



**ADDIS ABABA INSTITUTE OF TECHNOLOGY
SCHOOL OF CIVIL AND ENVIRONMENTAL
ENGINEERING**

**Practice of Construction Planning in the Ethiopian
Building Construction Industry: A Case Study on Selected
Contractors in Addis Ababa**

By

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Declaration

I declare that this project work was composed by myself, that the work contained herein is my own except where explicitly stated otherwise in the text, and that this work has not been submitted for any other degree or professional qualification.

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ABSTRACT

Planning is the process of thinking about activities required to achieve a desired goal. Construction planning is the process of determining appropriate strategy for the achievement of predefined project objectives. In construction projects, the objective of construction planning is the completion of prescribed amount of work within fixed time, at a previously estimated cost and to a specific standard of quality. In the Ethiopian construction industry however, construction planning effort usually fails to achieve its objectives. Even large construction companies who practice planning to some level, frequently have difficulty in achieving their predetermined goals.

There is, therefore, a need to examine construction practices and develop strategies for improving construction planning effectiveness. With this in mind this research tries to identify the main factors that influence effective construction planning in Ethiopian construction industry. Thus, 19 factors were identified from comprehensive literature review and the industry overview. Using questionnaire survey their degree of impact on planning effectiveness were assessed by planning practitioners working in large construction companies. And their corresponding severity indices were used for ranking whereby the agreement among the practitioners in ranking the factors was conformed using coefficient of variance test.

The findings indicate that lack of adequate investment of time and money on planning phase and inadequate qualification and experience of construction planners are found to be significantly influential to planning effectiveness. Furthermore it revealed inadequate information gathering and ineffective method for planned information dissemination shadowed the construction planning practice in construction companies. These necessitate the enhancement of construction companies' commitment for construction planning phase and the need to keep construction planners qualified, updated with proper training and use of up-to-date planning techniques.

Keywords: Construction planning, Ethiopian construction industry, planning techniques

TABLE OF CONTENTS

Abstract.....	i
Table of Contents.....	ii
List of Abbreviations	vi
List of Figures	vii
List of Tables	vii
Chapter One	1
Introduction.....	1
1.1 Background.....	1
1.2 Objective of the study	2
1.3 Scope of the research	3
1.4 Limitation of the research	3
1.5 Methodology	3
1.6 Structure of the study	5
2. Chapter TWO.....	7
Literature review	7
2.1 Introduction.....	7
2.2 Definition of planning.....	7
2.3 Construction planning.....	8
2.3.1 Basic concept of construction planning	8
2.3.2 Construction Planning Process.....	11
2.3.2.1 Information gathering	11
2.3.2.2 Preparation of plans	11
2.3.2.2.1 Choice of technology and construction method.....	12
2.3.2.2.2 Definition of work tasks	13
2.3.2.2.3 Defining Precedence Relationships among Activities	13
2.3.2.2.4 Estimating Activity Durations.....	14
2.3.2.2.5 Estimating Resource Requirements for Work Activities	15

2.3.2.3	Information distribution.....	15
2.4	Significance of construction planning.	16
2.4.1	Users of construction plan.....	17
2.4.2	Purpose of construction planning.....	17
2.5	Problems in current construction planning.	18
2.5.1	Inadequate method for information gathering and management.....	19
2.5.2	Insufficient training.....	20
2.5.3	Misunderstanding of nature of planning process.....	20
2.5.4	Inadequate method for planning coordination.....	20
2.5.5	The cumbersome work structure in planning practice.....	21
2.5.6	An irregular and longer time interval to review/revise plan after commencement of work.....	21
2.5.7	Longer time interval between planning and implementation.....	21
2.6	Summary.....	22
3.	Chapter THREE.....	23
	Overview of Ethiopian construction industry.....	23
3.1	Introduction.....	23
3.2	Benefits Derived from the Construction Industry.....	24
3.3	Shortcomings of the Construction Industry.....	24
3.3.1	Financial Constraints of local contractors.....	25
3.3.2	Shortage of Skilled Manpower.....	25
3.3.3	Inadequate information flow and communication.....	26
3.3.4	Inadequate supply of construction material.....	26
3.4	Summary.....	26
4.	Chapter FOUR.....	28
	Research methodology and analysis of the questionnaire survey.....	28
4.1	Introduction.....	28
4.2	Questionnaire Design.....	28
4.3	Data source and sampling.....	29
4.3.1	Questionnaire Response Rate.....	30
4.3.2	Summary of Respondents.....	30

4.4	Analysis of the current planning practice in Ethiopian construction industry according to opinion of the respondents.	31
4.4.1	Understanding of plan	31
4.4.2	Planning outcome	32
4.4.3	Specialized planning department	32
4.4.4	Opinion towards planning	32
4.4.5	Purpose of plan	32
4.4.6	Information flow	33
4.4.7	Information gathering.....	33
4.4.8	Time interval between construction planning and commencement of work .	33
4.4.9	Timely planning	33
4.4.10	Planning process	34
4.4.11	Planning improvement.....	34
4.4.12	Outcome of plan	34
4.5	Analysis of the current construction planning practice in Ethiopian construction industry in local construction companies.....	35
4.6	Analysis of the influencing factors	37
4.7	Measuring concordance among respondents	38
4.8	Summary	39
5.	Chapter FIVE	41
	Discussion on the data analysis	41
5.1	Introduction.....	41
5.2	The current Ethiopian construction planning practice according to practitioner’s opinion	41
5.3	The current Ethiopian construction planning practice in construction companies 42	
5.4	The influencing factors	42
6.	Chapter SIX.....	46
	Conclusions and Recommendations	46
6.1	Introduction.....	46
6.2	Conclusions.....	46

6.3 Recommendations.....	48
7. References	50
Appendix A: Sample questionnaire	53
Appendix B: Summary of background information of the respondents.....	63
Appendix C: Summary of Questionnaire Section II.....	65
Appendix D: Summary of Questionnaire Section III.....	68
Appendix E: Summary of respondents' rating degree of impact	70
Appendix F: Computation of severity index of the influencing factors.....	73
Appendix G: Computation of coefficient of variance (COV).....	76
Appendix H: Ranking of severity index of the influencing factors....	78

LIST OF ABBREVIATIONS

AVG -	Average
CPM -	Critical Path Method
E.g. -	Example
ERA -	Ethiopian Road Authority
FYGTP -	Five Years Growth and Transformation Plan
GDP -	Gross domestic Product
GNP -	Gross National Product
ICT -	Information Communication Technology
ILO -	International Labor Organization
IMF -	International Monetary Fund
MDGs -	Millennium development goals
MOWR -	Ministry Of Water Resource
MWUD -	Ministry Of Works and Urban Development
No. -	Number
PASDEP -	Plan for Accelerated and Sustainable Development to End Poverty
PERT -	Programme Evaluation and Review Technique
WB -	World Bank

LIST OF FIGURES

Figure 1 Research Methodology Chart	5
Figure 2 Alternative Emphases in Construction Planning	10
Figure 3 Phases of the planning process	12
Figure 4 Summary of Analysis	35
Figure 5 Summary of Analysis2	37

LIST OF TABLES

Table 1 Response Rate	30
Table 2 Top 10 Influencing Factors	39

CHAPTER ONE

INTRODUCTION

1.1 Background

The Construction industry is large, volatile, and requires great capital outlays and is one of the largest industries in many developing countries, the same is true in the case of Ethiopia. Construction is not only one of the major sectors of an economy but it also accounts from 12% - 25% of the Gross National Product(GNP) of both developed and developing countries (Netsanet, 2004). It consumes the higher percentage of the annual budget of a country; specifically in our country Ethiopia it covers 58% of the annual budget, (Wubishet, 2004). In most developing countries the gross value of construction constitutes over one half of the gross fixed investment formation and usually accounts for between 3% and 8% of the Gross Domestic Product (GDP) (Ismael, 1996).

Construction industry is an industry which involved in the planning, execution and evaluation (monitoring) of all types of civil works. Physical infrastructures such as buildings, communication and energy related construction works, water supply and sewerage civil works etc. are some of the major projects (program) in the construction industry (Wubishet, 2004). Construction industry plays an important role in social, economic and political development of a country.

The most important phase of construction work is planning in which all choice of technology, the definition of work tasks, and the estimation of the required resources, duration for individual tasks and identification of any interactions among the different work tasks are defined. A good construction plan is the basis for developing the budget and the schedule for work. Developing a construction plan is a critical task in the management of construction, even if the plan is not written or otherwise formally recorded. In addition to these technical aspect of construction planning, it may also be necessary to make organizational decisions about the relationship between project participants and even which organizations to include in a project.

Lack of proper planning is one of the main reasons why such problems arise. These problems eventually lead to disagreements, disputes and sometimes even litigation. Planning and Scheduling are identified among the top potential areas needing improvements. In Ethiopia, in many of the construction projects the time and money invested for planning compared to the size of the project is very small.

As a result of the rise in population and the never ending demand for infrastructure, construction has become a rapidly growing industry. Thus the problem due to lack of proper construction planning in the industry becomes a massive problem and it may cause claims between stakeholders because these lack of planning may cause cost and time overrun. If these problems are not handled properly it may put the construction industry in danger. Currently there are a number of factors for the improper planning or absence of planning in the Ethiopian construction industry. One of the major factors is that, construction stakeholders do not want to invest enough amounts of time and money on planning and it is often seen as a waste. But usually these stakeholders will incur much bigger costs as a result of time and cost overruns emanating from lack of proper planning. Accidents will always happen, but careful planning from the start will prevent a simple accident from escalating into a major calamity, (Blake, 1989)

This study tries to assess the general understanding of professionals practicing in the construction industry, the significance of proper construction planning. Then proceeds to understand how the use of proper planning can help propel forward our construction performance and finally to have the clear perspective underperformances by local contractors as a result of improper construction planning or absence of planning altogether.

1.2 Objective of the study

The aim of this study is to determine the gaps and deficiencies of current construction planning practice which ultimately leads to inadequate performance of local construction companies. The objective extends to aid construction stakeholders and professionals involved to better understanding of the importance and significance of proper construction planning to minimize future construction underperformances. This particular study is also aimed at suggesting possible recommendations for enhancing the effectiveness of practical construction planning which in turn leads to a successful construction process.

The specific objectives include:

- to show the significance of construction planning practice for effective performance in Ethiopian contractors.
- to identify causes/factors for ineffectiveness of construction planning practice in Ethiopian construction industry.
- to propose possible recommendations to increase effectiveness of construction planning practice in Ethiopian construction companies.

1.3 Scope of the research

Although construction planning is performed by different parties: client, consultant and contractors and also planning has many stage from project inception to operation; the scope of this research is limited to the three construction planning stage performed by construction companies which are pre bid, pre constructions(from bid award to full mobilization) and during construction. This research will focus on relatively larger construction companies due to their active participation in complex projects and the significance of construction planning increases in large and complex projects.

1.4 Limitation of the research

This study has certain key limitations, mainly due to the characteristics of the sample and method of data collection. First, due to cost and time constraint, the sample size was relatively small and was geographically restricted to the city of Addis Ababa, Ethiopia. The samples were purposely chosen due to their accessibility and willingness to participate in the study. Thus making the samples non-random. Another limitation is that the sample is made up of construction companies which undertake a variety of project types. This introduces the possibility of variability in the sample, as construction companies tend to have different approach to planning depending on their area of project specialization.

1.5 Methodology

The research process was designed through defining the research problems, its objectives and questions. To accomplish these objectives the research was conducted by reviewing the related domestic and foreign literatures, on-going researches, books, the Internet, leading construction

management and engineering journals and relevant practices related to construction planning to obtain the current understanding of construction planning. Furthermore, gathering important factors and relevant information to understand the current Ethiopian construction industry was part of the study.

The questionnaire design adopted structured questions for the survey. This approach is chosen as structured questions are easy to understand and quick to respond to, (Fellows & Liu, 2015)). However, to avoid constraints of idea in closed questions, respondents were given the option to provide for any further suggestions they wish to be considered. Sufficiently simple and straight forward questions were developed in order to avoid potential ambiguities. The questions were systematically arranged to ease progressive assessment of the issues by the respondent.

The questionnaire distribution was focused on local Grade 1 and 2 construction companies registered under Ethiopian ministry of urban development and construction. The questions were designed to get both the professionals opinion on current construction planning practice and the actual construction planning practice in their perspective companies. These contractors are involved from medium to large construction projects where construction planning is expected to be practiced in a structured manner. The questionnaire was asked to be filled by professionals working in these construction companies at construction planning activity.

Conclusions are drawn and recommendations are forwarded based on the finding of the study and reviewed literature. The complete flow of this project from the beginning of the research project to the final conclusions and recommendations are presented in figure 1.

