHAPTER FIVE

CONCLUSION & RECOMMENDATIONS OF RESEARCH

5.1: RECOMMENDATION OF RESEARCH RESULTS.

5.2: CONCLUSION OF RESEARCH.

5.3: QUESTIONNUIRE FORM

Recommendations:

Through this research the questionnaire covers a big group of engineers with different experience in governmental and private sectors in scope of construction in Sudan, and this is the common recommendation following:

* Need to focus on the construction industry in Sudan, especially as it was at the stage of development and growth in addition to that they absorb a lot of labour at all levels.

* The competent authorities must be concerned primarily with the laws regulating the industry to suit all aspects of Sudan.

* Each working in this scope of work must be concerned of construction management concept and applied it correctly.

* involvement of foreign expertise has had a significant impact on the construction industry in Sudan, but there must be a clear law allows for training local workers in these projects.

* The need for a department or planning a special office in each company for the design and review of schedules and budgets for projects so as to prevent the delay which occurs by a large margin in construction projects in Sudan.

* The application of the concepts of time, cost and quality in construction projects and companies operating in Sudan in order to push this industry forward.

* Attention to the concept of quality management, risk management, safety and security in a measured way and refer to the experiences of developed countries in this field and not neglecting its cost because they do not have a cost, but it reduces the cost of delay time wasted resources in the non-conforming and accident, which is located in addition to the good and the free publicity, which makes us confident in the designed in situation.

* Attention to the process of planning and scheduling significantly since the beginning and before the start of the bidding proves and contracts and the use of approprait for each project and there must be updated time tables and cash flows so that we can work balancing of the resources of the company or particular project.

* Interest in the process of planning and scheduling in construction projects in Sudan helps us to use the factor of time, resources and cash flows dynamically.

* Interest in the process of planning and scheduling from the start of each project give us a clear picture of the shortcomings of each project and the time required to a accomplish the critical and important activities and resources that are available and not available and specifications of drawings, materials and equipments.

* Process of planning and scheduling using different techniques such as (primavera) gives us a clear picture of any project by giving daily, weekly, monthly and milestone report, and these can be reported in several forms can also address any problem easily without wasting time.

* The importance of planning and scheduling, we also realize the desire of the client work programme for the implementation of agreed client requirements and goals depending on e program submitted by him with more details so that we can make best control.

* concern with resource leveling. If the resource availability is quite limited. It cannot meet period by period variation. In this case, the project duration may be extended to the minimum possible such that the demand actually agrees with the availability and this is called Resource Leveling.

* concern with updating. Such an alteration may be due to several reasons such as the change in time schedule because of say, changes in the supply of materials, non-availability of additional labour during the project period etc.

* controlling and monitoring is importance application in planning process it is complementary to the planning process .once the scheduled plan has been prepared and execution commenced, control over the progress has to be exercised in order to complete the project by the stipulated.

* finally we can say that we need to change a lot of concepts prevailing in our community.

5.2: conclusion :

The importance of planning lies in the fact it is like a navigator of business circumstances and it is a beacon light of the dark and dismal and dynamic situation of the business enterprise. A business organization has to work in an environment which is uncertain and ever changing. With effective planning it would be difficult to anticipate future uncertain events. Proper planning enables a manager to carve out the future course of action and foundation stone of the most successful action of an enterprise. It brings orderliness, efficiency and stability in managerial actions and decisions. It provides a rational approach to managerial activities. The following are some important benefits of planning:

* without planned time table there are no based of controlling and monitoring to give chances to catch the expected problems and consequently search for speeding solution.

* successful plan concern with many concept time, quality, cost, budget, resources, safety ..etc.

* planning putting a clear picture for implementation from the start might lead to high degree of completion and achieving the project objectives.

* Planning helps in determining the objectives of the project.

* Planning avoids chaos because all efforts directed towards a pre determined goals of the project.

* Planning helps in better coordination because the well defined objectives, well publicized policies, well developed programmes and procedures help in coordination.

* Planning helps in control by distributing the responsibilities of different persons and jobs.

* Planning makes possible rational and realistic forecasting of the business activities of the enterprise.

* Planning minimizes the cost by utilizing the available resources in the best way.

* Planning encourages innovation and creativity among the managers because many new ideas come to the mind of manager at the planning stage. It creates a forward looking attitude among the managers.

*: Planning improves motivation and morale of managers as well as workers.

* Planning imparts competitive strength to the enterprise.

