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ASSESSMENT ON THE PLANNING PRACTICE OF LOCAL CONTRACTORS FOR FEDERAL PUBLIC ROAD CONSTRUCTION PROJECTS IN ETHIOPIA

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ASSESSMENT ON THE PLANNING PRACTICE OF LOCAL CONTRACTORS FOR FEDERAL PUBLIC ROAD CONSTRUCTION PROJECTS IN ETHIOPIA

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

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ABSTRACT

As seen from previous experience, most of our country's construction projects have not been successful, particularly to meet their schedule and cost targets due to the industry's weak practice of planning. With respect to this problem, the study was conducted to explore and to capture the existing project planning practice of local contractors for federal public road construction projects implemented in Ethiopia, in order to provide some understandings over the maturity level of the practice. Furthermore, the study has tried to identify the major factors influencing the quality of their project planning practice.

The study has developed its research framework through combining conceptual and contextual frameworks. This is because; conceptual developments originated from the global good practices of planning required for critical adaptation to the contexts of Ethiopia. Accordingly, the research has constructed five planning areas (general; schedule/time; resource; financial; and risk, safety, quality, communication and procurement) as practice categories containing thirty activities of planning in order to explore and rank the maturity by relative importance index generated from the collected data. On the other hand, thirty factors have identified and listed in six categories (time related; management related; information related; skill, knowledge and attitude related; planning technique, tools and process related; and software related) in order to rank their influence on the practice by principal component analysis loading of the collected data. Furthermore, SPSS and MS Excel ware used as data analysis software.

As the result of the research witnessed; even if there is adequate awareness on the benefits, the maturity of project planning practices of local contractors in Ethiopian federal public road construction projects is subsisted at low level. Relatively, the practices of planning risk, safety, quality, communication and procurement category are found to be the least matured practices; on the other hand, relatively the highest maturity level is found for their time planning practice. Furthermore, connected to the factors, management related factors are found as the most dominant factor that affects quality and maturity of their projects planning process. With respect to this, low level construction management capacity of the construction industry, shortage of qualified or skilled planner, and low level of project management knowledge and experience/practice of practitioners are the main challenges as well as the most influential factors affecting the planning practice of federal public road construction projects in Ethiopia.

Finally, the study has drawn recommendations, such as trainings and management capacity building program, for contractors' action as improvement intervention.

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ABBREVIATIONS

| ADM | Arrow Diagram Method |
|---|---|
| СРМ | Critical Path Method |
| ERA | Ethiopian Roads Authority |
| FDRE | Federal democratic Republic of Ethiopia |
| GERT | Graphical Evaluation and Review Technique |
| GTP | Growth and Transformation Plan |
| MCA | Multiple Correspondence Analysis |
| MOFED | Ministry of Finance and Economic Development |
| MOWUD | Ministry of Works and Urban Development |
| | |
| PCA | Principal Component Analysis |
| PCA PDM | Principal Component Analysis Precedence Diagram Method |
| PCA PDM PERT | Principal Component Analysis Precedence Diagram Method Program l Evaluation and Review Technique |
| PCA PDM PERT PPA | Principal Component Analysis Precedence Diagram Method Program l Evaluation and Review Technique Public Procurement Agency |
| PCA PDM PERT PPA RII | Principal Component Analysis Precedence Diagram Method Program l Evaluation and Review Technique Public Procurement Agency Relative Importance Index |
| PCA PDM PERT PPA RII RSDP | Principal Component Analysis Precedence Diagram Method Program l Evaluation and Review Technique Public Procurement Agency Relative Importance Index Road Sector Development Plan |
| PCA PDM PERT PPA RII RSDP SPSS | Principal Component Analysis Precedence Diagram Method Program l Evaluation and Review Technique Public Procurement Agency Relative Importance Index Road Sector Development Plan Statistical Package for Social Science |
| PCA PDM PERT PPA RII RSDP SPSS URRAP | Principal Component Analysis Precedence Diagram Method Program l Evaluation and Review Technique Public Procurement Agency Relative Importance Index Road Sector Development Plan Statistical Package for Social Science Universal Rural Road Access Program |

CHAPTER 1 INTRODUCTION

1.1 Background

In development of any country, the construction industry play a vital roles in transforming the aspirations and the needs of its people into reality by implementing successfully various physical structure projects such as road, buildings, railways, dams, etc (Ahemed, 2002). In order to meet these objectives, construction projects should be implemented successfully. A construction project is commonly acknowledged as successful when it is completed on time, within budget, in accordance with specification and to stakeholders' satisfaction (Omran et al., 2012). Alternatively, profitability to contractors with absence of claims and court proceedings, and "fitness for purpose" for occupiers has been used as measures of project success (Takim & Akintoye, 2002).

Owing to these, planning is usual starting point of project to begin the project management process for successful accomplishment. Planning has remained central to management ever since Henri Fayol listed it as a managerial function along with, among others, coordination and control in 1916 (Hodgson, 2004; Mintzberg, 1975; Wren et al., 2002). In addition, Chan (1996) pointed out; accurate construction planning is a key determinant in ensuring the delivery of project on schedule and within budget.

Road is one of the physical infrastructures which are the outputs of construction industry and usually constructed successfully through project management. In view of the fact that roads are a corner stone of any nations infrastructure and they are built to facilitate socio-economic development of the country (MoFED, 2010). Owing to these, road construction projects are widely undergoing for the last two decades, all over Ethiopia as part of the national development plan. Moreover, the government of FDRE releases five years plan termed as growth and transformation plan (GTP) in 2010, with vision to reach the country's economy at the level of those in middle income countries. Based on the GTP, the government of FDRE has target to increase the road network coverage in significant rate, up to 64522km excluding URRAP roads, by the end of 2014/15 budget year (MoFED, 2010). Growth and Transformation Plan envisages huge investment in infrastructure to strengthen the foundation for long-term sustained growth and development, and to meet the planed target. Thus, this is majorly the responsibility of

construction industry to ensure successful implementation planned infrastructures and utilize the opportunity furnished to the industry through the GTP (2010/2011 to 2014/2015).

Nevertheless, as seen from previous experience, most of our country's construction projects have not been successful, particularly to meet their schedule and cost targets. In other words, cost and time overrun are usual practice of the country's construction projects. Besides, capacities were not well organized and budget allocation and planned construction activities were not synchronized with existing capacities. Similarly, Karlsson (2011) support this idea and he noted that the planning processes are often neglected in Ethiopian construction projects and the execution is often started without developed project plan. Further he addressed in his research, the priority of project control is not high in Ethiopian projects, which together with the neglected planning often causes several problems for the Ethiopian construction project such as delay and cost overrun. The approach with the low priority of planning and control is, according to Howard (2010), connected to the Ethiopian culture, and problems are often solved as they occur rather than by controlling and planning to avoid them. Projects with insufficient planning and control are, according to Gupta (2008), highly likely to suffer severe delays and increased costs in the execution of the project. On the other hand, human resources of Ethiopian construction industry were found deficient in project management practices particularly in planning, monitoring and controlling function; consequently most of the country's construction projects have low performance in their execution (Wubishet, 2004).

On the contrary, ERA (2013) has shown that performance of road construction projects of Ethiopian government has been improving for the last sixteen years but further efficiency gained are possible by encouraging contractors to plan, and to perform and monitor the planed works throughout the period of implementation of the project. As all of those literatures pointed out, Ethiopian construction industry has weakness in project management; this is mainly the consequence of the industry and its practitioners' attitude of giving less priority to project planning.