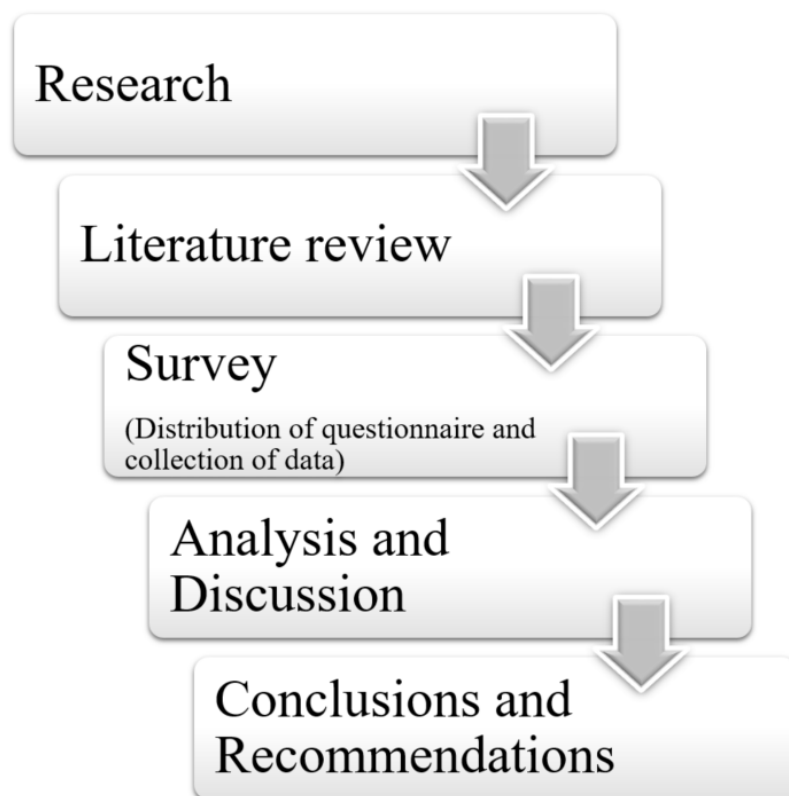


Figure 1 Research Methodology Chart

1.6 Structure of the study

Chapter 2 summarizes the literature survey on basic concepts of construction planning and examines the importance and significance of construction planning for a successful implementation of a project. Detailed discussion is made on the purpose of construction plan and about problems/factors affecting the effectiveness of current construction planning practice.

Chapter 3 establishes overview of the Ethiopian construction industry, objective of the industry during the Five Years Growth and Transformation Plan (FYGTP). The chapters also establish overview of the shortcomings of the industry.

Chapter 4 illustrates the details of research methodology, questionnaire design and the sampling method. This chapter presents empirical and analytical review of research. Furthermore, detail discussion is made on the findings from the study on the current construction planning practice in the industry and on the factors influencing effective construction planning.

Chapter 5 discusses the results of the data analysis covered in chapter 4. The discussion includes the current construction planning practice in Ethiopian construction industry according to practitioners' opinion and the practice in their respective organization. The discussion also includes the interpretation of the top ten ranked influential factors on construction planning effectiveness.

Chapter 6 draws conclusions for the study summarizing the aim of the research, scope of the research, research methodology adopted, the limitation of the research and the inference of the findings of the research. This chapter also covers possible recommendations for further research and suggestions for improvement of construction planning practice in the Ethiopian construction industry.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Construction planning is performed in a multi-disciplinary environment in which it is crucial to explore interdependencies, manage the uncertainty of the information exchange and the understanding of the context. Current construction planning often works on a “throw over the wall” basis - plans are developed only or mainly for control purpose, and ignore the “how” aspect. Construction method planning is treated as a linear process and isolated from information and logistics management. (Baiyi , Simon , & Thrope , 2006)

The large volume of information gathered, which is usually collected from informal communications in different formats, poses a challenge for planners. This is because planners are expected to convert the different inputs, analyze the data and come up with a comprehensive plan. The quality of the information received is also often poor (i.e. incomplete design information). In order to deal with the uncertainty caused by insufficient information, guesses are frequently made in the planning process, which neither the initial planner, nor the downstream planner will later check. They are usually ignored and left until execution of the plan, and only then is when the problems reveal themselves.

This research work discusses the importance of planning and effective management of information flow in a construction planning process and the need to improve construction planning to minimize underperformances of projects.

2.2 Definition of planning

From an extensive survey of the general literature, it is clear that the term planning is still widely debated. (E.g. (Wildavsky, 1973); (Mintzberg, 1981)). Some equate planning with management. In the project environment it is perceived to cover activities necessary to launch a project, while those follow the launch are defined as project control. Others claim planning to be a decision making process. But planning is in reality much more than just decision making.

It was proposed that construction planning is a process of several elements; the more of these elements that are present, the more readily the process is recognized as planning.

Planning elements comprises the following (Hendrickson & Au, 2008)

1. A decision making process
2. A process of anticipatory decision making
3. A process of integrating interdependent decisions into a system decision.
4. A hierarchical process evolving from general guideline to objective, to the elaboration of means and constraints that lead to a detailed course of action.
5. A process that include part or all of a chain of activities comprising information search and analysis, development and design of alternatives, analysis and evaluation of alternatives and choice making.
6. The systematic employment of procedures (standardized and formal to varying degrees).
7. Documented presentation, in the form of plan.

2.3 Construction planning

2.3.1 Basic concept of construction planning

Construction planning is a fundamental and challenging activity in the management and execution of construction projects. It involves the choice of technology, the definition of work tasks, estimation of the required resource and duration for individual tasks, and the identification of any interaction among the different work tasks. A good construction plan is the basis for developing the budget and the schedule for the work.

Construction planning involves:

- choice of technology,
- definition of work tasks,
- identification of any interactions among the different work tasks, and
- estimation of the required resources and durations for individual tasks.

Planning is the most essential and challenging phase in the project development cycle. It is highly sensitive to the project environment that is, the technology used, and the existing management and industry practice for a particular work. Planning is also the process of representing the project scope by its identifiable components. It involves the breakdown of the project in to definable,

measurable, and identifiable work tasks, and then establishes their logical inter - dependence and drawing their network diagram.

Planning answers the following questions: -

- what is to be done? That is; the definition of work tasks / activities.
- how to do it (logical order)? That is; activity relationships and their sequence. Synthesizing the means or the steps required.
- who does it? That is: showing responsibility.

Planning is a difficult task that can only be efficiently done through a good work team. The artistic and highly experience-based nature of time planning restricts it to human planners manually in a short period of time, requiring the assistance of commercial software. So, planners should be systematic to:

- minimizing over-weighting something
- sharing of ideas with the planning team
- having a clear definition of project scope and desired level of detail
- building confidence and commitment in to team workers
- effectively communicating the plan to site personnel.

A good construction plan is the basis for developing the schedule and the budget for work. Developing the construction plan is a critical task in the management of construction, even if the plan is not written or otherwise formally recorded. In developing a construction plan, it is common to adopt a primary emphasis on either schedule control or on cost control.

Scheduling and Cost: Most complex projects require consideration of both scheduling and cost over time, so that planning; monitoring and record keeping must consider both dimensions. In these cases, the integration of schedule and budget information is a major concern.

Expense Categories: In these cases, construction planning is cost or expense oriented. Within the categories of expenditure, a distinction is made between costs incurred directly in the performance of an activity and indirectly for the accomplishment of the project.

The different alternatives that can be used in order to plan are diagrammatically presented in figure 2 below.

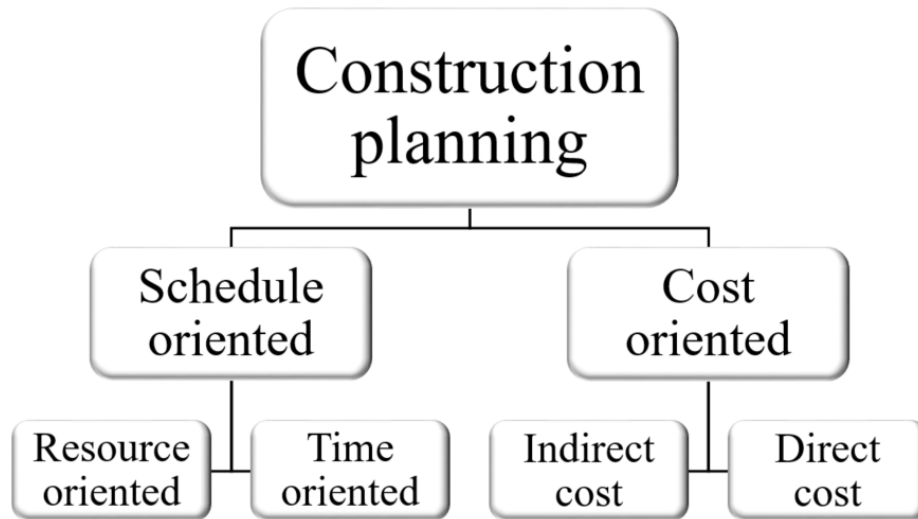


Figure 2 Alternative Emphases in Construction Planning

In developing a construction plan, it is common to adopt a primary emphasis on either cost control or on schedule control as illustrated in Fig. 2. (Hendrickson & Au, 2008) In these cases, construction planning is cost or expense oriented. Within the categories of expenditure, a distinction is made between costs incurred directly in the performance of an activity and indirectly for the accomplishment of the project. For example, borrowing expenses for project financing and overhead items are commonly treated as indirect costs. For other projects, scheduling of work activities over time is critical and is emphasized in the planning process. In this case, the planner insures that the proper precedence among activities are maintained and that efficient scheduling of the available resources prevails. Traditional scheduling procedures emphasize the maintenance of task precedence (resulting in *critical path scheduling* procedures) or efficient use of resources over time (resulting in *job shop scheduling* procedures). Finally, most complex projects require consideration of both cost and scheduling over time, so that planning, monitoring and record keeping must consider both dimensions. In these cases, the integration of schedule and budget information is a major concern.

2.3.2 Construction Planning Process

2.3.2.1 Information gathering

Information gathering has been identified as an important component of the planning process (Steiner G. A., 1969), (Galbraith, 1973)). A proper planner needs accurate and timely information flow, which reduce the degree of uncertainty of data used by planners. Planners should carefully examine different sources of information and use it to influence the future.

Information gathering requires considerable resource. The source of information required for planning a typical construction project includes: (Guyadeen, 2017)

- Contract document
- Blueprints and specifications
- Site and environmental conditions
- Construction technology
- Internal and external production resource (E.g. Availability and Cost)
- Production of labor and equipment
- Goals and constraints dictated by top management and the client
- Various external authorities regarding quality control, finance and law.

2.3.2.2 Preparation of plans

In developed construction companies where planning is standard procedure, a procedure manuals spells out the detailed planning steps of who does what, when and how. Each project ought to be analyzed beforehand and throughout its duration In respect of the features that makes it unique environmentally, technologically and organizationally. (Lindsay & Rue, 1980), (Steiner G. A., 1979)).

The normative process of planning comprises of five phases as shown in figure 3, which are:

- Planning the planning processes
- Information gathering

- Preparation of plans
- Information diffusion
- Planning process evaluation

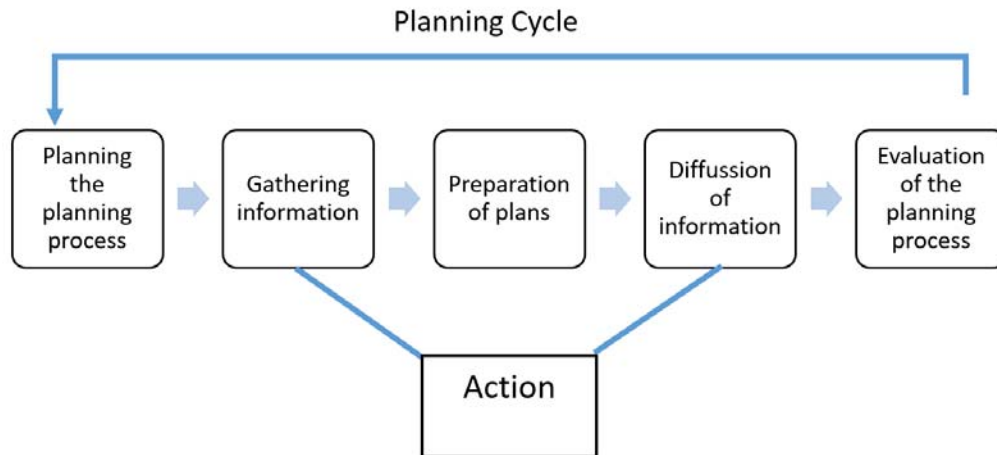


Figure 3 Phases of the planning process

The phase that receives the most and sometimes only attention is the preparation of plans. As already mentioned, the focus here is on the planning of time and resource, utilizing primarily CPM/PERT networks. Even though these tools have been used for over a few decades, their success has been limited. One survey in large construction companies has shown that only 15% of CPM/PERT users deem them very successful, (Davis, 1974). Another study in large companies found that only 43% used CPM effectively, (Business Roundtable, 1983). In small construction companies the situation is even less encouraging, as one study indicates that only 10% attempts to use CPM (Waddil and Mayes, 1986).