REFRENCES

1. Construction planning programming & control
   Brian Cooke and Peter Williams
2. Construction planning & management
   Dr V.K SHRIVASTAVA
   B.S.c Eng (civil), P.G DIP M.E. PhD. FIE (India), MISTE
   Professor of civil Engineering
3. Bourdon, C.C., and R.W. Levitt, *Union and Open Shop Construction*, Lexington Books, D.C. Heath and Co., Lexington, MA, 1980.
   - *Caterpillar Performance Handbook*, 18@+(th) Edition, Caterpillar, Inc., Peoria, IL, 1987.
   - Cordell, R.H., "Construction Productivity Management," *Cost Engineering*, Vol. 28, No. 2, February 1986, pp. 14-23.
   - Lange, J.E., and D.Q. Mills, *The Construction Industry*, Lexington Books, D.C. Heath and Co., Lexington, MA, 1979.
   - Nunnally, S.W., *Construction Methods and Management*, Prentice-Hall, Englewoood Cliffs, NJ, 2nd Ed., 1987.
   - Peurifoy, R.L., *Construction Planning, Equipment and Methods*, 2nd Edition, McGraw-Hill, New York, 1970.
   - Tersine, R.J., *Principles of Inventory and Materials Management*, North Holland,
4. Ahuja, H.N. and W.J. Campbell, *Estimating: From Concept to Completion*, Prentice-Hall, Inc., Englewood Cliffs, NJ, 1987.
   - Clark, F.D., and A.B. Lorenzoni, *Applied Cost Engineering*, Marcel Dekker, Inc., New York, 1978.
   - Clark, J.E., *Structural Concrete Cost Estimating*, McGraw-Hill, Inc., New York, 1983.
   - Diekmann, J.R., "Probabilistic Estimating: Mathematics and Applications," *ASCE Journal of Construction Engineering and Management*, Vol. 109, 1983, pp. 297-308.
   - Humphreys, K.K. (ed.) *Project and Cost Engineers' Handbook* (sponsored by American Association of Cost Engineers), 2nd Ed., Marcel Dekker, Inc., New York, 1984.

- Maevis, A.C., "Construction Cost Control by the Owners," *ASCE Journal of the Construction Division*, Vol. 106, 1980, pp. 435-446.
- Wohl, M. and C. Hendrickson, *Transportation Investment and Pricing Principles*, John Wiley & Sons, New York, 1984

5. Ang, A.H.S. and W.H. Tang, *Probability Concepts in Engineering Planning and Design: Volume I - Basic Principles*, John Wiley and Sons, Inc., New York, 1975.
   - Au, T., R.M. Shane, and L.A. Hoel, *Fundamentals of Systems Engineering: Probabilistic Models*, Addison-Wesley Publishing Co., Reading MA, 1972
   - Bowker, A.H. and Liebermann, G. J., *Engineering Statistics*, Prentice-Hall, 1972.
   - Fox, A.J. and Cornell, H.A., (eds), *Quality in the Constructed Project*, American Society of Civil Engineers, New York, 1984.
   - International Organization for Standardization, "Sampling Procedures and Charts for Inspection by Variables for Percent Defective, ISO 3951-1981 (E)", *Statistical Methods*, ISO Standard Handbook 3, International Organization for Standardization, Paris, France, 1981.
   - Skibniewski, M. and Hendrickson, C., *Methods to Improve the Safety Performance of the U.S. Construction Industry*, Technical Report, Department of Civil Engineering, Carnegie Mellon University, 1983.
   - United States Department of Defense, *Sampling Procedures and Tables for Inspection by Variables*, (Military Standard 414), Washington D.C.: U.S. Government Printing Office, 1957.
   - United States Department of Defense, *Sampling Procedures and Tables for Inspection by Attributes*, (Military Standard 105D), Washington D.C.: U.S. Government Printing Office, 1963
6. Au, T., C. Hendrickson and A. Pasquale, "Introduction of a Relational Database Within a Cost Estimating System," *Transportation Research Record* 1050, pp. 57-62, 1986.
   - Bosserman, B.E. and M.E. Ford, "Development of Computerized Specifications," *ASCE Journal of Construction Engineering and Management*, Vol. 110, No. CO3, 1984, pp. 375-384.