Therefore, in order to assess and identify the maturity level with the weakness areas in the industry's project management particularly the planning practice, and also to enable to take corrective actions; more researches and studies have to be done on the construction project management practice of the country. Specifically the country's construction industry project planning practice should be assessed and studied further, since planning is the base for other management functions. In addition, Winch and Kelsey (2005) stated that "planning remains

central to construction project management and its practice deserves more research attention than it currently receives". Moreover ERA, the official sponsor of this master's degree program, is interested on and wished-for to appreciate the research ideas collected from practical problems currently occurring during design and construction of road projects (ERA, May 2011). Despite of these, the researcher has motivated to conduct the study on the area of construction project management practices exercised during the construction/implementation phase of projects, particularly by concentrating on the planning practice of local contractors particularly who are participating in federal public road construction projects.

Therefore, this study has been tried to assess the maturity level of the planning practice adopted in federal public road construction projects of Ethiopia by focusing on the local contractors participating in those projects. Furthermore, the research has made an effort to identify the influential factors affecting the quality of planning practices; and also, it has forwarded some recommendations for intervention actions that can alleviate the weaknesses and improve the maturity.

1.2 Objectives of the Research

General Objective

The main objective of the study is to assess the maturity level of the planning practice of local contractors adopting on the construction/execution phase of federal public road construction projects in Ethiopia.

Specific Objectives

More specifically the study is intended to meet the following specific objectives:

- To identify factors influencing the maturity and quality of planning practice in road construction projects;
- To rank and prioritize the factors identified based on their degree of influence on quality of planning practice;
- To suggest and provide remedial measures to improve maturity and quality for the existing planning practice of federal public road construction projects in Ethiopia.

1.3 The Research Questions

In order to achieve the research objectives, this study has attempted to answer the following questions:

- 1. What are the existing planning practices of local contractors participating in federal public road construction projects of Ethiopia? And, how much is their practice matured?
- 2. What are the factors influencing quality of the planning practice? And, which are the most influential?
- 3. How can we improve the maturity and quality of the existing planning practice of federal public road construction projects?

1.4 Significance of the Study

The research has assessed maturity level of the planning practices currently exercised by local contractors all through construction/execution phase of federal public road construction projects in Ethiopia, and identified the factors influencing quality of the practice and prioritize them based on their degree of influence. In general for construction companies in Ethiopia, the study can serve as wake-up call about the maturity level of their planning practice and the main factors affecting to the quality of planning in construction project.

Hence; for local contractors as well as professionals who work on the construction project planning; the result is helpful to understand and visualize the maturity level and the existing situation of the planning practice in federal public road construction of Ethiopia, and also it is useful to know the influential factors affecting the practice. Consequently, they can take intervention actions to fill the gaps as well as to plan the works efficiently for the possible improvement in maturity and quality of the planning practice.

The findings of the study is to let the stakeholders of the industry and other concerned bodies to know about the maturity of the existing planning practice and the factors affecting quality of planning in federal public road construction projects of Ethiopia. For future research studies emphasis on the project management of the construction industry particularly the road construction sector of Ethiopian, these study is valuable and uses for them as a reference document. In addition to these, the final report of the research has gave an idea to researchers about the gaps and issues that have not been addressed by the study and that are let for further study and research.

1.5 Scope and Delimitation of the Study

The scope of the research is limited to public road construction projects in Ethiopia, which are implemented at federal government level, concerning mainly on the practice of planning during the construction or implementation phase of the project. In addition to these, it is conducted on some selected contractors currently participating in federal public road constructions projects carried out in Ethiopia.

CHAPTER 2 REVIEW OF LITERATURE

Various authors have defined project in different ways with emphasizing its diverse aspect. By summarizing those definitions given, this research defines a project as: "A unique, onetime event and temporary endeavor, that has specific work scope with definable tasks and definite beginning and ending time, undertaken following specific cycle of initiation, definition, planning, execution and close to create a unique and tangible set of deliverables such as product, service, or result through novel organization and coordination of human, material financial and other resources." [PMI, 2004; Muriithi & Crawford, 2003; Stanleigh, 2007].

In short term, a project is a group of tasks performed in a definable time period, to meet specific objective. From this definition, we realize that project has a life cycle began in initiation, prompt in the course of its definition, planning and execution, end by its closing along with tangible set of deliverables met with its objective. With regard to this, we can't speak no matter which about project success without its management. Hence, generally managing a project deals mainly with identifying requirements, establishing clear and achievable objectives, balancing the competing demands for quality, scope, time and cost, adapting specifications, plans, and approach to the different concerns and expectations of the various stakeholders. (PMI, 2004).

2.1 Project Management

Besides, Similar to the definition of project, by digesting definitions of different literature, this research defines Project management as: "The application and integration of modern management and management knowledge, skills, tools and techniques to the overall planning, directing, coordinating, monitoring and control of all dimensions of a project from its inception to completion ,and the motivation of all those involved to produce the product, service or result of the project on time, within authorized cost, and to the required quality and requirement, and to the satisfaction of participants. [Chartered Institute of Building, 2002; Fewings, 2005; Carmichael, 2004].

According to different literatures, cycle of project management can be designed based on either its function or processes. Based on management function, its cycle contain planning, organizing, directing and controlling as illustrated in Figure 1. On the other hand in the aspect of process project management cycle is composed with initiation process, planning process, control process and closing process as seen in the in Figure 2. In both aspects, planning and controlling are the basic component of project management cycle.





Figure 1: Project management functions cycle



In view of that, initiation process involves in developing project objective by identifying and gathering the project information related to the project need, developing project management team, and developing organizational commitment towards the project. On the other hand, planning process involves in scope definition, activity definition, and development of project management plan which has engrossed developing schedule, cost estimating, resource planning, and developing other subsidiary plans. Further, controlling process involves in distributing information of initiation and planning process out puts, update the project, performance reporting, and identify and manage changes. And towards the end, closure process involves in checking the project completion, project closeout, administrative closeout, and project completion.

2.2 Project Planning

In general, the dictionary definition of a plan is "a formulated and especially detailed method by which a thing is to be done" (Oxford, 2002). This dictionary definition indicates the importance of working towards an objective and identifying how that objective will be achieved. As a general rule, Planning is determining what needs to be done, by whom, and by when to full fill ones assigned responsibility (Kerzner, 2009). On the other hand, planning in a project environment may be described as establishing a predetermined course of action within a forecasted environment. Thus, project plan serves as a guideline for life time of the project, and it is fundamental to the success of any project. Further, Project planning is one of core project management process and activity which attempts to identify, define, combine, unify, and coordinate other project management processes and activities within the Project management environment (PMI, 2004). Hence, all projects, because of those mentioned and their relatively short duration as well as often prioritized resources controlling, have required detailed planning.

Based on the context of construction project, planning is also defined as the process of identifying all the activities necessary to complete the project successfully (Oberlender, 2000). It is also been explained by Westney (1985) as the process of breaking a project down into specific tasks, and defining the sequence in which those tasks can or must be performed. On the other hand, according to Payne et al. (1996), project planning means planning methods, choosing between different alternatives, deciding on cash flow for the cost plan or budget, and deciding on the schedule of operations or the timing plan. In addition to these, Spice (2003) highlighted that the project plan can be used to make forecasts, estimate impacts of risks and to make contingency plans for the consequences of delays or other changes in the plan.