2.3.2.2.1 Choice of technology and construction method

As in the development of appropriate alternative for construction project, choice of appropriate technology is often overlooked yet it is a critical ingredient in the success of the project. For example, a decision whether to pump or transport a concrete in a bucket will directly affect the cost and duration of tasks involved in building construction. A decision between these two alternatives should consider the relative cost, reliability, and availability of equipment for the two transport methods. Unfortunately, the exact implication of different method depends upon numerous consideration for which information may be sketchy during the planning phase, such as the experience and expertise of workers or the particular on the ground conditions at the site.

In selecting among alternative methods and technologies, it may be necessary to formulate a number of construction plans based on alternative methods or assumptions. Once the full plan is available, then the cost, time, and reliability impact of the alternative approaches can be reviewed.

In forming a construction plan, a useful approach is to simulate the construction process either in the imagination of the planner or with formal computer based simulation technique. By observing the result and conducting comparisons among different plans will lead us to understand the problems with an existing plan. Problems in resource availability identified during the simulation of construction process might be effectively forestalled by providing resource as part of the construction planning. For example, a decision to use a particular piece of equipment for an operation immediately leads to the question of whether or not there is sufficient access space for the equipment.

2.3.2.2.2 Definition of work tasks

At the same time that the choice of technology and general method are considered, a parallel step in the planning process is to define the various work tasks that must be accomplished. These work tasks represent the necessary framework to permit scheduling of construction activities, along with estimating the resources required by the individual work tasks and any necessary precedence or required sequence among the tasks. The terms "work tasks" or "activities" are often used interchangeably in construction plans to refer to specific, defined items of work. In job shop or manufacturing terminology, a project would be called a "job" and an activity called an "operation", but the sense of the terms is equivalent. The scheduling problem is to determine an appropriate set of activity start time, resource allocations and completion times that will result in completion of the project in a timely and efficient fashion. Construction planning is the necessary forerunner to scheduling. In this planning, defining work tasks, technology and construction method is typically done either simultaneously or in a series of iterations.

Activities involved include: defining the scope of work, identifying activities involved and establishing project duration.

2.3.2.2.3 Defining Precedence Relationships among Activities

Once work activities have been defined, the relationships among the activities can be specified. Precedence relations between activities signify that the activities must take place in a particular sequence. Numerous natural sequences exist for construction activities due to requirements for

structural integrity, regulations, and other technical requirements. For example, design drawings cannot be checked before they are drawn. Diagrammatically, precedence relationships can be illustrated by a network or graph in which the activities are represented by arrows.

In revising schedules as work proceeds, it is important to realize that different types of precedence relationships have quite different implications for the flexibility and cost of changing the construction plan. Unfortunately, many formal scheduling systems do not possess the capability of indicating this type of flexibility. As a result, the burden is placed upon the manager for making such decisions and insuring realistic and effective schedules. With all the other responsibilities of a project manager, it is no surprise that preparing or revising the formal, computer based construction plan is a low priority to a manager in such cases. Nevertheless, formal construction plans may be essential for good management of complicated projects.

2.3.2.2.4 Estimating Activity Durations

In most scheduling procedures, each work activity has an associated time duration. These durations are used extensively in preparing a schedule. All formal scheduling procedures rely upon estimates of the durations of the various project activities as well as the definitions of the predecessor relationships among tasks. The variability of an activity's duration may also be considered. Formally, the probability distribution of an activity's duration as well as the expected or most likely duration may be used in scheduling. A probability distribution indicates the chance that particular activity duration will occur. In advance of actually doing a particular task, we cannot be certain exactly how long the task will require.

A straightforward approach to the estimation of activity durations is to keep historical records of particular activities and rely on the average durations from this experience in making new duration estimates. Since the scopes of activities are unlikely to be identical between different projects, unit productivity rates are typically employed for this purpose.

A formula such as Eq. (1) can be used for nearly all construction activities. Typically, the required quantity of work is determined from detailed examination of the final facility design. This quantity-take-off to obtain the required amounts of materials, volumes, and areas is a very common process in bid preparation by contractors. In some countries, specialized quantity surveyors provide the information on required quantities for all potential contractors and the owner. The number of crews working is decided by the planner. In many cases, the number or amount of resources applied to particular activities may be modified in light of the resulting

project plan and schedule. Finally, some estimate of the expected work productivity, P_{ij} must be provided to apply Eq. 2.1.

$$D_{ij} = \frac{A_{ij}}{P_{ij}N_{ij}} \quad [\text{Eq. 2.1}]$$

Where A_{ij} = required quantity of work

P_{ij} = work productivity estimate

N_{ij} = number of crews working

The calculation of a duration as in Eq. 2.1 is only an approximation to the actual activity duration for a number of reasons. First, it is usually the case that peculiarities of the project make the accomplishment of a particular activity more or less difficult. For example, access to the formwork in a particular location may be difficult; as a result, the productivity of assembling formwork may be lower than the average value for a particular project. Often, adjustments based on engineering judgment are made to the calculated durations from Equation (1).

2.3.2.2.5 Estimating Resource Requirements for Work Activities

In addition to precedence relationships and time durations, resource requirements are usually estimated for each activity. Since the work activities defined for a project are comprehensive, the total resources required for the project are the sum of the resources required for the various activities. By making resource requirement estimates for each activity, the requirements for particular resources during the course of the project can be identified. Potential bottlenecks can thus be identified, and schedule, resource allocation or technology changes made to avoid problems.

Many formal scheduling procedures can incorporate constraints imposed by the availability of particular resources. For example, the unavailability of a specific piece of equipment or crew may prohibit activities from being undertaken at a particular time. Another type of resource is space. A planner typically will schedule only one activity in the same location at the same time. While activities requiring the same space may have no necessary technical precedence, simultaneous work might not be physically possible.

2.3.2.3 Information distribution

The preparation of plans is followed by information dissemination. In the common approach, information is distributed according to standard instruction in the company's manual, (Tenah, 1986). Though (Tenah, 1986) suggested this procedure dictates a selective distribution of reports according to the users' function; it does not cater for variation and assumes one best way.

Information dissemination should be according to users to a certain degree psychological assessment; of what information is required by whom, (Tuman, 1983) and in what format, (Cullen & Nankervis, 1985) ; what knowledge content is optimally/minimally required, (Mason & Hambrick, 1984); and what accompanying activities will offset anti-planning forces and ensures implementation according to plans, (Laufer & Lenah, 1985). If a drastic change in the execution of the project is called for, or if the response time must be very short, the medium and format of information distribution must be adapted accordingly. Under these circumstances, the planner not only makes the decisions concerning information distribution but often has to take an active role in its assimilation (Laufer & Lenah, 1985; Morton, 1983). To summaries, planned information dissemination means should be kept simple and understandable. Plans have to be communicated clearly and 'no doubt should be left as to what is to be done and when', (Ballard & Howell, 1998).

2.4 Significance of construction planning.

Beyond a general consensus that planning is the most important function of the construction manager, to identify planning deficiencies it is necessary to dissect the planning objective into consistent components which are in practice are perused all together.

(Laufer A. , Tucker , Shapira , & Shenhar, 1994) concluded that construction planning plays four distinct roles:

- Execution
- Coordination
- Control
- Forecasting

Execution concerns are directing parties to implement the project. Coordinating refers to communicating with many stakeholders based on the project plan. Control involves constantly

evaluating performance and taking corrective actions when project performance diverges from plans, finally, forecasting the possible risks during implementation.

In this study the central conclusive finding was that in mature construction companies construction planning indeed played multiple roles, most of them being perused quite extensively. The other important findings were, the extent to which the various roles are pursued is contingent upon the situation, example, owner's requirement, project characteristics, project stage, uncertainty level, etc. Yet another finding was control is still the most widely pursued role, especially with regard to formal plans, nevertheless, action planning emerges as a high-priority role as well, both in the formal and semi-formal planning.

In their study, (Laufer & Ohenea, 1986), have found that for a 20 million dollar construction project lasting 18 months, three months are invested in planning prior to the onset of construction, while control (including preplanning), during the course of construction required five times more time than planning for this particular project. This stands to show a larger emphasis is usually given to control.

2.4.1 Users of construction plan

The purposes of construction planning are strongly correlated with the users of the plan. Common users are

- the owner(identifiable in at least three distinct different bodies :sponsor, client and users)
- various design engineers
- home office (including various functional departments)
- site management(project manager, general superintendent, foremen, project/field engineer , scheduling engineer, cost engineer)
- Various subcontractors and suppliers.

2.4.2 Purpose of construction planning

As to the purpose of construction planning, different roles have been gathered from various literatures and books, most of which are formally and significantly pursued throughout the project life. The purposes indeed follow the evolution of project life, from setting out of

objectives, through to planning of construction means at various levels and control of the performance during construction to drawing of lessons after project completion. They are summarized as follows:

1. Setting the objective, their priorities and trade-offs, and determining project constraints.
2. Providing a basis for contractual commitments between owner and contractor, as well as between contractors, as well as between contractors and sub-contractors
3. Obtaining a better understanding of the objectives, clarifying them and maximizing the probability of attaining them.
4. Defining and breaking down all required work(setting clear boundaries between work packages) to enable each project participants to identify and plan their share in it.
5. Preparing a preliminary model and general guidelines for future plans to allow sufficient lead time and to maintain continuity and global perspective.
6. Preparing action plan (process-oriented decisions), articulating direct work assignment for implementation.
7. Improving communication, coordination and integration of the multilevel, multifunctional and multistage inputs and decisions.
8. Providing a yardstick for monitoring, reviewing and controlling project execution.
9. Preparing a forecast of performance for ongoing project control and as premise for owner's future planning.
10. Improving optimization by considering and analyzing more alternative.
11. Avoiding wrong decisions by probing the future implications of current decisions.
12. Speeding up ability of response (flexibility) to future changes.
13. Utilizing the experience and the record accumulated from previous projects in a systematic learning process.

2.5 Problems in current construction planning.

Effective planning is influenced by things such as the project delivery method, contract procurement, management of the client and supervision of the planning team, and encompasses factors such as information exchange management and quality management. However, it can be argued that the fundamental activity in the planning is to manage, to control and to evaluate tasks. An early part of the research involved a literature review and informal interviews with the academic researchers and construction industry professionals to investigate current practice in planning management and its associated problems (Baiyi, 2004). These professionals, who included architects, planners, and building site logistics engineers, identified the main problems in current construction planning process as being due to:

1. An inadequate method for information gathering and management;
2. Insufficient training;
3. Misunderstanding of the nature of planning process;
4. Inadequate methods for planning coordination; and
5. The cumbersome work structure in planning practice.
6. Improper reviewing of plan.
7. Longer time interval between planning and commencement of work.

Few among many problems are discussed in more detail in the following sections.

2.5.1 Inadequate method for information gathering and management

Planners often experience information gathering problems and lack of method for the effective management of information flows. Information is often “pushed” from the upstream players. Planners usually do not know how and where to get information. On the other hand, it is difficult for the planners to select the required information from a huge pile which is in different formats from a variety of supply chain organizations and disciplines. In addition, the quality of much of the information received is often poor. For example, the planners often receive incomplete design information, in extreme cases; the planner may even have to modify or even redraw some of the drawings. The most common problems are that the designers showed a lack of understanding of the installation space requirements, making installation difficult or even impossible. As a result, planners have to prepare plans with incomplete information and in order to deal with the uncertainty caused by information deficiencies, a lot of guess work must be taken in the planning

process. However, neither the initial planner, nor the downstream planner will check these assumptions later. They are usually ignored and are simply left until execution of the plan, when incorrect guesses manifest themselves. It is very common in current practice that the planners often start a planning task earlier than anticipated based upon assumed information. (Eknarin, 2004) had the same findings and points out that the current planning approaches isolate the role of planning from information and logistics management.

2.5.2 Insufficient training

Planning is not an easy task. Becoming a good planner requires a long training process, which includes not only a lot of site work experience, but also the knowledge of detailed construction methods. In addition, planners should have good communication skills, be keen to learn and are expected to be familiar with new techniques, materials and regulations.

2.5.3 Misunderstanding of nature of planning process

Current construction planning often works on the “throw over the wall” principle, i.e. information is pushed on to the next person with little interaction. The client, designers, main contractor and subcontractors often develop their own plans in isolation. The selection of the construction method, scheduling activities and scheduling space are interrelated and interdependent; they should not be undertaken independently. The interdependences are often ignored at the planning stage and until execution. As a result, in the current construction practice, the construction space allocation often works on the principle of “first come, first served”, and the choice of construction method depends on the self-interest of individual organizations. This leads to dynamic, complex and uncertain time-space conflicts. It can be argued that a subcontractor’s planning decisions should not be undertaken in isolation but that selection of the work methods (including prefabrication) and site logistics can have important impacts on time-space conflicts and may hamper the performance of other subcontractors.