- Date, C.J., *An Introduction to Database Systems*, 3rd Ed., Addison-Wesley, 1981.
- Kim, W., "Relational Database Systems," *ACM Computing Surveys*, Vol. 11, No. 3, 1979, pp. 185-211.
- Mitchell, William J., *Computer Aided Architectural Design*, Van Nostrand Reinhold Co., New York, 1977.
- Vieceli, A.M., "Communication and Coding of Computerized Construction Project Information," Unpublished MS Thesis, Department of Civil Engineering, Carnegie Mellon University, Pittsburgh, PA, 1984.
- Wilkinson, R.W., "Computerized Specifications on a Small Project," *ASCE Journal of Construction Engineering and Management*, Vol. 110, No. CO3, 1984, PP. 337-345.
- Latimer, Dewitt and Chris Hendrickson, "Digital Archival of Construction Project Information," Proceedings of the International Symposium on Automation and Robotics for Construction, 2002."

7. Au, T. and P. Christiano, *Structural Analysis*, Prentice-Hall, Inc., Englewood Cliffs, NJ, 1987.
   - Building Research Advisory Board, *Exploratory Study on Responsibility, Liability and Accountability for Risks in Construction*, National Academy of Sciences, Washington, D.C., 1978.
   - Drucker, P.F., *Innovation and Entrepreneurship: Practice and Principles*, Harper and Row, New York, 1985.
   - Gaylord, E., and C. Gaylord (Editors), *Structural Engineering Handbook*, McGraw-Hill Book Co., New York, 1979.
   - Levitt, R.E., R.D. Logcher and N.H. Quaddumi, "Impact of Owner-Engineer Risk Sharing on Design Conservatism," *ASCE Journal of Professional Issues in Engineering*, Vol. 110, 1984, pp. 157-167.
   - Simon, H.A., *The Science of the Artificial*, Second Edition, MIT Press, Cambridge, MA, 1981.
   - Tatum, C.B., "Innovation on the Construction Project: A Process View," *Project Management Journal*, Vol. 18, No. 5, 1987, pp. 57-67.
   - Pre-Project Planning Research Team, *Pre-Project Planning Handbook* Construction Industry Institute, Publication 39-2, April 1995

8. Baracco-Miller, E., "Planning for Construction," Unpublished MS Thesis, Dept. of Civil Engineering, Carnegie Mellon University, 1987.
   - Construction Specifications Institute, *MASTERFORMAT - Master List of Section Titles and Numbers*, Releasing Industry Group, Alexandria, VA, 1983.
   - Jackson, M.J. *Computers in Construction Planning and Control,* Allen & Unwin, London, 1986.
   - Sacerdoti, E.D. *A Structure for Plans and Behavior,* Elsevier North-Holland, New York, 1977.
   - Zozaya-Gorostiza, C., "An Expert System for Construction Project Planning," Unpublished PhD Dissertation, Dept. of Civil Engineering, Carnegie Mellon University, 1988
9. www.maxwideman.com
   Guest Articles – David Gar Land
   Home Issacons PM Glossary Papers\ Books
   Max's Musings Gust Articles Contact Info
10. www.the gef.org\gef\content\gef documents- publications
    manual : project cycle management
    Brussels: European commission, Europe Aid.2001

Questionnaire for supplementary research entitled

The process Of planning And Scheduling In Construction Projects In Sudan

(Towards Optimum Application)

Remark :

This questionnaire is after the study of how to put scientific planning and ability to execute in construction projects to all parties .

These information's is going to be used for research and are going to kept secret.

1/ First Section : General Information:

Name : ……

Scope of work : ……

Sector Of Labor:

Governmental Sector ☐ Private Sector ☐

Years of experience:

- Less than 5 years. ☐
- From (5 to 10) years. ☐
- Greater than 10 years. ☐

Job description :

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……
……

2/ Second Section: Construction Management In Sudan In Both Governmental And Private Sector.

1/ Construction Industry In Sudan is Considered as the most important attractive industry, the degree of

high ☐ mean ☐ weak ☐

2/ Construction industry importance comes from:

- Afford a large labour numbers. ☐
- Follow advanced techniques around the world. ☐
- Enter new building techniques. ☐
- Use new communications with all parts of the world. ☐

- More needs for its products. ☐
- all the above is correct. ☐

3/ Construction industry is considered as a service industry:

I very much agree ☐ I agree ☐ I do not agree ☐

Explain:

……
……

4/ Success or failure of construction industry in Sudan we can holding for:

- Organization laws for construction industry in Sudan. ☐
- Construction Contracts. ☐
- Responsible employees on construction industry whether private sector, general sector or foreign companies. ☐
- Local labor utilized. ☐
- all the above is correct. ☐

Explain:

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……

5/ the concept of construction management industry is applied with:

high ☐ mean ☐ weak ☐

6/ construction industry recently has more attention because of the involvement of foreign companies.