Founded on these definitions, as a general term, we can say that planning is a process entails and focuses in defining every tasks of a project, selecting methods and alternatives, estimating time and cost, and identifying risks and estimating their impact on a project, so as to enable a project to meet the objective. In the same way but broadly, as the component of project management process, PMI (2004) said that planning involves on: establishing the project objective and scope of the work; delineating the project organization/team; defining the work; determining the timing; establishing resource requirement and availability; establishing a cost budget; attempting to evaluate, optimize and freeze baseline plan; and distributing information. That's why; the majority of literatures have said that the most important responsibilities of a project manager are planning, integrating plans, and executing plans.

2.2.1 Objectives Project Planning

The project plan is the road map that defines how to get from the start to the final results. Based on this, many authors and reference literatures have identified different objectives of project planning in different ways underlining its different aspects. According to most of the literatures reviewed, the primary objective of project planning and scheduling is usually to coordinate project activities in order to complete the project with the best time, the best cost, and the least risk. Furthermore, there are also secondary objectives of project planning and scheduling such as studying alternatives, developing an optimal schedule, using resources effectively, communicating, refining the estimating criteria, obtaining good project control, and providing for easy revisions.

With this context and from management perspective, Lee (1998) point out some objectives of project planning. These are: to reduce the consequence of uncertainties and risks; to persuade people to perform sequential tasks to ensure that the available resources are best utilized at all

times; and to provide the basis for project control. On the other hand, Mawdesley et al (1997) cited other objectives of project planning; these are: to provide a basis for estimating time and cost; to predict the timing of activities, their sequence and the total construction period; to provide a basis for claims evaluation, in particular extension of time entitlement calculations; to predict the level of resources such as labor, staff, plant and material; and to enable the safety, quality and environmental impact of the work to be properly considered.

As discussed by PMI (2013), the major objective of project plan is to provide basic guide lines and instruments of project management; and these guide lines and instruments are used to:

Direct and Manage Project Work: which is the process of leading and performing the work defined in the project plan, implementing approved changes and it provides overall management of the project work to achieve the project's objectives. Direct and manage project work activities include perform activities to accomplish the objectives; create deliverables to meet the planned work; provide, train, and manage the team members assigned; obtain, manage, and use resources; implement the planned methods and standards; establish and manage communication channels; generate work performance data such as cost, schedule, technical and quality progress, and status to facilitate forecasting; manage risks and implement risk response activities; manage stakeholders and their engagement; and collect and document lessons learned.

Monitor and Control Project Work: which is the process of tracking, reviewing and reporting the progress to meet the performance objectives defined in the project plan. Monitor and control a project work is concerned with: comparing actual performance against the plan; assessing performance to determine whether any corrective or preventive actions are indicated, and then recommending those actions as necessary; identifying new risks and analyzing, tracking, and monitoring existing project risks to make sure the risk response plans are being executed; providing information to support status reporting, progress measurement, and forecasting; and providing forecasts to update current cost and current schedule information; Perform Integrated Change Control: this is the process of reviewing all change requests; approving changes and managing changes to deliverables, organizational process assets, project documents, and the project management plan; and communicating their disposition.

2.2.2 Remuneration of Project Planning to Project Controlling

In any construction project, time, money and quality are the three inter-related factors and the primary elements of project management those need to be controlled (Mawdesley, et al., 1997),

in order to meet the objectives of planning. So, planning without controlling is worthless and vice versa. Planning and controlling are amalgamated and interrelated project management functions, and the existence of each is vital and necessary for the success of each other.

The simplest definition of project controlling, according to Babcock (1991), is compelling events to conform to plans. Further, literatures define and express the project controlling in different ways and terms. For instance: control entails seeing that project tasks are carried out according to plan and to avoid large deviations from the plan (Roman, 1986); controlling a project is done by measuring performance and correcting deviation from the plan (Lee, 1998); controlling a construction project fulfils the need for spotting mistakes, recognizing lack of work progress, and identifying areas of poor quality (Mawdesley, et al., 1997); and also Gould and Joyce (2002) wrote that the purposes of project control are to guarantee that the project's plan, budget and schedule are met by the project and to identify deviation early when any objective begins to slip so that appropriate correction of plan can be made by revise it, depending on the circumstances and project type.

On the other hand, some literatures have identified the reasons "why planning and control is conjugally necessary?" as follows:

- ✓ to prepare for unforeseen factor to reduce consequence of uncertainties and risks (Lee, 1998 & Roman, 1986)
- ✓ to persuade teams to perform tasks to ensure project's objectives are met (i.e. timely completion, optimal use of resources etc) (Chan, 1997 and Gould and Joyce, 2002)
- ✓ to provide basic coordination (Gould and Joyce, 2002)
- ✓ to avoid communication breakdown (Roman, 1986 and Ahuja, 1994)
- ✓ to fulfill financier's, client's, or contractual requirement (Ahuja, 1994)
- ✓ to provide continuity of personnel when experienced personnel leaves (Ahuja, 1994).

Alternatively, Hendrickson and Au (2000) mentioned that the key factors for unsuccessful projects are ill-defined scope, poor management, poor planning, breakdown in communication between engineering and construction, unrealistic scope, schedules and budgets, many changes at various stages of progress and lack of good project control. Therefore these factors can be managed by implementing proper planning and proper controlling in parallel to planning from starting to completion of the project.

2.2.3 Who is Responsible to Plan the Construction Project?

While project management evolved, best practices became important. Best practices can be learned from both successes and failures. Accordingly, this section have disused the best practice of the global construction industry related to the successful project planners and also project managers as a planner.

For the construction contractor, planning is a key element of construction project management that begins with procuring the work and continues throughout the construction process. Thus, project managers look to the planner to guide them on future work in order to make forecasts on future events (what will happen and when?), to measure construction process and to identify potential construction problems/risks. Further, detailed planning needs to be decentralized to those responsible for the execution of the works. (Ballard and Howell, 1998; Barber et al. 1999; Faniran et al. 1999).

Within this context and according to Kerzner (2009), the major responsibility of the project manager is planning. If project planning is performed correctly, then it is conceivable that the project manager will work himself out of a job because the project can run itself. In most cases, the project manager provides overall or summary definitions of the work to be accomplished, but the line managers (the true experts) do the detailed planning. Further he says, as the architect of the project plan, the project manager must provide information for base lines of the detail plan such as task definitions, major timetable milestones, end-item quality and reliability requirements, and the basis for performance measurement. These factors, if properly established, result in assurance that functional units understand their responsibilities toward achieving project needs; and to know and early identification of problems so that effective corrective action and replanning can be taken to prevent or resolve the problems.

On the other hand, Project managers are responsible for project administration and establishing its requirements as a planner. Establishing project administrative requirements is part of project planning. Executives must either work with the project managers at project initiation or act as resources later. Improper project administrative planning can create a situation that requires a continuous revision of project policies and procedures, a continuous shifting in responsibility with unnecessary restructuring, and a need for staff to acquire new knowledge and skills (Kerzner, 2009).

Project success is often measured by the "actions" of the project manager and his team; and Kerzner (2009) identifies the fundamental planning lessons for management by combining their relevant actions, as follows:

- \checkmark When starting off in project management, plan to go all the way
- ✓ Allow adequate time and effort for laying out the project groundwork and defining work by using work breakdown structure and network planning as an instrument
- ✓Ensure that work packages are the proper size, manageable and realistic in terms of effort and time
- ✓ Establish and use planning and control systems as the focal point of project implementation that enable to know "where you're going?" and "when you've gotten there?".
- ✓ Be willing to re-plan and do so since the best-laid plans can often go astray and change is inevitable.
- ✓ Tie together responsibility, performance and rewards by means of management by objective that is a key to motivation and productivity.
- ✓ Long before the project ends, plan for its end.