2.5.4 Inadequate method for planning coordination

There are two dilemmas in construction planning: who should do planning and when should they do it? (Laufer A. , Tucker , Shapira , & Shenhar, 1994) pointed out that project managers have the capability to plan but are often busy undertaking other management issues, such as communication with clients, negotiations and organizing staff. The operational engineers have enough time, but they often experience difficulties in decision making and information gathering. In order to get to a realistic plan, it is imperative that both project managers and operational

engineers take part in the planning of a construction project. Project engineers ensure the quality and timeliness of construction deliverables while project managers oversee the entire project and ensure that it meets the business objectives that it was designed to satisfy. Thus in order to account for quality, time and cost both project engineers and project managers have to work in collaboration.

2.5.5 The cumbersome work structure in planning practice

The planning process is not linear but iterative. For example, the selection of construction methods could have a very important impact on space scheduling, and in turn, space availability could affect the subcontractor choosing their construction method. However, current planning practice takes little account of the interdisciplinary, iterative nature of the process. This leads to a compromised planning process containing inevitable cycles of rework together with associated time and cost penalties in both planning and construction. Plans are often developed only or mainly for control purpose, and ignore the “how” aspect, which is the other main purpose of planning.

In construction the terms planning and scheduling are often used synonymously. Planning often refers to using scheduling techniques, such as CPM, bar charts or networks to produce a time related schedule. (Neale & Neale, 1989), define planning “as a creative and demanding mental activity of working out what has to be done, how, by why, by whom, and with what, i.e. doing the job in the mind”. However, scheduling is the determination of the timing of activities and follows logically from the planning process. In other words, scheduling is the process of producing a time related schedule of the planning decisions.

2.5.6 An irregular and longer time interval to review/revise plan after commencement of work

In a construction project, after the work begins on site, most projects lack regular reviewing of the original plan at regular time interval. Even if they do, such reviews are limited to identifying deviation between planned and actual performance and taking decisions on corrective action. But these reviews should not be limited; they should involve a critical re-examination of the original construction plans and seeking means of improvement through changes in construction methods.

2.5.7 Longer time interval between planning and implementation

Longer time interval between planning and implementation increase the uncertainty concerning the planned activity, (Laufer A. , 1989). The higher the uncertainty in a project, the more difficult

it is to plan and the less effective the planning will be in accurately articulating actions and outcomes. Sophisticated models for planning are inadequate for coping with highly uncertain situation. In some construction companies construction planning will be well ahead of implementation, then the work will commence without revising the plan.

2.6 Summary

Project planning is important ingredient in every construction work undertaken by a contractor. Without a proper planning it is only by chances that a project can be run smoothly even though at the end of the day, the project will be delivered, but, with a very high price that contractor needs to pay. The cost could be another capital loosing for doing a construction project. For some this is a very painful but valuable lesson that must not be forgotten. The moral of this will be "learn from the past experience".

Now a days, to be a competitive contractor it is not only that one needs a good networking of suppliers, strong cash flow, having large number of skilled workers, equipment, plant and machineries but proper project planning. With a proper construction planning, all of the resource utilization can be optimized to deliver a higher profit margin without jeopardizing the quality of the end product. With a good construction practice and well planned project, contractor should be able to meet their contract requirement as well as their own objective.

CHAPTER THREE

OVERVIEW OF ETHIOPIAN CONSTRUCTION INDUSTRY

3.1 Introduction

This chapter, using researches, governmental publications and different journals, will review the current situation of Ethiopian construction industry and the issues that are casting a shadow on the effectiveness of the industry.

The role the construction industry plays in socio-economic development is significant. The industry is a distinct sector of the economy, which makes its direct contributions to economic growth. It provides the basis upon which other sectors can grow by constructing the physical facilities required for the production and distribution of goods and services, (Ministry of Finance and Economic Development , 2007)The industry has a significant multiplier effect on the economy as a whole.

As is identified in PASDEP, economic growth is one of the most effective ways of reducing poverty and delivering infrastructure has been identified as one of its key drivers. The industry has great employment generation potential as labor intensive technologies are economically viable for most items of construction work.

The expectation is that government spending will improve the quality of infrastructure and pave the way for the efficient delivery of other services and reduce the cost of business, thus serving as a catalyst for a higher economic growth and employment creation. For the reasons stated, supported by international experience, Ethiopia is committed to rapid development of a strong and diversified construction industry.

The Five-Year Growth and Transformation Plan for 2010/11 to 2014/15, which was unveiled for consultations in August 2010, projects continuing economic growth at a minimum of 10 percent per annum, and an ambitious best-case scenario of doubling GDP over the five year plan period.

This plan has three major goals (Ministry of Agriculture and Rural Development, 2010):

- continuing rapid economic growth;
- expanding access to, and improving the quality of social services; and
- infrastructure development.

Construction is seen as the key driver of economic development with particular attention given to scaling-up best construction industry practices to provide a foundation for expansion of the industrial sector. Furthermore infrastructures involving civil works were identified in most sectoral development programs of developing countries. The government policy has clearly showed importance to education, health, power and road development programs through its commitments for the FYGTP.

3.2 Benefits Derived from the Construction Industry

Different literatures identified numerous benefits that can be derived from the industry in their own expressions. Construction industry plays multiple roles in national growth and development in the economic and human terms. The Guideline for the Development of small- scale construction enterprises summarized these benefits in four major elements, (ILO, 1987). These are:

- contribution to GDP;
- backward linkage to the other industrial sector;
- its direct demand for labor; and
- its contribution to the national capital formation.

3.3 Shortcomings of the Construction Industry

Although the above benefits can be derived from the construction industry, currently the industry is incapable of providing the benefits as it's supposed to because of many shortcomings that handicapped the construction industry.

The shortcomings of the construction industry in Ethiopia primarily undermined the importance of the construction sector for the development of the country. A study by SMEC international (An Australian company), concluded that the general state of the domestic construction industry in Ethiopia is low. They, following SMEC, reportedly characterize these deficiencies by:

- an inadequate capital base, specifically to contractors,
- old and limited numbers of equipment and their low levels of utilization,

- deficiencies in human resources with regard to technical, managerial, financial and entrepreneurial skills, and
- limited experience and participation in private sector for road, bridge and water related construction works and provision of consulting services.

These characteristics agree with the realities to most of the developing countries. As a result, Domestic construction companies are deficient to cater for the country's demands; Practitioners are not well acquainted to project management theories and practices specifically construction planning practices; Domestic construction companies are uncompetitive with their international counterparts; and they did not receive sufficient attention from the governments of developing countries for their development.

Key problems common to most of the construction industries in developing countries are:

3.3.1 Financial Constraints of local contractors

Many Construction Projects suffer from preventable problems. The research works showed that contractors in the construction industry face serious liquidity problems, (Wubishet, 2004). The financial problems also associated to poor fleets of plants and equipment. Again problems in acquiring bonds and guarantees while participating and signing contracts arose from the deficiency of finance in the contractors. Banks consider construction as a high- risk business ((ILO, 1987); SMEC, 1999). Because of this, Banks in developing countries close their doors to the Construction Industry except when real assets as collaterals back the loan applicants. (EACE, 2003; ILO, 1987; WB, 1984).

3.3.2 Shortage of Skilled Manpower

It is reported that shortage of skilled manpower, (ILO, 1987), lack of capable and professional practitioners, especially in the contract administration, project planning and monitoring as well as the deficient in the design checking capability, (Wubishet, 2004) are the critical problems of the construction industry.

Comparing to the rapid growth of construction industry, there is significant shortage of employees at the skilled and semi-skilled level. This shortage creates uncertainty in labor supply of skilled personnel and limits productivity.

In Ethiopia, since there is shortage of educational facilities and formal training program for project management profession there is shortage of managerial skill in the industry. This facts coupling with lack of adequate training for the profession lessen full utilization of current managerial concept for proper planning of the project.

3.3.3 Inadequate information flow and communication

Lack of appropriate information and communication management left without sufficient information about the capacities of domestic contractors during procurements and for their strategic interventions. It has also been distracted with insufficient information management system. As a result, the management system and its capacity are at its lowest level.

- Poor information Management Systems;
- Weak relations among the stakeholders in the industry; and
- The force Maguire is significant challenges in the industry

In line with lack of adequate and effective information and effective information and communication infrastructure in the country, construction companies are poorly linked with the external environment. High installation and training costs coupled with less wide acceptance by community of practice in the industry, ICT assistance for planning is still remains to be limited.

3.3.4 Inadequate supply of construction material

There is a significant shortage of manufactured construction material in the local market. The rapid development of construction industry coupling with material supplied local manufacturing industry, push the country's construction industry to rely on importation.

Besides the expensiveness of imported materials capable contractors import their own material for their work, but because of lack of proper procurement and construction plan the resource flow seemed to be affected.

3.4 Summary

Challenges facing the Construction Industry in Ethiopia in general enjoy a high level of prestige. Indefinitely more fundamental, more serious and complex problems face the industry. Different literatures identified the challenges by categorizing in different perspectives. Among many challenges: lack of competitiveness, absence of strong and experienced local contractors, inadequate supply of construction materials, lack of the required skill in man power, financial

constraints of local contractors, uncertain economic environment are few which undermine the industry.

Currently Ethiopian construction industry is suffering from these deficiencies. One of the problems emanating from deficiencies in technical skill and very limited experience of local contractors is improper/ineffective construction planning practice. As construction planning is the most important activity of project life cycle, without proper plan the construction industry will suffer from delays and cost overruns which will lead to claim, dispute, litigations and so on. Therefore, issues of effective construction planning practices should be given wider and deeper attentions to keep the construction industry from sinking into greater chaos.

CHAPTER FOUR

RESEARCH METHODOLOGY AND ANALYSIS OF THE QUESTIONNAIRE SURVEY

4.1 Introduction

This chapter summarizes the research methodology used for this study. It explains the sampling and data collection methods used. The collected data were analyzed in three stages. The first stage covers the practitioners view and opinion on the current planning practices. The second stage covers the current construction planning practice in the respondents' respective organization. The third stage discussed the statistical analysis carried out to rate the severity factors influencing effective planning and rank them according to their corresponding severity indices.

4.2 Questionnaire Design

Questionnaire survey was used to collect the data. Both the professionals view and opinion working on planning activities at Grade 1 and Grade 2 local contractors registered under Ministry of Urban Development and Construction and the current planning process in their respective organization were targeted. This is because next to foreign contractors, Grade 1 and Grade 2 local contractors participate in relatively large and complex projects that need proper construction planning to achieve the project objective. The literature review and overview of Ethiopian construction industry are used to gain understanding of significance/importance of construction planning and to identify major influencing factors that shadowed effective construction planning. From these reviews, 19 factors that can be said to affect effective construction planning were drawn in the context of Ethiopian construction industry.

In the covering letter the professionals have been introduced for the purpose of the study and assured the confidentiality of the information collected through the questionnaire. The questionnaire was designed to meet the set objectives of the research, consisting of the following four sections.

Section I: Requires the respondent to provide the background information regarding the experience and annual turnover of their respective organizations; the professionals' job title, their experience in construction planning activities.

Section II: Aimed to collect views and opinions of practitioners regarding the current construction planning practices in Ethiopia.

Section III: Aimed to collect the practitioner's organization current construction planning practice.

Section IV: Listed 19 factors that influence effective construction planning. The respondents were asked to evaluate the impact of these factors in relation to their respective organization planning activity.

4.3 Data source and sampling

The questionnaire was copied from Appendix B, case study project questionnaire of a book titled 'Construction Manager-at-Risk Project Delivery for Highway Programs' by (Gransberg & Shane, 2008) and modified to meet the specific need of this research. Distribution of questionnaire survey focused only on companies that are Construction Grade 1 and Grade 2 because of the high caliber status of the contracts they handle. The study is going to be limited only to construction companies that are based in Addis Ababa due to time limitation of the research, accessibility and financial constraint. The study samples are going to be selected using stratified sampling to include equal percentage ratios of all Grade1 and Grade2 construction companies.

According to the 'Ministry of Urban Development And Construction Coordination Bureau' the numbers of construction companies that are based in Addis Ababa are;

Construction Grade1 84

Construction Grade2 38

Total No. of construction companies 122

Slovin's formula is used to calculate the sample size from the total population size and a margin of error.

$$n = N / (1 + Ne^2).$$

whereas:

n = no. of samples

N = total population

e = error margin / margin of error

Using a total population size of 122 and a margin of error of 15%, yields a sample size of 33.