I highly agree ☐ I agree ☐ I don't agree ☐

Explain:

……
……

7/ Effect of applying construction management appears for operating companies in the field in :

Factors	Big	Mean	Weak
Time			
Cost			
Quality			

8/ Construction industry in Sudan, satisfied the users wishes with:

high ☐ Mean ☐ Weak ☐

9/ the development of construction industry in Sudan is clear in:

General sector ☐ Private sector ☐ General and private ☐

10/ competition in the market of constructional industry in Sudan is in a:

high ☐ Mean ☐ Weak ☐

11/ Are the rules and inspection affairs put for construction industry in finding new companies fair:

high ☐ mean ☐ weak ☐ not enough ☐

Explain:

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……
……

12/ Quality concept in construction management is applied in general and private sector in:

high ☐ mean ☐ weak ☐ not applied ☐

13/ how far is risk management concept is applied in construction management:

at high range ☐ in narrow range ☐ in average range ☐ not applied ☐

14/ Security and safety in the construction industry in Sudan(how understood):

at high range ☐ narrow rang ☐ average range ☐
applied ☐

Third section: The process of planning and scheduling in construction industry in Sudan:

1/ as to local experience, the process of planning and scheduling in Sudan aims to :

- Apply requirement construction contract.
- Follow construction performance through time and cash flows.
- Revise works according to previous specified planning and take right decision in suitable time.
- All above is correct.

2/ as the performance of your institute , the effect degree of planning and scheduling in construction projects in terms of:

Effective factors	big	mean	little	nothing
Effective utilization of time factor				
Effective utilization of resources and cash flows.				
Establishment a clear picture for project performance from the start.				
Responsibilities clarification.				

3/ used programmes for planning and scheduling projects generally are:

Primavera ☐ Ms project ☐ Excel Sheet ☐ Others ☐

4/ how do you coordinate and follow up between your time table and the main table used by the owner .

Daily ☐ weekly ☐ monthly ☐ at different times ☐

5/ how frequent management meetings for negotiating and follow up of the project.

Daily ☐ weekly ☐ monthly ☐ at different times ☐

6/ how is planning and follow up carried out in your corporation:

Specialized department ☐ part time job ☐ others ☐

Explain:
……
……

7/ how do you coordinate and follow up time table decided by planning director with projects directors and site engineers.

Daily ☐ weekly ☐ monthly ☐ n time to time ☐

8/ how do you need to tabulate materials supply with the preliminary time table and the updating on construction programme.

Daily ☐ weekly ☐ monthly ☐ from time to time ☐

9/ it is very important for the planning engineer or project director to form and idea a preliminary points as he at first looked in the project documents to put light plan for suitable planning techniques or methods: With your experience how do you see the effect of the following points in the concern:

Study points	The degree importance				
	Very low	low	mean	high	Very high
Study of all project documents					
Site visit					
Project size (activities and specification)					
Put a clear relationship between project value and achievement time, to put real profitability.					

10/ importance of the process of planning and scheduling of a project is for different factors, please show how important every factors:

factors	How important				
	Very low	low	mean	high	Very high
The degree of project complexity					
Knowledge of start time and finishing of the project.					
Knowledge project start and hand over.					
Knowledge the necessary time to start and finish to every activity.					

11/ according to your academic and practical experience in construction projects there are cases when project is delay, the agreed that for the following:

causes	Degree of delaying				
	Very little	little	mean	high	Very high
Complete design of the project is not available.					
Large number of change orders in the implementation					
differences in Contract documents					
no interest for skilled labours utilization					
probable accidents on site.					
Bad weather					
Not proper understanding between three parties (owner, engineer and contractor)					
Not concerning for legal affairs from the start.					

12/ these are a lot of construction techniques in planning and scheduling, how is the experience in your corporation towards:

- Forecasting contract value curve. ☐
- Cumulative percentage value. ☐
- Bar Chart programme. ☐
- The good guess method ☐

13/ In planning and scheduling process there are different division of project budget.