Conversely, one of the most difficult activities of management in the project environment is to keep the planning on target; and in order to overcome this difficulty Kerzner (2009) designs the procedures, which are derived from good practice of global construction industry, that can assist project managers and/or project planners during planning activities:

- ✓ Let functional managers (the people who must do the work) do their own planning.
- ✓ Establish goals before planning otherwise short-term thinking takes over.
- ✓ Set goals for planners to guard against unnecessary effort for payoff and the nonessentials.
- \checkmark Stay flexible to use people-to-people contact and to stress fast response.
- ✓Keep a balanced outlook by shunning overreact and inflated pose for an upturn.
- ✓ Welcome top-management participation since they have the potential to make/break a plan, and may well be the single most important variable of the project.
- ✓ Beware of future spending plans so that to eliminate the tendency to underestimate.
- \checkmark Test the assumptions behind the forecasts, and do not depend solely on one set of data.
- ✓Don't focus on today's problems by trying to get away from crisis management and fire fighting.
- ✓ Dispel illusions by avoiding the Persian messenger syndrome and by giving attention to bad news.

2.3 Skill and Knowledge for Project Planning

In general, planning skills are absolutely helpful and essential for the successful planning and more management of any undertaking either simple/small or large/complex projects. According to Kerzner (2009), effective project planning requires particular skills far beyond writing a document with schedules and budgets. Further as he said, it requires communication and information processing skills to define the actual resource requirements and administrative support necessary; and also the ability to negotiate the necessary resources and commitments from key personnel in various support organizations with little or no formal authority.

On top of these, effective planning requires skills in the areas of securing commitments, incremental and modular planning, assuring measurable milestones, and facilitating top management involvement. On the other hand, construction project planning involves not only knowledge and experience of the construction process but also the ability to secure and co-ordinate information from a number of sources, both internally within the contractor's organization and externally from numerous specialist suppliers. In spite of this, construction project planning is not a task undertaken in isolation; and it is worked in a network of relationships which demand negotiating and facilitating skills and the ability to work collaboratively.

Besides, from the aspects of construction projects, Baldwin & Andrew (2014) list the basic domain specific knowledge and skill required by planners as follows:

- \checkmark Better understanding of site processes and construction works
- ✓ Better understanding of mechanical and electrical services and co-ordination with other trades
- ✓ Development of better communication skills including listening
- ✓ Experience through working on a wide range of projects
- ✓ Better understanding and administration of contracts and tender processes
- ✓ Development of the ability to anticipate problems
- ✓ Better understanding of 3D/spatial aspects of the work
- ✓ Development of a feel for task outputs and durations
- ✓ Better understanding supply chain management

Construction planners have to undertake their work under the constraints of time. Often the level of information is limited and there is a need to secure and collate information before making a decision. Where no information is available assumptions need to be made. Planners need to be

comfortable working in a world of uncertainty. Planning tasks may be similar from project to project but the form of procurement drives planning practice.

2.4 Project Planning and Scheduling Techniques

Construction project management is continually seeking new and better control techniques and tools to cope with the complexities, masses of data, and tight deadlines that are characteristic of highly competitive industry. Managers also want better methods for presenting technical and cost data to customers, project stakeholders and other concerned bodies. Further, project managers and/or project planners need suitable tools and techniques to process complex and wide range information in the project, the organization and the enterprise environment. Unless the planner select and utilize the appropriate as well as best fit planning tools and techniques, total project planning cannot be accomplished effectively. Generally, network Planning/Scheduling techniques, planning software and expertise analysis are the most tools and techniques used in the construction industry.

2.4.1 Network Planning/Scheduling Techniques

Network analysis can provide valuable information for planning, integration of plans, time series studies, scheduling, and resource management. According to PMI (2013), the most common network planning/scheduling techniques are listed as Gantt or bar charts, milestone charts, line of balance, networks, arrow diagram method (ADM), program evaluation and review technique (PERT), critical path method (CPM), precedence diagram method (PDM), and graphical evaluation and review technique (GERT).

In general, the primary purpose of network planning is to eliminate the need for crisis management by providing a pictorial representation of the total project plan/program. Furthermore, with limitation of Gantt and milestone charts as their inability to show the interdependencies between events and activities, Kerzner (2009) viewed the following as the advantages of network scheduling techniques:

- ✓Form the basis for all planning and predicting, and help to decide how to use resources to achieve time and cost goals;
- ✓ Provide visibility and enable to control "one of a kind" programs;
- ✓Help to evaluate alternatives by answering "how time delays will influence project completion?", "where slack exists between elements?", and "what elements are crucial to meet the completion date?";

- ✓ Provide a basis for obtaining facts for decision-making;
- ✓Help to utilize time network analysis as the basic method to determine manpower, material and capital requirements, to provide a means for checking progress, and provide the basic structure for reporting;
- ✓ Reveal interdependencies of activities, and help to identify the longest path or critical paths;
- ✓ Facilitate "what if" exercises; and aid in scheduling risk analysis; and
- ✓ Provide information such as completion time, impact of late and early starts, trade-offs between resources and time, cost of a crash program, slippage in plan/performance and performance evaluation.

However, there are some planning practices that can impact the effectiveness of scheduling techniques; these are using unrealistic estimates for effort and duration, inability to handle employee workload imbalances, having to share critical resources across several projects, overcommitted resources, continuous readjustments to the WBS primarily from scope changes, and unforeseen bottlenecks.

2.4.2 Planning/Scheduling Software

Today, project managers have a large array of software available to help in the difficult task of planning, tracking and controlling projects. While it is clear that even the most sophisticated software package is not a substitute for competent project leadership and it does not identify or correct any task-related problems by itself. It can be a terrific aid to the project manager in tracking the many interrelated variables and tasks that come into play with a project. Specific capabilities of most planning software include (Kerzner, 2009):

- ✓ Project data summary that show expenditure, timing, and activity;
- ✓ Project management capability such as critical path analysis, sub-networking, resource planning and analysis with leveling, Cost and variance analysis, multiple calendars, and graphical presentation;
- ✓ Customized reporting formats and capabilities, data management, and multi-project tracking;
- ✓Impact analysis (what if . . .), early-warning systems, and On-line analysis of recovering alternatives.

2.4.3 Expert Based Planning/Scheduling Tools and Techniques

In order to use network scheduling techniques as well as planning software effectively, there are other subsidiary tools and techniques which depend on the personal skill of the planner. Accordingly PMI (2013), present the following subsidiary tools and techniques.

- Expert judgment: utilized to tailor the process to meet the needs; develop technical and management details to be included in the plan; determine resources and skill levels needed to perform work; and prioritize the work to ensure resources are allocated to the appropriate work at the appropriate time.
- Facilitation techniques: such as brainstorming, conflict resolution, problem solving and meeting
- Analytical techniques: such as analogous estimating (estimating duration or cost by historical data), parametric estimating (algorithm based on historical data and project parameters), three-point estimating (considering estimation uncertainty and risk), reserve analysis (to include time reserves or buffers), and decomposition and rolling wave.
- Resource optimization techniques: such as resource leveling or resource smoothing.
- Modeling: such as what if scenario analysis and simulation.
- Schedule compression: such as crushing or fast tracking to shorten duration without reducing the scope.
- Organization charts and position descriptions: such as hierarchical, matrix, and textoriented.