Once the sample size has been decided, then convenience sampling was used to handout questionnaires and collect responses.

- total number of construction companies that are going to be surveyed is 33.
- the study is going to be conducted through the questionnaire method.

Using the data from the survey the study is expected to show the source of the problem in the current construction planning practice in these companies. The study is also going to use different literature to give recommendations as to how this gap can be filled.

4.3.1 Questionnaire Response Rate

A structured questionnaire was prepared (Appendix A) and sent to the different participant of the construction industry especially contractors and key professionals in the country directly hand over. The survey was carried out over the period from May 1, 2012 to May 22, 2012, and the response rate is as shown in the Table 1.

Table 1 Response Rate

No. of Participant	33
No. of respondents	25
Response rate	75.7%

It is acknowledged that with the increased number of research projects and as they are busy with commercial purpose, collecting data from construction companies become difficult. For this particular research, among 33 distributed questionnaires only 25 replied fully. Apparently, as the response rate is calculated in the Table 4.1 is greater than 75% which makes this research reliable in construction industry, where the normal rate of questionnaire response expected is 20% - 30% ((Fellows & Liu, 2015), (Elhag et. al., 2005))

4.3.2 Summary of Respondents

About 75.7% of the responses were returned to the researcher. 64% of the construction companies have more than 10 years of experience, 28% of the construction companies have between 5 – 10 years of experience and 8% of the construction companies have less than 5 years of experience in construction since establishment. The next information on the contractors shows that 39% of the construction companies have annual turnover more than 100 Million Birr, 48% of the construction companies have annual turnover between 50 – 100 Million Birr and the remaining 13% of the construction companies have annual turnover less than 50 Million Birr. This information shows that the participating construction companies are medium to large and they have stayed in the construction industry for relatively longer years.

Regarding the respondents professional experience in construction industry; 21% of the respondents have more than 10 years of experience, 58% of the respondents have between 5 – 10 years of experience and the remaining 21% of the respondents have less than 5 years of experience in the construction industry. The proportion of the respondents in terms of number of years involved in construction planning; 9% of the respondents have more than 10 years of experience, 61% of the respondents have between 5 – 10 years of experience and the remaining 30% of the respondents have less than 5 years of experience in construction planning activity. 44% of the respondents are office engineers, 16% of the respondents are site supervisors, 16% of the respondents are project managers, 16% of the respondents are cost engineers and 8% of the respondents are contact engineers. The majority of the respondents have rich experience in construction industry and construction planning activities. Hence the participants have a good perspective on the planning activity in their respective construction companies. Summary of the participants professional and construction companies profile is included in Appendix B.

4.4 Analysis of the current planning practice in Ethiopian construction industry according to opinion of the respondents.

Under section II of the questionnaire questions were discussed to gain generic understanding of the current planning practice in Ethiopia in the respondents' organization. A five scale rating ranging from strongly agree, agree, neutral, disagree and strongly disagree has been used. The responses were converted to three scales rating to agree, neutral and disagree for the purpose of analysis. The responses are analyzed here under and the details of the statistical summary of the responses are included in Appendix C.

4.4.1 Understanding of plan

The respondents were asked if construction planning is a fundamental and challenging activity in the management and execution of construction works.

The responses summarized as: Agreed: 100% Neutral: 0 Disagree: 0

All respondents agreed that construction planning is essential and challenging task in construction work.

4.4.2 Planning outcome

The respondents were asked if effective construction planning have a major influence for projects to achieve their objective without unnecessary cost and time overrun.

The responses summarized as: Agreed: 96% Neutral: 4% Disagree: 0

The majority of the respondents agreed with the idea of effective construction planning is fundamental in order to achieve a project goal without unnecessary cost and time overrun.

4.4.3 Specialized planning department

The respondents were asked if construction companies should have specialized planning department.

The responses summarized as: Agreed: 96% Neutral: 4% Disagree: 0

The respondent discussed that in current Ethiopian construction planning is performed in engineering and construction department but they suggested construction planning should be practiced in its own specialized department.

4.4.4 Opinion towards planning

The respondents were asked if in the current construction planning practice the time given for the planning phase is enough considering its significance.

The responses summarized as: Agreed: 20% Neutral: 20% Disagree: 60%

The majority of the respondents disagrees that enough time given for the planning process in current Ethiopian construction considering the significance of construction planning.

4.4.5 Purpose of plan

The respondents were asked if the current construction plans are developed for the “how” aspect as much as for the controlling purpose.

The responses summarized as: Agreed: 24% Neutral: 36% Disagree: 40%

Most of the respondents disagree with the idea that the current Ethiopian construction plans are developed for “how the construction implement”. They also further discussed that the construction plan should be prepared considering the methodology and the habit of preparing for just bidding purpose should be avoided.

4.4.6 Information flow

The respondents were asked if during planning information like labor market, currency inflation/deflation, material availability, weather statistics data, government regulation should be considered.

The responses summarized as: Agreed: 80% Neutral: 8% Disagree: 12%

Most of the respondents agree that information like labor market, currency inflation/deflation, material availability, weather statistics data, government regulation.

4.4.7 Information gathering

The respondents were asked if in current construction planning practice, planners has to prepare plan with incomplete information and in order to deal with uncertainties caused by information deficiencies, a lot of guesses works must be taken in the planning process.

The responses summarized as: Agreed: 52% Neutral: 28% Disagree: 20%

4.4.8 Time interval between construction planning and commencement of work

The respondents were asked if longer time interval between planning and commencement of construction project, increase the uncertainty concerning the planned activity and decrease the effectiveness of the plan

The responses summarized as: Agreed: 84% Neutral: 16% Disagree: 0

The respondents discussed that one of the causes of increase in the uncertainty for the construction plan is longer time interval between planning and project commencement.

4.4.9 Timely planning

The respondents were asked if in current Ethiopian construction industry, construction plan is properly revised in a regular time interval.

The responses summarized as: Agreed: 16% Neutral: 32% Disagree: 52%

The majority of the respondents disagree that in the current Ethiopian construction industry, construction plan is properly revised in a regular time interval.

The respondents also discussed that construction plan should be revised in a regular time interval depending on the complexity of the project; otherwise the plan will be outdated.

4.4.10 Planning process

The respondents were asked if sub-contractor's construction plan should be considered in the master plan of the main contractor.

The responses summarized as: Agreed: 76% Neutral: 16% Disagree: 8%

The majority of the respondent agreed that there should be a coordination between the main contractor and sub-contractors construction plan.

The respondents also further discussed that no coordination effort is seen most of the time and involvement of sub-contractors in the master plan of main contractor is limited.

4.4.11 Planning improvement

The respondents were asked if utilizing the experience and the record accumulated from previous projects in a systematic learning process improves construction planning.

The responses summarized as: Agreed: 100% Neutral: 0 Disagree: 0

All of the respondents agreed that construction planning can be improved by utilizing the previous project experience and records accumulated in a systematic learning process.

4.4.12 Outcome of plan

The respondent were asked if with the proper construction planning project resources usage can be optimized to deliver even higher profit margin without jeopardizing the quality of the end product.

The responses summarized as: Agreed: 92% Neutral: 8% Disagree: 0

The majority of the respondents agreed that higher profit margin can be achieved without jeopardizing the quality by optimizing the project resources usage by proper construction planning.

Analysis of the current planning practice in the Ethiopian construction industry according to opinion of the respondents is presented in a summarized graph by Figure 4.

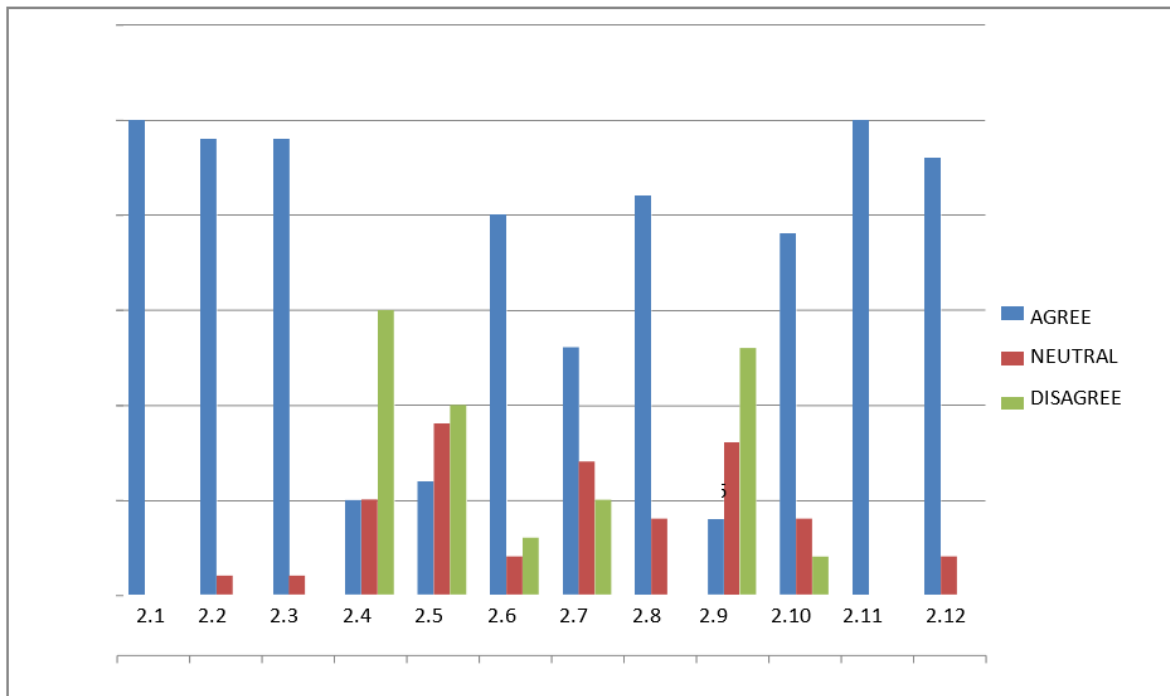


Figure 4 Summary of Analysis

4.5 Analysis of the current construction planning practice in Ethiopian construction industry in local construction companies.

Under section III of the questionnaire questions were discussed to gain generic understanding of the current planning practice in Ethiopia in the respondents’ organization. A “Yes” or “No” answer has been used. The responses are analyzed here under and the details of the statistical summary of the responses are included in Appendix C.

3.1 The respondents were asked, are the professionals working on construction planning in your organization have the experience and qualification for construction planning?

The responses summarized as: Yes: 92% No: 8%

3.2 In your company, is there construction planning department?

The responses summarized as: Yes: 24% No: 76%

3.3 Did the company that you are currently working on revise the master plans regularly?

The responses summarized as: Yes: 44% No: 56%

3.4 Construction planning and scheduling is performed by the same professionals or professional crews?

The responses summarized as: Yes: 60% No: 40%

3.5 In your construction company, the personnel or crew that made the master plan will be involved in planning activity throughout the project life cycle?

The responses summarized as: Yes: 32% No: 68%

3.6 In your construction company, during selection among alternative construction method and technologies, did the company practice to formulate a number of construction plans based on alternative method or assumption.

The responses summarized as: Yes: 48% No: 52%

3.7 In forming a construction plan, a useful approach is to simulate the construction process either in the imagination of the planner or with formal computer based simulation technique .by observing the result, comparisons among different plans or problems with existing plan can be identified.

Is this the usual trend that you use in your company? The responses summarized as: Yes: 32% No: 68%

3.8 In current construction planning practice, in order to deal with uncertainties caused by insufficient information, guesses are frequently made in the planning process. In your company are these guesses later checked with initial planner or with the downstream planner?

The responses summarized as: Yes: 56% No: 44%

3.9 In your company did sub-contractor's construction plan considered in the master plan of the main contractor.

The responses summarized as: Yes: 40% No: 60%

3.10 In your construction company, the experience and the record accumulated from previous projects is utilized as a systematic learning process to improve construction planning.

The responses summarized as: Yes: 36% No: 64%

Analysis of the current construction planning practice in Ethiopian construction industry in local construction companies is presented by Figure 5.