As for your experience how important is every budget:

Type of leveling	The degree of importance			
	Very high	high	mean	high
(operating budget) Labours – offices – profit – contractors				
(annual sales budget). Main contractor budget.				
(capital expendure) Cost of operating machines.				
(cash flow budget). Expected expendure and reporting company loans				
(master budget). Expectation of difference between profits and losses.				

14/ for a practical and true leveling for any project there are factors to put in mind, As from your experience evaluate what is being done in your corporation.

factors	Extent of application				
	Very low	low	mean	high	Very high
Preparing expectations for a certain budget.					
Determine Company's policy.					
Prepare budget from in puts, necessary quantities for the project compared with preliminary cost with costing and rate of interest.					
Revise the expected budget.					

15/ in your firm, when you out the real budget to start construction comparing it with contract budget, how due find the difference:

high ☐ mean ☐ weak ☐ no differences ☐

16/ there are many implementation plans in the process of planning and scheduling, as from your experience how far at these plans applied in your institute:

Implementation plans	The extent of the work				
	Very little	little	mean	high	Very high
Owner implementation plan (project planning)					
Prepare with Tender contractors (pretender planning)					
Prepare with main and sub contractors (pre-contract planning)					

17/ all factors effecting the project implementation depend wholly on the planned time and that includes general point, as for your experience defined how the important of this point:

points	The extent of the work				
	Very little	little	mean	high	Very high
Start and finish of the milestones stages of the project.					
Length of Holidays					
Preliminary and final handing over of the project.					
Taking over works and materials testing.					

18/ write your special comments:

……
……
……
……

استبيان لبحث تكميلى بعنوان

عملية التخطيط والجولة في مشاريع التشييد في السودان (نحو تطبيق أمثل)

ملحوظه:

هذا الاستبيان يهدف لدراسة كيفية وضع تخطيط علمى وسليم والمقدره على تطبيقه والعمل به بصوره كبيره فى مشاريع التشييد فى السودان للوصول الى أفضل النتائج المرضيه لجميع الأطراف وهذه المعلومات تستخدم بغرض البحث وسوف يتم المحافظه على سريتها.

1/ الجزء الأول : معلومات عامه:

الاسم .....

مجال العمل.....

قطاع العمل : قطاع حكومى ☐ قطاع خاص ☐

سنوات الخبره:

- أقل من 5 سنوات ☐
- من 5 _ 10 سنوات. ☐
- أكثر من 10 سنوات. ☐

الوصفالوظيفى.....

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2/ الجزء الثانى: ادارة التشييد فى السودان فى القطاعين العام والخاص

1/ تعتبر صناعة التشييد فى السودان من أهم الصناعات الرائده بدرجة:

كبيره ☐ متوسطه ☐ ضعيفه ☐

2/ أهمية صناعة التشييد تأتى من :

*استيعاب عدد كبير من الأيدى العامله ☐

*مواكبة التطور الحاصل فى كل العالم ☐

*ادخال تقنيات بناء جديده ☐

*انفتاح المواطن السودانى على العالم من خلال أجهزة الاتصال ☐

*الاحتياج المتنامى لمنتجاتها ☐

*كل ما ذكر صحيح ☐

3/ صناعة التشييد تعتبر صناعة خدميه:

أوافق بشده ☐ أوافق ☐ لا أوافق ☐

علل

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4/ نجاح أو فشل صناعة التشييد فى السودان يمكن أن نحمله على:

*القوانين المنظمه لصناعة التشييد فى السودان ☐

*عقود التشييد ☐

*العاملين على صناعة التشييد سواء كان قطاع عام أو خاص أو شركات أجنبيه ☐

*العماله المحليه المستخدمه ☐

*كل ماذكر صحيح ☐

علل.....

.....

5/ مفهوم ادارة التشييد فى المشروعات يتم تطبيقه بصوره :

كبيره ☐ متوسطه ☐ ضعيفه ☐

6/ اذداد الاهتمام بصناعة التشييد فى الآونه الأخيره بسبب دخول الشركات الأجنبيه :

أوافق بشده ☐ أوافق ☐ لا أوافق ☐

علل

اجابتك.....

.....