2.5 Processes of Project Planning

Developing a Project Plan is the process of defining, preparing, and coordinating all subsidiary plans and integrating them into a comprehensive project management plan. In general the output of project planning process defines how the project is executed, monitored and controlled, and closed. Even if the content of project plan varies depending upon the application area and complexity of the project, it is developed through a series of integrated processes extending from beginning to project closure and progressively elaborated by updates, and controlled and approved through integrated change control process.

In general, according to Kerzner (2009), the logic and process of planning requires answers to several questions in order for the alternatives and constraints to be fully understood and addressed. A list of questions would include:

- ✓ Prepare environmental analysis: Where are we? And how and why did we get here?
- ✓ Set objectives: Is this where we want to be? And where would we like to be?
- ✓List alternative strategies: Where will we go if we continue as before? Is that where we want to go? And how could we get to where we want to go?
- ✓List threats and opportunities: What might prevent us from getting there? And what might help us to get there?
- ✓ Prepare forecasts: Where are we capable of going? And what do need to take us where we want to go?
- ✓ Select strategy portfolio: What is the best course for us to take? What are the potential benefits? And what are the risks?
- ✓ Prepare action programs: What do we need to do? When do we need to do it? How will we do it? And who will do it?

In order to answer those questions several information are required, as an input, throughout the planning process. Further, effective total project planning cannot be accomplished unless the necessary information becomes available during the start as well as throughout the whole process of planning until complete it. According to PMI (2013) the primary input information includes:

- ✓ The statement of work (SOW): brief description of the work
- ✓The project specifications
- ✓ Basic milestones: start date, finish date and other major milestones of the project
- ✓ The work breakdown structure (WBS) templates
- ✓ Enterprise environmental factors: such as governmental or industry standards, project management focus area (environmental, safety, or risk), organizational structure, management practices, infrastructure (existing facilities and capital equipment), and personnel administration (hiring and termination guidelines, performance reviews, and development and training records).
- ✓ Organizational process assets: such as standardized guidelines and performance measurement criteria, project plan template, organization's set of standard processes to satisfy the needs of the project, project closure guidelines or requirements, change control procedures, project files from previous projects (scope, cost, schedule and performance measurement baselines, project calendar, schedule network diagrams, and risk registers), and historical information and lessons learned.

Moreover, PMI (2013) identifies also components of the Project management plan and its subsidiary plans with their development processes as follows:

- 1) Develop scope management plan: involves in collect requirements, define scope, and create WBS
- 2) Develop schedule/time plan: involves in define activities, sequence activities, estimate activity resources, estimate activity durations, and develop schedule
- 3) Develop cost/financial plan: involves in estimate costs and determine budget
- 4) Develop quality management plan
- 5) Develop resource plan: involves in develop human resource, equipment, and material plan
- 6) Develop communications management plan
- 7) Develop risk management plan: involves in identify and analyze risks and plan risk responses
- 8) Develop procurement management plan
- 9) Develop stakeholder management plan

2.5.1 Scope Management Planning

Developing scope management plan is the first step of planning process. The scope management plan is a component of the project plan that describes how the scope will be defined, developed, monitored, controlled, and verified. Scope management planning is the process of defining scope baseline and creating WBS of work to be carried out. The components of scope Plan include (PMI, 2013):

Project scope statement: is the description of the project scope, major deliverables, assumptions, and constraints. The detailed project scope statement, either directly, or by reference to other documents, shows acceptance criteria, project deliverables, project exclusions, project constraints, and project assumptions.

WBS: is a hierarchical decomposition of the total scope of work to be carried out by the project team to accomplish the project objectives and to create the required deliverables. Each descending level of the WBS represents an increasingly detailed definition of the project work. The WBS is finalized by assigning each work package to a control account and establishing a unique identifier for that work package from a code of accounts. These identifiers provide a structure for hierarchical summation of costs, schedule, and resource information.

WBS dictionary: is a document that provides detailed deliverable, activity, and scheduling information about each component in the WBS, and supports the WBS. Information in the WBS dictionary may include code of account identifier, description of work, assumptions and constraints, responsible organization, schedule milestones, associated schedule activities, resources required, cost estimates, quality requirements, acceptance criteria, technical references, and agreement information.

2.5.2 Schedule/Time Planning

Project schedule/time plan is a document that provides basic baseline information for the project time management processes and their associated tools and techniques. The schedule/time plan is a component of the project plan. Generally, project schedule/time plan development process involves the following processes and steps (PMI, 2013):

Define Activities: is the process of identifying and documenting the specific actions to be performed to produce the project deliverables. The output of this process; which provides basis for estimating, scheduling, executing, monitoring, and controlling the project work; includes activity list, activity attributes, and milestone list.

Sequence Activities: is the process of identifying relationships among the project activities. The output of this process includes project schedule network diagrams and project documents updates.

Estimate Activity Resources: is the process of estimating the type and quantities of material, human resources, equipment, or supplies required to perform each activity. The output of this process includes activity resource requirements and resource breakdown structure that helps to identifies the type, quantity, and characteristics of resources required to complete the activity which allows more accurate cost and duration estimates.

Estimate Activity Durations: is the process of estimating the number of work periods needed to complete individual activities with estimated resources. The output of this process provides the amount of time each activity will take to complete with activity duration estimates.

Develop Schedule: is a process of analyzing activity sequences, durations, resource requirement and schedule constraints to create the project schedule model. The output of this process includes schedule baseline, project schedule (presented by using bar chart, milestone chart or network diagram), schedule data (schedule milestones, schedule activities, activity

attributes, all identified assumptions and constraints, resource requirements by time period, alternative schedules, scheduling of contingency reserves, resource histograms, cash-flow projections, and resource order and delivery schedules), project calendars (identify working days and shifts available), and project plan with documents updates.

Generally, the finalized and approved schedule is the baseline that will be used in the control of project schedule/time. As the project activities are being performed, the majority of effort in the project time management will occur in the control process to ensure completion of project work in a timely manner.

2.5.3 Project Cost Planning

Project cost plan is primarily concerned with the cost of resources needed to complete project activities. The cost planning effort occurs early in project planning and sets the framework for each of the cost management processes so that performance of the processes will be efficient and coordinated. Generally, project cost planning involves the following process and steps (PMI, 2013):

Estimate Costs: is a process of developing an approximation of the monetary resources needed to complete project activities. The output of this process comprise activity cost estimates (show cost of direct labor, materials, equipment, services, facilities, information technology, and special categories such as cost of financing, interest charges, inflation allowance, exchange rates, contingency reserve, and other indirect costs), and basis of estimates (supporting detail documents of estimate that shows how the estimate was developed, all assumptions made, any known constraints, indication of the range of possible estimates, and indication of the confidence level of the final estimate).

Determine Budget: is a process of aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline. The output of this process includes cost baseline (that is time phased project budget excluding any management reserve), and project funding requirements.

2.5.4 Project Human Resource Planning

Even if some components of human resource plan such as type and number of human resource required by time period, done during time planning, additional information are required in order to manage human resource effectively. Accordingly, human resource planning is a process establishes and provides project roles and responsibilities, project organization charts, and the

staffing management plan including the timetable for staff acquisition. In addition to the required type and number in time period which is identified in time plan, the outputs of project human resource planning process includes (PMI, 2013):

Human resource plan: contain role and responsibility matrix that show role, authority, responsibility with competency, and project organization chart.