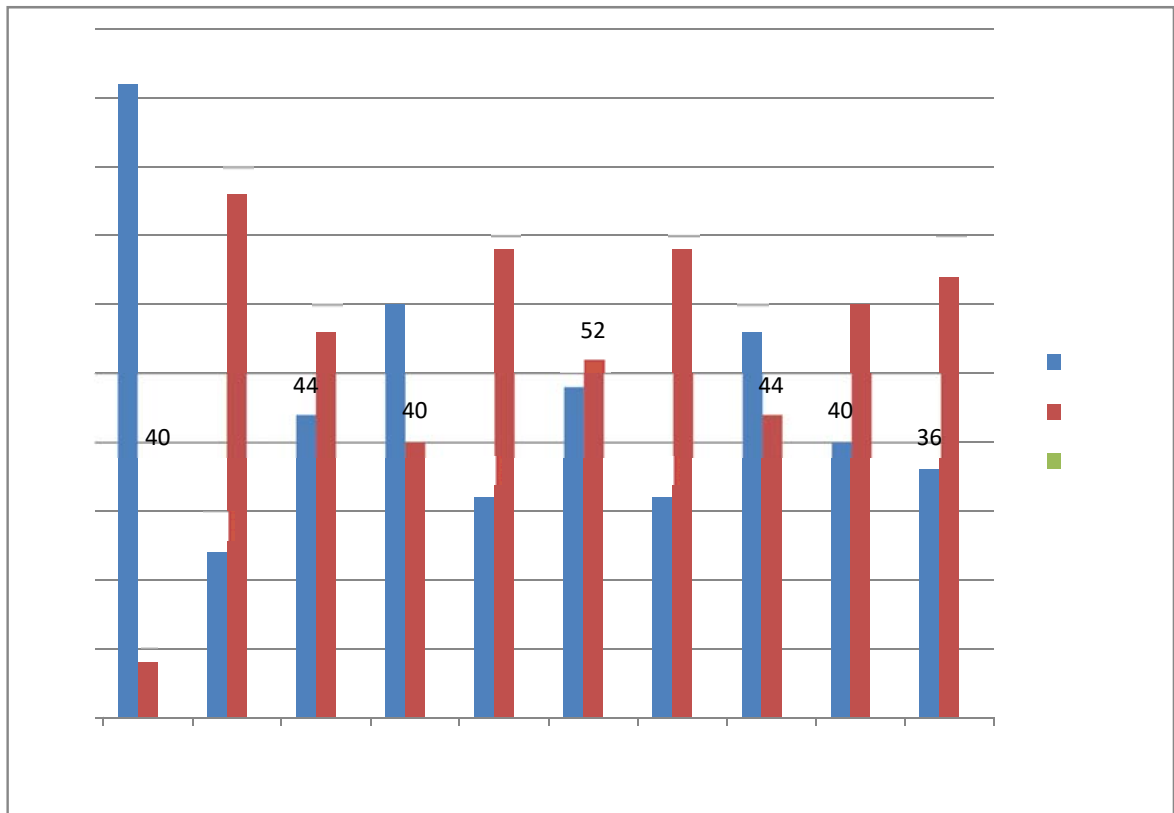


Figure 5 Summary of Analysis2

4.6 Analysis of the influencing factors

For each of the factors influencing effective planning respondents were asked to indicate the degree of impact in five point measurement scale run from very high, high, medium, low and none. The collected data were properly recorded and severity indices for the factors were statistically analyzed. The severity index that measures the degree of influence of each variable

is calculated using the equation 4.1 below. This statistical approach has been used in related previous researches (Hiwot Mosisa, 2010)

$$SI = \left(\frac{\sum W_i * f_i}{5 \sum f_i} \right) * 100 \quad [\text{Eq.4.1}]$$

Where i represent the ratings from 1 to 5, w_i represents the weighting for each rating, f_i represents frequency of responses.

The summary of the responses collected and analysis of rating of factors (SI %) is attached in Appendix D and E respectively. Among 19 factors 14 maintained severity index between 70%-90% and the remaining 5 maintained severity index between 55% - 70%. This shows that the planning practitioners regarded the 14 factors as influential on effective planning in Ethiopia. The factors were further ranked according to their severity index. However, further analysis is carried out to check the concordance between respondents in rating and ranking the factors.

4.7 Measuring concordance among respondents

The measure of the standard deviation as a percentage of the mean is used to compare relative variability of different responses, (Elhag et. al., 2005). The coefficient of variation is used to measure this variability is computed using equation 4.2 below.

$$COV = (S/X) * 100 \quad [\text{Eq.4.2}]$$

Where, S is the standard of deviation and X is the weighted mean of the sample.

The summary of the compound COV is annexed in Appendix G. It shows the variation of response ranging from 13.6% to 30.83% for all the factors, which is relatively low. This indicates there is high agreement between planning practitioners on their judgment of the influencing factors.

Confirming the agreement among planning practitioners, the severity index for each factors were computing and used to estimate the common ranking. Table 4.2 below shows the ranking of the severity index of the top ten factors with severity index ranging from 75% - 86%. The detail analysis of ranking of factors is included in Appendix H.

No.	Influencing Factors	Severity index (%)	Rank
2	Inadequate investment of time and money on planning phase.	85.6	1
3	Lack of specialized planning department in construction companies.	82.4	3
4	Inadequate qualification and experience of planners.	84.8	2
5	Inadequate information gathering.	79.2	7
6	Inadequate interaction between different parties involved. (Client, consultant, contractor, government municipals).	76.8	9
7	uncertainties and guess work on planning stage	77.6	8
11	Inadequate method for planned information distribution.	79.2	6
13	Lack of effective monitoring and progress reporting system.	81.6	4
14	Lack of proper and timely revision of plan.	80.8	5
19	Inability to document and seek feedbacks from completed projects.	75.2	10

Table 2 Top 10 Influencing Factors

4.8 Summary

Qualitative survey approach was used to address the research problem and identify the influencing factors of effective construction planning. 38 structured questionnaires were distributed to medium to large construction companies. 65.7% of 38 structured questionnaires were collected. 64% of the construction companies have more than 10 years of experience and

39% of the construction companies have annual turnover more than 100 Million Birr. Furthermore, 58% of the respondents have more than 5 years of experience in construction industry.

Among 19 factors 10 of them are found to be highly influential with more than 75% of severity index. The compound coefficient of variation for each factor, range between 13.6% - 30.8% this shows that there is less variation in rating the factors by the respondents. Further conclusions reached on the above basis will be discussed in the next chapter.

CHAPTER FIVE

DISCUSSION ON THE DATA ANALYSIS

5.1 Introduction

This chapter discusses the results of the analyses covered in chapter four. The discussion includes the current construction planning practice in Ethiopia construction industry according to the practitioner's opinion and the current construction planning practice in their respective organization. The discussion also includes interpretation of 10 influential factors which are ranked 1- 10 according to their severity index analysis.

5.2 The current Ethiopian construction planning practice according to practitioner's opinion

100% of planning practitioners agree that construction planning is a fundamental and challenging activity in the management and execution of construction projects. Yet, the majority of the respondents, 60%, disagree with the proposition that in current construction planning practice the time given for the planning phase is enough considering its significance. Furthermore, the majority of the participants, 96%, agreed that effective construction planning have a major influence for projects to achieve their objective without unnecessary cost and time overruns.

40% of planning practitioner disagree with the proposition that current construction plans are developed for the 'how' aspect as much as the controlling purpose. Further explanation by the participants showed construction plans should be prepared considering the 'how the construction project is going to be implemented' and the habit of preparing plans just for bidding purpose should be avoided.

The survey indicates in current construction planning practice, planners has to prepare plan with incomplete information and in order to deal with uncertainties caused by information deficiencies, a lot of guesses works must be taken in the planning process. 84 % of the respondents agreed that longer time interval between planning and commencement of construction project, increase the uncertainty concerning the planned activity and decrease the effectiveness of the plan. 76% of the respondents also agreed that there should be coordination between the main contractor and sub-contractors construction plan.

5.3 The current Ethiopian construction planning practice in construction companies

The survey indicates that, 92% of the respondents respective construction firms have qualified and experienced professionals working on construction activity in their organization. Although the majority of these construction firms do not have a specialized department and they perform planning with in engineering or construction departments. Furthermore, the majority of construction firms, 60%, imply that construction planning and scheduling is performed by the same professionals or professional crew.

The survey also indicates that, the majority of construction firms, 60%, did not consider sub-contractor's construction plan when developing the master plan. This shows there is a lack of interaction between construction firms and sub contractor's construction plan. Furthermore, 68% of the construction firms, the personnel of crew that make the master plan will be involved in planning activity throughout the project life cycle.

5.4 The influencing factors

As shown in table 4.1 10 factors was ranked from 1- 10 with severity index ranging from 75% - 86%. These top ten factors were identified as the most significant influential factors on effective construction planning. Further discussion on detail of each top ten factors is illustrated hereunder.

i. Inadequate investment of time and money on planning phase

This factor is ranked as the first most significant factor on the effective construction. Among 19 factors this factor showed 85.6% of severity index. This factor can be correlated with the lack of attitude towards the significance of construction planning.

Construction planning is important ingredient in every construction work undertake by contractor. Without a proper planning it is only by chances that a project can be run smoothly. Construction planning is the most essential and challenging activity in a construction project. This factor showed there is a need to put more time and money planning phase and also there is a need to educate local contractors about the significance of construction planning.

ii. Inadequate qualification and experience of planners

The second rated factor affecting construction planning effectiveness is 'inadequate qualification and experience of planners' with severity index of 84.8%. Most of local contractors perform

construction planning by their office engineers. As to planning being not an easy job, becoming a good planner requires a long training process which includes not only a lot of site work experience, but also knowledge of detailed construction method, which most of this office engineers lacks. Although some local contractors perform construction planning by their project managers, this project managers have the capability but not the time since they are busy under taking other managerial issues, (Laufer, 1992).

From these, this factor showed that, local contractors need to train their office engineers to specialize in construction planning or hire experienced professionals for just construction planning purpose.

iii. Lack of specialized planning department

The practitioners ranked 'lack of specialized department' as the third affecting the effectiveness of construction planning with severity index of 82.4%. This might be an indicator that construction firms have poor organizational structure and less attention is given for work specialization of staffs. Although in smaller construction companies the availability of a specialized construction department might not be achievable.

The lack of specialized planning department hinders the effectiveness of construction plan. Most local contractors perform planning in their respective engineering/construction department or have a person designated as construction planner. This factor shows, local contractors should structure a specialized construction planning and assign more than one person to work as a team since planning is more effective and efficient when it is performed by a team rather than a single person.

iv. Lack of effective monitoring and progress reporting system

This factor is ranked as the fourth influential factor affecting effective construction planning with a severity index of 81.6%. This shows that construction plans are not effective without proper monitoring and progress reporting system. Most local contractors prepare construction plans just for bidding purpose and after winning the bid they do not effectively monitor the progress. This factor shows there is a need to effectively monitor plans and the need to have improved progress reporting system.

v. Lack of proper and timely revision of plan

This factor is ranked as fifth influencing factor of the effective construction planning with severity index of 80.8%. This factor is related to lack of effective monitoring and progress reporting system.

Without adequate monitoring and progress reporting system, the planners could not regularly review the original plan at regular interval .even if they do, such review will be limited to identifying deviation from the original plan and taking decision on corrective action. This factor shows construction firms should have a regular construction plans reviewing system after commencement of work.

vi. Inadequate method for planned information distribution

This factor is ranked as a sixth influential factor of effective construction planning with a severity index of 80%. In the common approach, information is distributed according to standard instrument in the company's manual, (Tenah, 1986)

Plans have to be communicated clearly and 'no doubt should be left as to what is to be done and when', (Ballard & Howell, 1998). This factor shows the need to have an adequate method for planned information distribution and planned information dissemination method should be kept simple and understandable.

vii. Inadequate information gathering

The seventh ranked factor influencing effective construction planning is 'inadequate information gathering' with severity index of 79.2%.

As to information gathering, it is an important component of the planning process, ((Steiner G. A., 1979): (Galbraith, 1973)). Construction planners need to have an accurate and timely information flow which reduces the degree of uncertainty of the data which is going to be used for planning purpose (Smith, 2002). Therefore, this factor shows planners should have a sufficient information gathering system and they should carefully examine information and used it to influence the construction project.

viii. Uncertainty and guess work in planning stage

The practitioners ranked 'Uncertainty and guess work in planning stage' as the eighth factor affecting the effectiveness of construction plan with severity index of 77.6%. Planners have to prepare construction plans with incomplete information and in order to deal with this; a lot of guess work must be taken into the plan preparation.

However, uncertain information and guess works used at planning initial planning phase are usually ignored and are simply left until execution. This factor shows this uncertain information and guess works should not be ignored until the incorrect guess manifest themselves and both the initial planners and the downstream planners should continuously check these assumptions.

ix. Inadequate interaction between different parties (Client, Consultants, Contractors and Government municipals).

The factor ‘inadequate interaction between different parties(Client, Consultants, Contractors and Government municipals) is ranked as the ninth factor influencing effective construction planning with the severity index of 76.8%.

This factor shows local construction firms in the industry should try to prepare construction plan interacting with clients, designers and sub-contractors.

x. Inability to document and seek feedback from completed projects.

The practitioners’ ranked “inability to document and seek feedback from completed projects” as the tenth influential factor of effective construction planning with a severity index of 75.2%. This shows that there is a need for construction companies to develop the habit to learn a lesson from the previously completed projects, document challenges from completed projects and evaluate the planning process of completed projects.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter draws conclusions for the study by summarizing the aim of the research, research methodology adopted, and the inference of the findings of the research. This chapter also covers recommendations for improvement of construction planning practice in Ethiopian construction industry.