7/ تأثير تطبيق مفهوم ادارة التشييد بالنسبه للشركات العامله فى المجال يظهر فى :

العامل	كبيره	متوسطه	ضعيفه
الزمن			
التكلفه			
الجوده			

8 / صناعة التشييد فى السودان تحقق رغبة الزبون بصورة :

كبيرة ☐ متوسطة ☐ ضعيفه ☐

9 / يظهر ازدهار صناعة التشييد فى السودان بوضوح فى :

القطاع العام ☐ القطاع الخاص ☐ فى القطاعين معآ ☐

10 / واقع المنافسة في سوق صناعة التشييد في السودان يكون بدرجه :

كبيره ☐ متوسطه ☐ ضعيفة ☐

11 / الضوابط والرقابة الموضوعة لصناعة التشييد وانشاء الشركات الجديده كافيه بشكل:

كبير ☐ متوسط ☐ ضعيف ☐ غير كافيه ☐

علل اجابتك

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12/ من مفاهيم إدارة التشييد مفهوم الجودة، يطبق هذا المفهوم في القطاعين العام والخاص بصورة :

كبيره ☐ متوسطه ☐ ضعيفه ☐ لا يطبق ☐

13 / مفهوم ادارة المخاطر في صناعة التشييد في السودان ومدى العمل به :

فى اطار واسع ☐ فى اطار ضيق ☐ فى اطار متوسط ☐ لا يعمل به ☐

14/ مفهوم الأمن والسلامه فى صناعة التشييد والعمل به فى السودان :

فى اطار واسع ☐ فى اطار متوسط ☐ فى اطار ضيق ☐ لا يعمل به ☐

<u>3/ الجزء الثالث : عملية التخطيط والجدوله فى صناعة التشييد فى السودان :</u>

1/ من خلال الممارسه المحليه تهدف عملية التخطيط والجدوله فى مشاريع التشييد الى :

*تطبيق مطلوبات عقد التشييد.

*متابعة الاداء خلال مراحل التشييد من حيث الزمن والتدفقات النقديه.

*مراجعة الاداء وفقآ للتخطيط الموضوع مسبقآ واتخاذ القرار الصحيح فى الوقت المناسب.

*كل ما ذكر صحيح.

2/ حسب اداء مؤسستك تكون درجة تأثير عملية التخطيط والجدوله فى مشاريع التشييد من حيث :

العوامل المؤثرة	كبيره	متوسطه	قليله	لا يوجد
فاعلية استخدام عامل الزمن				
فاعلية استخدام الموارد والتدفقات النقديه				
وضع تصور واضح لأداء المشروع من البدايه				
توضيح المسئوليات				

3/ البرامج التي تستخدم لتخطيط وجدولة المشاريع بصوره عامه هى :

Primavera ☐ Ms project ☐ Excel Sheet ☐ Other ☐

4/ كيف تنسق وتتابع بين جدولك الزمنى والجدول الرئيسى المعمول به من قبل المالك :

يومياً ☐ اسبوعياً ☐ شهرياً ☐ على فترات متباعده ☐

5/ كيف يكون برنامج الاجتماعات الدوريه لادارة المشاريع للمناقشه والمتابعه للمشروع :

يومياً ☐ اسبوعياً ☐ شهرياً ☐ على فترات متباعده ☐

6/ كيف تتم عملية ادارة التخطيط والمتابعه فى مؤسستك :

ادارة متخصصة ☐ تكليف وقتى ☐ أخرى ☐

وضح

.....

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7/ كيف تنسق وتتابع الجدول الزمنى الموضوع بواسطة مدير التخطيط مع مدراء المشاريع وبالتالى مع مهندسى المواقع :

يومياً ☐ أسبوعياً ☐ شهرياً ☐ على فترات متباعده ☐

8/ كيف تحتاج لجدولة توريد المواد ومقاولى التنفيذ مع الجدول الزمنى الابتدائى وعملية تحديث برنامج التنفيذ المعمول به :

9/ اذا كان اجابتك فى السؤال رقم (6) بلا فأرجو توضيح كيف تتم عملية متابعة المشاريع فى مؤسستك :

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10/ من المهم جدا لمهندس التخطيط أو مدير المشروع أن يكون فكره ونقاط ابتدائيه بمجرد اطلاعه على مستندات المشروع لتحديد صوره واضحة لطريقة التخطيط المناسبة، من خلال خبرتك العمليه برأيكم ما مدى تأثير النقاط التاليه فى هذا السياق :

نقاط الدراسه	درجة الأهميه				
	قليله جداً	قليله	متوسطه	كبيره	كبيره جداً
دراسة جميع مستندات المشروع					
زيارة الموقع					
معرفة حجم المشروع من حيث كمية وطبيعة الأعمال					
انشاء علاقه واضحه بين قيمة المشروع وزمن تنفيذه لوضع الربحيه الحقيقيه للمشروع					