Staffing management plan: contain that staff acquisition and release plan, calendar of resources, training needs plan, recognitions as well as rewards, compliance, and safety.

2.6 Factors Affecting Quality of Planning

Some problems are faced to the project manager and the project planning team usually during the implementation of planning and control. Regarding to this, some researchers identified the major problems such as communication failure (Malliet, 2001), disinterest in project planning & control due to perceived poor returns from its implementation (Clarke, 1999 & Cox, 1993), lack of information input & feedback for planning & control due to its image as a 'corporate reporting tool (Clarke, 1999), changes in projects' scope (Clarke, 1999; Rakes, 1992), cultural and individual issues (Baba, 1996), and unavailability of resources (Roman, 1986).

Moreover, no matter how hard we try, planning is not perfect, and sometimes plans fail. Some typical reasons listed by Kerzner (2009) and Lewis (2005) include:

- ✓ Corporate goals are not understood at the lower organizational levels.
- ✓ Plans encompass too much in too little time.
- ✓ Financial estimates are poor.
- ✓ Plans are based on insufficient data.
- \checkmark No attempt is being made to systematize the planning process.
- ✓ Planning is performed by a planning group without involving people who must do the work.
- ✓ No one knows the ultimate objective, staffing requirements, and major milestone dates.
- ✓ Project estimates are best guesses, and are not based on standards or history.
- ✓ Not enough time has been given for proper estimating.
- \checkmark No one has bothered to see if there will be personnel available with the necessary skills.
- \checkmark People are not working toward the same specifications.
- ✓ People are consistently shuffled in and out of the project with little regard for schedule.
- ✓ Ready-fire aim. People are convinced they don't need a plan and Failing to Plan for risks.
- ✓ Planning in too little detail or Planning in too much detail.

Moreover, without proper planning projects can start off "behind the eight ball"; and consequently, this situation may led the project to initiate without defined requirements, wild enthusiasm (unruly & untamed eagerness), disillusionment (disappointment & discouragement), chaos (confusion), search for the guilty, punishment of the innocent, and promotion of the nonparticipants (Kerzner, 2009).

2.7 Construction Project Management and Planning in Ethiopia

As Wubishet (2004) stated, "a detailed literature on the management practices of construction projects in Ethiopia is difficult to find. As a result research works in such an industry is difficult or mystified". Despite of this limitation, the research will be tried to summarize existing little number of literature on the construction project management practices in Ethiopia, most of which are result of Master's thesis done at Ethiopian Universities and a doctoral dissertation done abroad, and also mainly the country's conditions of contract chronologically used in public construction projects with the provision on planning.

2.7.1 Maturity of Construction Project Management in Ethiopia

Similar to any developing country, the construction industry of Ethiopia plays major role and contributes highly to the development of the country's economy. In Ethiopia, next to agriculture, the industry provides one of the largest employment opportunities (Yimam, 2011). In addition to these, developing countries spend substantial amount of their budgets in infrastructure development that involve significant construction works or projects such as construction of roads, buildings, water works, telecom civil works, etc. This is also the case in Ethiopia. For instance, the Ethiopian government has spent about 50% of its total budget in fiscal year 2007/2008 for capital projects out of which road construction accounts about 33% (MoFED, 2008). Even though significantly large amount of money is being poured in to the country's infrastructure development for the last twenty years, the infrastructure of the country is still considered to be very poor, even when seen by the standards of the Sub-Saharan countries (Yimam, 2011and ERA, 2013). In spite of this, to develop infrastructure coverage of the country, Ethiopian government have allocating huge amount of budget every year.

Nevertheless, the construction industry of the country looks unprepared for these huge volumes of works. For instance, according to Yimam (2011), the current state of Ethiopian construction industry is characterized by low level of management, especially project management knowledge and practice (i.e. low level of contract administration, project planning and project monitoring

capabilities). Likewise Wubishet (2004) states that, there is not enough construction and management capacity in the country and the practitioners (in Ethiopia) are less experienced in project management. Furthermore, according to his view, the management of construction project in the country is highly influenced by the utilization of scarce financial and physical resource with controlling activities limited to cost and time monitoring dimensions only. On the other hand, Karlsson (2011) stated that, the planning processes are not prioritized in Ethiopian projects and many organizations start the execution of a project without sufficient planning.

2.7.2 Project Planning in Ethiopian Construction Industry

In Ethiopia; there is a condition in the contract that a contractor must provide and maintain a program of work/plan; and also this plan is done by using Gantt charts, and other technique/method forms of project scheduling such as the CPM and PERT are rarely used due to lack of qualified personnel (Tesfahun, n.d). Further he said that contractor have inadequate practice in using computers for planning and the use of computer for them is limited to accounts, preparation of payrolls and word processing only.

The chronology of the last twenty years show that in order to procure public works, the government of Ethiopia has issued three different bidding documents, by MOWUD in 1994, by PPA in 2006 and by PPA in 2011, which are the revision and replacement of one another respectively. Those entire bidding documents have section of general condition of contract that are in effect for the country's public construction projects contract administration until they are revised and had gone out of date. Besides, those general conditions of contract are mainly focused on time planning as a provision of planning.

According to MOWUD (1994), preparing and submitting plan within a fixed time period after acceptance of the tender is stipulated as the obligation of the contractor but the approval was a part for the consultant. Further it required that a plan has to show the order of procedure to carry out the works (if required), also to provide information on the arrangements and methods adopt for the execution of the works; and update the plan by request of the consultant any time if actual progress of the works does not conform to the approved program. Therefore, MOWUD's (1994) provision of planning is limited to time planning and overpasses other basic components of project plan as well as subsidiary plans.

Likewise, PPA (2006) has given planning for the contractor and its approval for the consultant. Added to this, its provision has limited to a time plan that ought to be showing the general methods, arrangements, order, and timing for all the activities in the works. On the other hand in connection to updating the plan, within time interval stated in SCC it is expected to shows the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities, updating the plan, which shows the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities. To enforce the contractor if fails to do so, it is possible to withhold some amount from the payment of the contractor until the updated has been submitted. In general, PPA (2006) has a little bit better provision than MWUD (1994), but it also overpasses other basic components of project plan as well as subsidiary plans

In contrast, PPA (2011) consider planning as a duty of contractor that have to be started on bid period in order to submit it with technical proposal of bid as a preliminary plan that includes a statement of work methods, equipment, personnel, mobilization and construction schedule, site organization, and any other information as required. Then after signing of contract, by completing the work program given as part of the bid, the contractor have to provide the consultant with a plan of implementation of the tasks, broken down by activity and by month and include the order to carry out the works, the time limits within submission and approval of the drawings are required, an organization chart containing the names, qualifications and curricula vitae of the staff responsible for the site, a general description of the method including the sequence of works by month and nature, a plan for the setting out and organization of the Site, and such further details and information as require. Further, its provision for updating plan is similar to PPA (2006). Generally, this document addresses planning in better way than earlier conditions.