6.2 Conclusions

The data collected has been analyzed in three stages. The first stage assessed the respondents' professional opinion on use of the current Ethiopian construction planning. And learned that current construction planning is focused mainly on controlling purpose rather than how the construction is going to be performed. Furthermore the time given for planning phase is not enough even though construction planning is a fundamental and challenging activity in the management and execution of the work which have a major influence for projects to achieve their objective without unnecessary cost and time overrun.

The second stage assesses the current construction planning practice in the respondents' respective organization. From this analysis it is observed that most construction companies do not have specialized construction planning department to perform planning activities. In most of the cases the personnel/crew who made the master plan will not be involved in planning activity throughout the project which cumpers the planning personnel/crew from developing their construction planning practice experience by learning from their previous project. And also construction planning and scheduling performed by different personnel. Furthermore this analysis implies construction companies do not consider subcontractors' construction plan in their master plan.

In the third stage severity index statistical analysis was adopted to compute the severity index of factors that influence the construction planning practice. Among 19 factors 10 factors maintained a severity index ranging from 75%-86%. Relatively low coefficient of variance, ranging 13% - 31%, was computed for each factor showing high agreement among professionals in judging the factors.

1. The finding of the research implies that the qualification and experience of construction planners have significant influence on the companies' planning effectiveness.
2. Another implication of the findings of the research is the quality time and money invested on planning phase has a highest influence on construction planning effectiveness. When construction companies are unable to invest adequate time and money on planning phase either due to their capacity limitation or their attitude towards construction planning is low, the construction plan fails to achieve the project objective.
3. The study also revealed that construction companies' effort to document and seek feedback from completed projects has major influence on the effectiveness of construction plans on the next project.
4. The finding of the research has shown that inadequate information gathering has a major influence on construction planning effectiveness. When construction companies lack an adequate information gathering system, construction planners are forced to prepare a plan with lots of uncertain information and guesswork which results in ineffective construction plan/.
5. The other main implication of the study is that the observed loose interaction among different parties involved affects construction planning effectiveness. The client, consultant, contractor and government municipalities interaction reduces the uncertainties during planning which improve the plan.
6. The study also revealed that the construction companies' planning effort has to be supported with specialized planning department to bring effectiveness in the planning process and its implementation.
7. The construction firm's planning effort has also been found to be highly influential on effective planning. Appropriate planning process comprised adequate information dissemination; effective monitoring and progress reporting system and proper and timely revision of plans are necessitate for effective planning.

6.3 Recommendations

1. Construction companies should invest substantial time and money in construction planning prior to commencement of work on site. Planning is often not carried out during a tendering process due to insufficient time and low rates of bid success. However it is advisable that construction companies should start the planning process before the outcome of the tendering is known, this is done so as to ease the challenge arising from a sudden planning that often takes place after being awarded a construction project. Furthermore, since the time available for pre-construction planning is not entirely in the control of construction companies, clients also have an important role to play by allowing sufficient time between contract award and project commencement.
2. Construction companies should focus on the determination of appropriate construction method during construction planning rather than placing priority on the development of schedules for controlling project progress. While it is acknowledged that schedules are normally prepared on the basis of a predetermined construction method, planners should not limit themselves to one feasible and acceptable way. Rather, the focus of construction planning should be on developing and evaluating alternative construction method for all probable project environment conditions.
3. After work commencement on site, the original construction plan should be reviewed at proper interval. However, such reviews should not be limited to identifying deviation between planned and actual performance and taking decision on correcting actions. The review should involve a critical reexamination of the original construction plan and seeking means of improvement through changes in construction method. And also anticipate future challenges of the project to avoid surprises during execution of the work.
4. Since construction planning is a fundamental and challenging activity, construction companies need to develop a specialized construction planning department and maintain planning crews that are qualified and experienced for developing a construction plan. Further construction companies should keep their construction planning crews updated with proper training and use of latest planning software to stay competitive in the industry.

5. Construction companies should keep their construction planning crews to participate on the project life cycle not only to follow, revise and correct the original plan but also to learn the implication of their decision by documenting and obtaining feedbacks from completed projects for future planning purposes as a continuous learning process.
6. In the presence of incomplete and uncertain information, then the planner should conduct the construction planning in a way that the plan will be flexible and open to accommodate changes in the future. Construction companies need to have a systematic ways of coping with uncertainties encountered during the planning of construction projects. This can be achieved by
 - Narrowing down uncertainties by gathering more information.
 - Adjusting to uncertainties by deferring and splitting decisions as much as possible.
 - Absorbing uncertainties by making flexible decision.
7. Diffusion of information should be clear and simple to understand for the users. To achieve this construction companies should identify the disseminated information users and analyze their current information needs. Also construction companies should use papers, screens, phones, tables, graphs and pictures as a medium and format of communication transfer frequent planned issues for the users.
8. Further studies are recommended on road and general contractors to understand the existing conditions of these contractors with regards to planning. Expanding the geographical limitation of this study to include all building contractors with in Ethiopia is advised. In addition the effect of proper construction planning on the execution of tasks is another area of study which is highly recommended.

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APPENDIX A: SAMPLE QUESTIONNAIRE

Dear participants,

As part of my MEng study in Construction Technology and Management at Addis Ababa Institute of Technology, School of Civil and Environmental Engineering, I am currently working on a project titled, “The Practice of Construction Planning in the Ethiopian Construction Industry”.

It is well known among the stakeholders (i.e. client, consultant, contractors, practicing professionals...) that construction planning is very essential to achieve the project objective without incurring unnecessary cost and time overrun as per the design and quality. However in the current Ethiopian construction planning practice, it is not being practiced as it is supposed to be practiced.

The aim of this research is to investigate and identify the proper processes that are necessary for effective construction planning and the emphasis that should be given to construction planning. This questioner has been developed to collect views of practicing professionals and construction companies.

Please be informed that your response will be kept strictly confidential and it will be exclusively used without any change or alter for this research only. I kindly request you to complete the questioner within a week of receipt, so as to enable us to finalize the research on time.

Looking forward to receive your reply, I would like to thank you in advance for you professional cooperation and you time to fill the questioner.

Sincerely;

Biruh Tesfaye

Section 1: Background Information

The questions below are related to your organization and yourself. Please indicate your response by ticking (X) in the appropriate box (es) or by filling the blank spaces provided, as appropriate.

1.1 Name of the organization you are currently working (optional):

1.2 Years since establishment:

<5 years 5-10 years >10 years

1.3 The annual turnover of your organization(\$ millions)

<Birr50 Birr, 50-100 >Birr, 100

1.4 Your work experience in construction projects:

<5 years 5-10 years >10 years

1.5 Your experience in construction planning activities:

<5 years 5-10 years >10 years

1.6 Your job title and contact address:

Profession: _____ Job title: _____

Contact address (optional) Email:_Tell: _____

Section 2: The construction planning and implementation process

The questions below are aimed to gain generic understanding of the current construction planning practice in your opinion. Please indicate your response by ticking (X) in the appropriate space. Moreover, could you please give further explanation and suggestion on the area that needs improvement at the space provided under each question?

Questions

2.1 In your opinion construction planning is a fundamental and challenging activity in the management and execution of construction works.

Strongly Agree Neutral Disagree Strongly
Agree Disagree

2.2 In your opinion effective construction planning have a major influence for projects to achieve their objective without unnecessary cost and time overrun.

Strongly Agree Neutral Disagree Strongly
Agree Disagree

2.3 In your opinion construction companies should have specialized planning department.

Strongly Agree Neutral Disagree Strongly
Agree Disagree

2.4 In your opinion in the current construction planning practice the time given for the planning phase is enough considering its significance.

Strongly Agree Agree Neutral Disagree Strongly Disagree

2.5 In your opinion the current construction plans are developed for the “how” aspect as much as for the control purpose.

Strongly Agree Agree Neutral Disagree Strongly Disagree

2.6 In your opinion during planning information like labor market, currency inflation/deflation, material availability, weather statistics data, government regulation are considered.

Strongly Agree Agree Neutral Disagree Strongly Disagree

2.7 In your opinion in current construction planning practice , planners has to prepare plan with incomplete information and in order to deal with uncertainties caused by information deficiencies, a lot of guesses works must be taken in the planning process.

Strongly Agree Agree Neutral Disagree Strongly Disagree

2.8 In your opinion longer time interval between planning and commencement of construction project, increase the uncertainty concerning the planned activity and decrease the effectiveness of the plan

Strongly Agree Agree Neutral Disagree Strongly Disagree

2.9 In current Ethiopian construction industry, construction plan is properly revised in a regular time interval.

Strongly Agree Agree Neutral Disagree Strongly Disagree

2.10 In your opinion sub-contractor's construction plan should be considered in the master plan of the main contractor.

Strongly Agree Agree Neutral Disagree Strongly Disagree

2.11 In your opinion utilizing the experience and the record accumulated from previous projects in a systematic learning process improves construction planning.

Strongly Agree Agree Neutral Disagree Strongly Disagree

Agree

Disagree

2.12 In your opinion, with the proper construction planning project resources usage can be optimized to deliver even higher profit margin without jeopardizing the quality of the end product.

Strongly Agree Neutral Disagree Strongly
Agree Disagree

Section 3: Respondents' company construction planning practice

The questions below are aimed to gain generic understanding of the current construction planning practice in your organization please indicate your response by ticking (X) in the appropriate box (es). Moreover, could you please give further explanation and suggestion on the area that needs improvement at the space provided under each question?

Questions

3.1 Are the professionals working on planning department in your organization have the experience and qualification for construction planning?

Yes No

3.2 In your company, is there construction planning department?

Yes No

If yes, how many personnel are working in the department?

3.3 Did the company that you are currently working on revise the master plans regularly?

Yes No

If yes, how often is the revision of master plan takes place?

3.4 Construction planning and scheduling is performed by the same professionals or professional crews?

Yes No

3.5 In your construction company, the personnel or crew that made the master plan will be involved in planning activity throughout the project life cycle?

Yes No

3.6 In your construction company, during selection among alternative construction method and technologies, did the company practice to formulate a number of construction plans based on alternative method or assumption.

Yes No

3.7 In forming a construction plan, a useful approach is to simulate the construction process either in the imagination of the planner or with formal computer based simulation technique .by observing the result, comparisons among different plans or problems with existing plan can be identified. Is this the usual trend that you use in your company?

Yes No

3.8 In current construction planning practice, in order to deal with uncertainties caused by insufficient information, guesses are frequently made in the planning process. In your company are these guesses later checked with initial planner or with the downstream planner?

Yes No

3.9 In your company did sub-contractor's construction plan considered in the master plan of the main contractor.

Yes No

3.10 In your construction company, the experience and the record accumulated from previous projects is utilized as a systematic learning process to improve construction planning.

Yes No

Section 4: Factors affecting the effectiveness of construction planning practice

The following factors that influence the effectiveness of construction planning practice are identified from the literature review and from overview of current Ethiopian construction planning practice which was gathered through structured interview to different practitioners in the industry. The factors are identified from the planning effort, the planning team, the organization for planning and the communication of plans. The aim of the questions below is to evaluate the degree of impact of the factors on current construction planning practice in Ethiopia.

	FACTORS	Degree of impact				
		Very high	High	Moderate	Low	None
4.1	Lack of attitude towards the significance of construction planning.					
4.2	Inadequate investment of time and money on planning phase.					
4.3	Lack of specialized planning department in construction companies.					
4.4	Inadequate qualification and experience of planners.					
4.5	Inadequate information gathering.					
4.6	Inadequate interaction between different parties involved.(client, consultant, contractor, government municipals..).					
4.7	uncertainties and guess work on planning stage					
4.8	Inadequate checking of uncertain and guessed information used at initial planning.					
4.9	Lack of interaction between main contractor's and subcontractor's construction plan.					

4.10	Focus on scheduling than the "how" aspect.					
4.11	Inadequate method for planned information distribution.					
4.12	Delay of commencement of work after planning is completed.					
4.13	Lack of effective monitoring and progress reporting system.					
4.14	Lack of proper and timely revision of plan.					
4.15	Inability of planner to share ideas with the planning team.					
4.16	Inability of the planner to have a clear definition of the project scope and desired level of detail.					
4.17	Inability of planners to build confidence and commitment into the team.					
4.18	Inability of planners to effectively communicate the plan to site personnel.					
4.19	Inability to document and seek feedbacks from completed projects.					