11/ تأتى أهمية عملية التخطيط والجدولة للمشروع المعين لعدة عوامل أرجو إفادتنا بمدى أهمية كل عامل:

العوامل	درجة الأهمية				
	قليله جداً	قليله	متوسطه	كبيره	كبيره جداً
درجة تعقيد المشروعات					
معرفة الزمن اللازم لبداية ونهاية المشروع					
معرفة بداية ونهايات المشروع					
معرفة الزمن اللازم لبداية ونهاية كل نشاط على حدي					

12/ حسب خبرتك العملية والعلميه التأخير في تنفيذ مشاريع التشييد في السودان قد يعزى إلى :

الأسباب	درجة التأخير				
	قليلة جداً	قليلة	متوسطه	كبيره	كبيره جداً
عدم وجود تصميم متكامل للمشروع					
كثرة التغيير فى أوامر التنفيذ					
اختلاف فى وثائق العدم					
عدم الاهتمام بكفاءة العماله المستخدمه					
الحوادث التى يمكن ان تقع فى الموقف					
سوء الأحوال الجويه					
عدم الفهم الجيد للعلاقة بين الأطراف الثلاثه(المالك&المقاو&الاستشار					
عدم الاهتمام بالنواحى القانونيه من البدايه					

13/ أى من التقنيات التى تستخدم فى مؤسستك لعمل توقعات التدفقات النقديه هل هى :

*Forecasting contract value curve . ☐

*Cumulative percentage value. ☐

*Bar chart programme ☐

*The good guess method ☐

14 / فى عملية التخطيط والجدوله هناك عدة أقسام من ميزانيات المشاريع حسب خبرتك العمليه ما مدى أهمية كل ميزانيه:

نوع الموازنه	مدى أهميتها			
	قليلة جداً	قليلة	متوسطة	كبيره
موازنة العماله- الموظفين- الأرباح-المواد-مقاولين الباطن operating budget				
موازنة المقاول الرئيسى annual sales budget				
موازنة منصرفات الآليات المستخدمه captal expendure				
توقعات منصرفات وتقرير سلفيات الشركه cash flow budget				
توقعات لموازنة الفارق بين الربحيه مع كمية الفاقد Master budget				

15/ لعمل موازنه عمليه وواقعيه لأى مشروع هناك عوامل يجب وضعها فى الاعتبار حسب خبرتك فند أى عامل حسب المعمول به فى مؤسستك :

العوامل	مدى العمل بها				
	قليلة جداً	قليلة	متوسطة	كبيرة	كبيرة جداً
تجهيز التوقعات اللازمه للميزانيه المعينه					
تحديد سياسة الشركة					
حساب الميزانيه من الموارد والكميات اللازمه للمشروع مع مقارنة التكلفه الأوليه مع التسعير ونسبة الأرباح					
مراجعة الميزانيه المتوقعه					

16/ فى مؤسستك وعند حساب الميزانية الحقيقية لبدء عملية التنفيذ ومقارنتها بالتكلفة الموضوعة في مرحلة العطاء نجد أن هذا الاختلاف قد يكون :

كبير ☐ متوسط ☐ ضعيف ☐ لا يوجد ☐

17/ هناك عدد كبير من مخططات التنفيذ فى عملية التخطيط والجدوله حسب معرفتك ماهو مدى العمل بهذه المخططات فى مؤسستك :

مخططات التنفيذ	مدى الأهمية				
	قليلة جداً	قليلة	متوسطة	كبيرة	كبيرة جداً
مخطط التنفيذ الموضوع بواسطة المالك project planning					
يعمل بواسطة مقاولين العطاءآت pretender planning					
يعمل بواسطة المقاول الرئيسي ومقاولين الباطن precontract planning					

18/ جميع العوامل التى تؤثر على المشروع وادائه تعتمد اعتماد كلى على الزمن المعين والمخطط له سابقاً ويتضمن ذلك عدة نقاط حسب خبرتك حدد مدى أهمية هذه النقاط:

النقاط	مدى أهميتها				
	قليلة جداً	قليلة	متوسطة	كبيرة	كبيرة جداً
بداية ونهاية المراحل المهمة للمشروع					
مدة الاجازات					
التسليم الابتدائى والنهائى للمشروع					
استلام الأعمال واختبارت المواد					

19/ أكتب تعليقك الخاص

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