Even though all of contractual provisions and contract conditions, used by the country's public construction projects for the last 22years, have not address all components of project plan, it has seen improvement from time to time through their revision. Consequently, as Karlsson (2011) stated that, the planning processes are not prioritized in Ethiopian projects and many organizations start the execution of a project without sufficient planning.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

This section presents the methodologies adopted for the study during the process of collecting data both from desk review and field, analyzing and interpreting the collected data and information to answer the research questions. The study has gathered facts and information based on research problem that was instigated mainly from observations and experience of the researcher. The gathered information has included primary and secondary data sourced from selected contractors participated currently in federal public road construction projects.

3.1 The Research Population and Sample

3.1.1 Research Area

This research has covered the planning practice of federal public road construction projects in Ethiopia, which is one of the fast growing and land locked country located in East of Africa. According to 15 years performance assessment of RSDP issued by ERA on January 2013, the country has total road network of 63,083 km including woreda roads, and also has road density of 57.3 km per 1000 sq. km and 0.75 km per 1000 population.

3.1.2 The Study Population

The study population covers particularly local contractors participating in federal public road construction projects of Ethiopian. Accordingly, as of October 2015, there are 26 contractors currently participating in federal government active road construction projects (ERA, 2015).

3.1.3 Sampling Technique and Sample Size

Singh (2006) states that "the study of the total population is not possible and it is also impracticable. The practical limitation: cost, time and other factors which are usually operative in the situation stand in the way of studying the total population. Therefore the concept of sampling has been introduced with a view to making the research findings economical and accurate". Based on this, systematic random sampling technique is preferable, if there the complete information about the population is available at hand (Singh, 2006).

In view of the fact that the complete information of the study population is already available at the hand of the researcher, systematic random sampling been used as the sampling technique of the research in order to select an appropriate sample. Based on these, first each individual of the population have been arranged and listed in systematic way, and then each individual of the sample was selected from the list by using systematic random sampling method assisted with MS Excel spread sheet.

Accordingly, from out of the total twenty six contractors currently participating in federal government active road construction projects eight contractors were selected by using systematic random sampling method assisted with MS Excel spread sheet. The sample size of research is eight contractors participating in federal government road construction projects.

3.2 The Research Approach

Kumar (2005) considers research as a process of collecting, analyzing and interpreting information to provide solutions to questions. For the purpose of this thesis, research is defined as a practical investigation or exploration to find out facts or assemble old facts by scientific ways for the purpose of identifying existing problems and its real solutions.

Since the motivation for the research has emanated mainly from observations and experience of the researcher in different public construction projects, the research has inductive research format but it has largely quantitative research approach. Owing to this and the desire of the researcher to undertake an applied research, which has aims at contributing knowledge towards solving a practical problem, the research was started by investigating a practical problem.

3.3 The Research Process

As cited in the above as the research has aims at contributing knowledge towards solving a practical problem, it was started by investigating a practical problem. Experience, observations and results of previous studies have formed the ground for formulating the research problem and the research questions.

Based on the formulated problem statement and research question, first an extensive review of literatures on the subject has been undertaken. And then, an investigation on the existing project planning practice of Federal Public Road Construction Projects have been carried out, by using methodological scientific approach for collecting, analyzing and interpreting data related to the subject under consideration. Besides, these have been done with the view of discovering whether the existing practice matches to theoretical proposition and global practice, what has been discussed in the literature, or not.
Finally, based on the result, the conclusion statements have been formulated and that have been backing to draw recommendations for improvement of the current practice. In general, the summarized procedures of the research methodology and processes, which have been followed throughout the research, are illustrated in Figure 3.



Figure 3: Research design

3.4 Instruments of Data Collection

In order to achieve the objectives of the study and adequately answer the research questions, information has been gathered through the questionnaire. Questionnaire survey was used as the field data collection instrument of this study, owing to its suitability to the high level of information required from participants and to researches that have cost and time limitations.

Initially, pilot study has been conducted in order to test the validity of the questionnaire. This will be done through in-depth interviews with some selected road construction project managers. The feedbacks of the pilot study have assisted to prepare the final questionnaire of the study; and further to prepare the ground for the main study.

Accordingly, the study has designed the final questionnaire of the research, which is composed with structured questions centred and focussed on the research objectives and the research questions. The questions are presented in three parts as: part one contains company and respondent general information; part two contains list of possible factors that may influence the planning practice of construction projects in Ethiopia; and part three contains list of planning practices in order to seek the actual situation of the Ethiopian construction projects. Except part one of the questionnaire, ordinal scales were used to gather the data.

3.5 Study variables

In order to design the research variables, information has been gathered through the review of literatures. As a desk study, literature review was carried out mainly to understand the concept of planning and globally adopted good practice of project planning, and to identify the study variables in depth and clearly. Accordingly, this study has reviewed the relevant literature on the subject of construction project management functions looking at the planning process/function. More specifically, the desk review has concerned to understand the basic planning concepts and the current global practice of the industry with lesson learned; to list out activities of planning process as well as the potential factors affecting and influencing the quality of planning practice of construction projects, in order to enable to study and analyze the available practice in Ethiopian context.

Specifically, in order to answer the first question of this research, maturity of planning practice was designed as a dependent variable of the study which is depends on the 30 planning practices designed as independent variables of the study; and they are listed and discussed in section 3.5.2. On the other hand, in order to answer the second question of this research, quality of planning practice was designed as a dependent variable of the study which is depends on the 30 factors that affect the planning practice designed as independent variables of the study which is depends on the 30 factors that affect the planning practice designed as independent variables of the study; and they are listed and discussed in section 3.5.1.

3.5.1 Factors Affecting Quality of Planning in Road Projects

Based on the literatures review, 30 factors ware identified and then categorized to 6 groups according to their related characteristics. These are: time; management; information; skill, knowledge and attitude; planning technique, tools and process; and software. These groups can give a comprehensive summary. The factors considered as independent variables of the study, are summarized as follows.

Time Related

- 1. Unrealistic or short contract duration
- Unrealistic or short bid period (duration between date of invitation to bid and date of submission) and/or mobilization period (duration between site hand over and commencement date)
- 3. Shortage of time for planning or Short time to do the work (planning)

Management Related

- Low level of project management knowledge, experience and practice of the practitioners in Ethiopia construction industry (i.e. on Contract administration, Project planning and Project monitoring capabilities)
- 2. Low level construction management capacity and maturity in Ethiopia construction industry
- 3. Unavailability or shortage of qualified or skilled professional planner in the country's industry

Information Related

- 1. Incomplete, unclear or inadequate details in drawing, specification and BOQ
- 2. Lack or unavailability of standards for resource output factors and crew formation in the company as well as in the country's industry
- 3. Lack or unavailability of reference documents related to earlier similar projects' plan, work procedure, success and failure
- 4. Lack or unavailability of practical standard and template in the company as well as in the country's industry for structuring activities in WBS

Skill, Knowledge and Attitude Related

- 1. Planners or project managers lack of or incomplete understanding on construction site processes and construction work procedures, and materials and other resources supply chain
- 2. Planners or project managers' lack of or incomplete skill to examine and formulate for task outputs and durations
- 3. Little or no involvement of the people who must do the work (such as construction engineers, site engineers, superintendents, etc) in the planning process.
- 4. Disinterest of planners, project managers and management of the company in project planning due to perceived poor returns from its implementation
- 5. Cultural and individual issues such as fire fighting behaviour, short term thinking, poor team work behaviour
- 6. Planners or project managers lack of or incomplete planning skills in the areas of securing commitments, assuring measurable milestones, processing information, and facilitating top management involvement.