APPENDIX C: SUMMARY OF QUESTIONNAIRE SECTION II

Id No.	Criteria	Respondent Id																									Total	%
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25		
2.1	Agree																										25	100
	Neutral																										0	0
	Disagree																										0	0
2.2	Agree																										24	96
	Neutral																										1	4
	Disagree																										0	0
2.3	Agree																										24	96
	Neutral																										1	4
	Disagree																										0	0
2.4	Agree																										5	20
	Neutral																										5	20
	Disagree																									15	60	
2.5	Agree																										6	24
	Neutral																										9	36
	Disagree																										10	40
	Agree																									20	80	
	Neutral																										2	8

APPENDIX D: SUMMARY OF QUESTIONNAIRE SECTION III

Id No.	Criteria	Respondent Id																									Total	%	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25			
3.1	Yes																										23	92	
	No																											2	8
	Other																											0	0
3.2	Yes																										6	24	
	No																										19	76	
	Other																										0	0	
3.3	Yes																										11	44	
	No																										14	56	
	Other																										0	0	
3.4	Yes																										15	60	
	No																										10	40	
	Other																										0	0	
3.5	Yes																										8	32	
	No																										17	68	
	Other																										0	0	
	Yes																										12	48	

APPENDIX E: SUMMARY OF RESPONDENTS' RATING DEGREE OF IMPACT

Id No.	Influencing Factors	Respondents Id																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
4.1	Lack of attitude towards the significance of construction planning.	5	5	3	2	5	2	3	3	4	4	4	3	2	2	3	4	4	3	3	2	4	3	2	5	4
4.2	Inadequate investment of time and money on planning phase.	4	4	5	4	4	4	4	4	5	5	4	4	2	5	2	4	5	4	5	4	5	5	4	5	5
4.3	Lack of specialized planning department in construction companies.	4	5	5	4	4	4	4	5	4	5	4	4	3	5	4	3	3	4	4	4	5	4	4	4	4
4.4	Inadequate qualification and experience of planners.	5	4	4	5	4	4	4	5	4	4	5	5	2	5	5	3	3	4	5	5	5	5	4	3	4
4.5	Inadequate information gathering.	3	4	4	4	4	3	3	4	5	4	4	4	3	4	5	3	4	5	4	4	4	5	3	4	5
4.6	Inadequate interaction between different parties involved.(client, consultant, contractor, government municipals..).	4	3	4	3	3	3	3	4	4	5	4	4	2	5	5	4	5	3	4	5	4	4	4	4	3

Practice of Construction Planning in the Ethiopian Building Construction Industry

4.7	uncertainties and guess work on planning stage	4	4	4	4	3	4	5	4	3	4	5	3	3	4	5	3	5	3	5	4	4	3	4	3	4
4.8	Inadequate checking of uncertain and guessed information used at initial planning.	5	5	3	3	3	3	2	3	4	4	3	3	2	5	4	2	5	4	4	5	4	4	4	2	5
4.9	Lack of interaction between main contractor's and subcontractor's construction plan.	4	3	3	4	3	3	3	3	3	3	3	2	2	5	3	4	5	3	3	3	3	3	3	3	4
4.10	Focus on scheduling than the "how" aspect.	5	5	4	3	5	3	4	4	4	3	4	3	4	2	3	3	5	3	4	3	3	4	3	3	4

4.11	Inadequate method for planned information distribution.	3	4	4	4	4	4	4	4	4	4	4	3	3	4	5	3	5	4	5	4	4	4	4	4	4
4.12	Delay of commencement of work after planning is completed.	4	5	3	4	3	3	3	4	3	4	4	3	3	4	3	5	5	2	3	3	3	3	3	5	3
4.13	Lack of effective monitoring and progress reporting system.	3	4	4	4	4	4	3	3	5	5	3	4	2	5	5	3	5	4	5	5	5	4	5	4	4
4.14	Lack of proper and timely revision of plan.	4	4	4	4	4	4	4	3	4	4	4	4	2	5	5	3	4	4	4	5	4	4	5	3	4
	Inability of planner to share ideas																									

Practice of Construction Planning in the Ethiopian Building Construction Industry

4.15	with the planning team.	2	4	3	4	3	3	3	4	3	4	3	3	2	4	4	3	5	3	3	4	3	2	4	2	4
4.16	Inability of the planner to have a clear definition of the project scope and desired level of detail.	3	3	5	5	3	4	3	4	3	3	4	3	2	4	4	4	5	2	3	2	4	2	3	4	5
4.17	Inability of planners to build confidence and commitment into the team.	2	3	3	2	3	3	2	3	3	3	2	3	3	3	3	4	5	2	3	2	3	3	3	4	4
4.18	Inability of planners to effectively communicate the plan to site personnel.	4	3	4	4	4	4	3	4	5	4	3	4	3	4	3	4	4	3	2	3	2	4	3	4	5
4.19	Inability to document and seek feedbacks from completed projects.	4	3	4	4	4	4	4	4	4	5	4	4	3	5	4	4	4	3	3	3	3	3	4	3	4

APPENDIX F: COMPUTATION OF SEVERITY INDEX OF THE INFLUENCING FACTORS

Id No.	Influencing Factors	Degree of impact					Total responses	Severity index (%)
		Very high	High	Moderate	Low	None		
		5	4	3	2	1		
4.1	Lack of attitude towards the Significance of construction planning.	4	7	8	6	0	25	67.2
4.2	Inadequate investment of time and money on planning phase.	10	13	0	2	0	25	84.8
4.3	Lack of specialized planning department in construction companies.	6	16	3	0	0	25	82.4
4.4	Inadequate qualification and experience of planners.	11	10	3	1	0	25	84.8
4.5	Inadequate information gathering.	5	14	6	0	0	25	79.2
4.6	Inadequate interaction between different parties involved.(client, consultant, contractor, government municipals..).	5	12	7	1	0	25	76.8
4.7	uncertainties and guess work on planning stage	5	12	8	0	0	25	77.6

4.8	Inadequate checking of uncertain and guessed informations used at initial planning.	6	8	7	4	0	25	72.8
4.9	Lack of interaction between main contractor's and subcontractor's construction plan.	2	4	17	2	0	25	64.8
4.10	Focus on scheduling than the "how" aspect.	4	9	11	1	0	25	72.8
4.11	Inadequate method for planned information distribution.	3	18	4	0	0	25	79.2
4.12	Delay of commencement of work after planning is completed.	4	6	14	1	0	25	70.4
4.13	Lack of effective monitoring and progress reporting system.	9	10	5	1	0	25	81.6
4.14	Lack of proper and timely revision of plan.	4	17	3	1	0	25	79.2
4.15	Inability of planner to share ideas with the planning team.		9	11	4	0	25	65.6
4.16	Inability of the planner to have a clear definition of the project scope and desired level of detail.		8	9	4	0	25	69.6
4.17	Inability of planners to build confidence and		3	15	6	0	25	59.2

	commitment into the team.							
4.18	Inability of planners to effectively communicate the plan to site personnel.		13	8	2	0	25	72
4.19	Inability to document and seek feedbacks from completed projects.		15	8	0	0	25	75.2

$$SI = (\sum Wi * fi / 5 \sum fi) * 100$$

Equation 7-1 Severity Index

Where,

SI= Severity Index

i = ratings from 1 to 5,

Wi = weighting for each rating

fi = frequency of responses.

APPENDIX G: COMPUTATION OF COEFFICIENT OF VARIANCE (COV)

Id No.	Respondents Id																									Total Response	Mean \bar{x}	SD	COV
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25				
4.1	5	5	3	2	5	2	3	3	4	4	4	3	2	2	3	4	4	3	3	2	4	3	2	5	4	25	3.36	1.04	30.83
4.2	4	4	5	4	4	4	4	4	5	5	4	4	2	5	2	4	5	4	5	4	5	5	4	5	5	25	4.24	0.83	19.59
4.3	4	5	5	4	4	4	4	5	4	5	4	4	3	5	4	3	3	4	4	4	5	4	4	4	4	25	4.12	0.60	14.56
4.4	5	4	4	5	4	4	4	5	4	4	5	5	2	5	5	3	3	4	5	5	5	5	4	3	4	25	4.24	0.83	19.59
4.5	3	4	4	4	4	3	3	4	5	4	4	4	3	4	5	3	4	5	4	4	4	5	3	4	5	25	3.96	0.68	17.06
4.6	4	3	4	3	3	3	3	4	4	5	4	4	2	5	5	4	5	3	4	5	4	4	4	4	3	25	3.84	0.80	20.83
4.7	4	4	4	4	3	4	5	4	3	4	5	3	3	4	5	3	5	3	5	4	4	3	4	3	4	25	3.88	0.73	18.70
4.8	3	4	4	4	4	4	4	4	4	4	4	3	3	4	5	3	5	4	5	4	4	4	4	4	4	25	3.96	0.54	13.60
4.9	4	3	3	4	3	3	3	3	3	3	3	2	2	5	3	4	5	3	3	3	3	3	3	3	4	25	3.24	0.72	22.33
4.10	5	5	4	3	5	3	4	4	4	3	4	3	4	2	3	3	5	3	4	3	3	4	3	3	4	25	3.64	0.81	22.26
4.11	5	5	3	3	3	3	2	3	4	4	3	3	2	5	4	2	5	4	4	5	4	4	4	2	5	25	3.64	1.04	28.46
4.12	4	5	3	4	3	3	3	4	3	4	4	3	3	4	3	5	5	2	3	3	3	3	3	5	3	25	3.52	0.82	23.37

Practice of Construction Planning in the Ethiopian Building Construction Industry

4.13	3	4	4	4	4	4	3	3	5	5	3	4	2	5	5	3	5	4	5	5	5	4	5	4	4	25	4.08	0.86	21.13
4.14	4	4	4	4	4	4	4	3	4	4	4	4	2	5	5	3	4	4	4	5	4	4	5	3	4	25	3.96	0.68	17.06
4.15	2	4	3	4	3	3	3	4	3	4	3	3	2	4	4	3	5	3	3	4	3	2	4	2	4	25	3.28	0.79	24.13
4.16	3	3	5	5	3	4	3	4	3	3	4	3	2	4	4	4	5	2	3	2	4	2	3	4	5	25	3.48	0.96	27.66
4.17	2	3	3	2	3	3	2	3	3	3	2	3	3	3	3	4	5	2	3	2	3	3	3	4	4	25	2.96	0.73	24.83
4.18	4	3	4	4	4	4	3	4	5	4	3	4	3	4	3	4	4	3	2	3	2	4	3	4	5	25	3.6	0.76	21.22
4.19	4	3	4	4	4	4	4	4	4	5	4	4	3	5	4	4	4	3	3	3	3	3	4	3	4	25	3.76	0.60	15.88

$$COV = \left(\frac{\delta}{\mu} \right) * 100$$

Equation 7-2 Coefficient of Variation

Where,

COV= Coefficient of Variance

δ = the standard of deviation

μ = weighted mean of the sample

APPENDIX H: RANKING OF SEVERITY INDEX OF THE INFLUENCING FACTORS

Id No.	Influencing Factors	Degree of impact					Total responses	Severity index (%)	Rank
		Very high	High	Moderate	Low	None			
		5	4	3	2	1			
4.1	Lack of attitude towards the significance of construction planning.	4	7	8	6	0	25	67.2	16
4.2	Inadequate investment of time and money on planning phase.	10	13	1	1	0	25	85.6	1
4.3	Lack of specialized planning department in construction companies.	6	16	3	0	0	25	82.4	3
4.4	Inadequate qualification and experience of planners.	11	10	3	1	0	25	84.8	2
4.5	Inadequate information gathering.	5	14	6	0	0	25	79.2	7
4.6	Inadequate interaction between different parties involved.(client, consultant, contractor, government municipals..).	5	12	7	1	0	25	76.8	9
4.7	uncertainties and guess work on planning stage	5	12	8	0	0	25	77.6	8
4.8	Inadequate checking of uncertain and guessed information used at initial planning.	3	19	3	0	0	25	72.8	11

4.9	Lack of interaction between main contractor's and subcontractor's construction plan.	2	4	17	2	0	25	64.8	18
4.10	Focus on scheduling than the "how" aspect.	4	9	11	1	0	25	72.8	12
4.11	Inadequate method for planned information distribution.	7	7	7	4	0	25	79.2	6
4.12	Delay of commencement of work after planning is completed.	4	6	14	1	0	25	70.4	14
4.13	Lack of effective monitoring and progress reporting system.	9	10	5	1	0	25	81.6	4
4.14	Lack of proper and timely revision of plan.	4	18	3	0	0	25	80.8	5
4.15	Inability of planner to share ideas with the planning team.	1	9	11	4	0	25	65.6	17
4.16	Inability of the planner to have a clear definition of the project scope and desired level of detail.	4	8	9	4	0	25	69.6	15
4.17	Inability of planners to build confidence and commitment into the team.	1	3	15	6	0	25	59.2	19

4.18	Inability of planners to effectively communicate the plan to site personnel.	2	13	8	2	0	25	72	13
4.19	Inability to document and seek feedbacks from completed projects.	2	15	8	0	0	25	75.2	10