Planning Technique, Tools and Process Related

- 1. Planning in too little detail when designing and preparing WBS
- 2. Planning in too much detail when designing and preparing WBS
- 3. Giving no or little attention for detail of execution, technological implication of different construction techniques, and production capacity of machines and labours during planning
- 4. Giving no or little attention for estimation of activity cost and time during planning

- 5. Giving no or little attention for sequencing of tasks and their dependency, precedence, and lead and lag during planning
- 6. Giving no or little attention for working hour, overtime, holly days, non-working days and other related issues during planning
- 7. Giving no or little attention for short term and long term funding requirement during planning
- 8. Giving no or little attention for safety requirement during planning
- 9. Giving no or little attention for quality requirement during planning
- 10. Giving no or little attention for identification and allocation of potential risks during planning

Software Related

- 1. Lack of or little awareness on the use of planning software
- 2. Inadequate or little skill and knowledge of planners or project managers to operate and use planning software
- 3. Unavailability or shortage of computer as well as software (due to cost or other reasons)
- 4. Complexity and difficulty of planning software

Figure 4 illustrated the conceptual model of all group of factors affecting the quality of planning process in construction projects.



Figure 4: Factors affecting quality of planning

3.5.2 Maturity of Planning Practice in Road Projects

Based on the literatures review, 30 activities and practices are identified and selected, and then categorized them in 5 groups according to their related characteristics. These are: general planning; schedule/time planning; resource (human, material and equipment) planning; financial planning; and risk, quality, safety, communication and procurement planning. These groups can give a comprehensive summary.

3.6 Questionnaire Distribution

As mentioned in Section 3.1.3, systematic sampling technique was used in order to extract the sample easily and to ensure cases are spread across the population; and though, eight contractors were selected by using systematic random sampling method assisted with MS Excel spread sheet.

Based on this, the questionnaires were distributed to the selected contractors and their practitioners. Totally thirty two questionnaires are distributed for the selected eight contractors.

3.7 Data Measurement and Analysis

3.7.1 Factors Affecting Quality of Planning in Road Projects

Data Measurement: In this research, ordinal scales were used to rate the data of factors influencing the quality of planning. Ordinal scale as shown in Table 1 is a ranking or a rating data that normally uses integers in ascending order corresponding to ascending order of their frequency of occurrence.

Table 1: Ordinal scale used for data measurement of factors

| Response | Always | Often | Rarely | Not at all | |
|----------|------------------------|-------------------|---------------------|------------------|-----------------------|
| Item | Very high Important | High Important | Medium Important | Low Important | Very low Important |
| Scale | 5 | 4 | 3 | 2 | 1 |

Analysis: Principal component analysis (PCA) is used here to determine different road projects perceptions of the respondent about the factors affecting quality of planning in Ethiopian Federal Public road construction projects.

Principal component analysis (PCA) is one of the popular statistical methods in multivariate data analysis. It was introduced in the early 20th century for the purpose of aggregating data (Pearson, 1901 and Hotelling, 1933). Initially, it was designed to reduce the dimension of multivariate continuous data which follow a multivariate normal probability distribution. However, since its application in social science such as generating index (Socio-economic status, climate adaptability index etc) and assigning weight for different variables which are designed to measure latent variables has increased over time and most of social science data are mixed. i.e. composed of categorical and continuous variables, different approach has been proposed.

One of the approaches is changing the categorical variables into dummy variable and treats the data as normal data and performs PCA (Filmer & Pritchett 2001). This method was quickly

accepted and used by World Bank as a vital means of assessing the socio-economic status of a household based on household assets such as electricity, radio, television, telephone, refrigerator, bicycle, motorcycle, car or truck and facilities such as source of drinking water, toilet type, source of heat for cooking, materials used for flooring, walls, and roofing (Gwatkinet al, 2003). However, this method has got challenges regarding the technicality behind PCA. When the variable has more than two factors (levels), more than one dummy variable. This introduces a lot of spurious correlations. i.e. the dummy variables created from the same variable are negatively correlated and as a result the dependency declines with the number of categories. When we fit PCA on this kind of data, PCA getting confused as to whether the main source of common variation is due to the correlation with the variables or due to the correlation among the variables that are created based on the same categorical variable.

The second approach is to use polychoric or tetrachoric correlations coefficients. The polychoric correlation coefficient is a measure of association for ordinal variables which rests upon an assumption of an underlying joint continuous distribution. It was first proposed by Karl Pearson in year 1900. His method was not widely accepted since its computation was complicated (Pearson, 1900).

In this research, the analysis has used the polychoric correlation coefficient when all variables are ordinal and the correlation matrix is used to fit PCA. Whereas when the data is mixed (quantitative and the categorical variable(s) is/are dummy), then the usual PCA has been fitted. When the categorical variables in the mixed dataset have not been dummy, the categorical variables are transformed into a disjunctive data table (crisp coding) and then scaled using the specific scaling of Multiple Correspondence Analysis (MCA). The analysis was done using psych, FactoMineR and missMDA packages of R programming language.

The first principal component is always explaining much of the variation. So, for index generation we have taken the first principal component.

3.7.2 Maturity of planning practice in Road construction projects

Data Measurement: In this research, ordinal scales were used to rate the data of planning practice maturity. Ordinal scale shown in Table 2 is a ranking or a rating data that normally uses integers in ascending order corresponding to descending order of their level of maturity.

Table 2: Ordinal scale used for data measurement of practice

| Response | High | Medium | Low | Not at all |
|----------|-------------------|---------------------|------------------|-------------------------|
| Item | High Important | Medium Important | Low Important | Not at all Important |
| Scale | 4 | 3 | 2 | 1 |

Analysis: The relative importance index (RII) is used here to determine different road projects perceptions of the respondent about the maturity of planning practice in Ethiopian Federal Public road construction projects. The relative importance index is computed as (Cheung et al, 2004).

$$RII = \frac{\sum W}{A * N}$$

Where:

W is the weight given to each factor by the respondents and ranges from 1 to 4

A = the highest weight = 4

N = the total number of respondents

 $W = \Sigma[(f_1 x n_1) + (f_2 x n_2) + (f_3 x n_3) + \dots + (f_n x n_n)]$

fn = score ranking nn = corresponding number of responses

3.7.3 Statistical Test of Data

This section presents test of reliability of questionnaire according to the study. The reliability of an instrument is the degree of consistency which measures the attribute; it is supposed to be measuring (Polit & Hunger, 1985). The less variation an instrument produces in repeated measurements of an attribute, the higher its reliability. Reliability can be equated with the stability, consistency, or dependability of a measuring tool. The test is repeated to the same sample of people on two occasions and then compares the scores obtained by computing a reliability coefficient (Polit & Hunger, 1985).

Chronbach's alpha is the most commonly used measure of reliability (i.e., internal consistency). Chronbach's coefficient alpha (George and Mallery, 2003) is designed as a measure of internal consistency. The normal range of Chronbach's coefficient alpha value between 0.0 and + 1.0. The closer the Alpha is to 1, the greater the internal consistency of items in the instrument being assumed.

Chronbach's basic equation for alpha (α) is:

$$\alpha = \frac{n}{n-1} \bigg[1 - \frac{\sum_{t=1}^{n} V_t}{V_{overall}} \bigg]$$

Where:

n is number of questions,

 V_i is variance of the ith rater (questions) and

Voverall is pooled variance.

Nunnaly (1978) has indicated 0.7 to be an acceptable reliability coefficient, and as a rule of thumb:

Table 3: Acceptability range of reliability coefficient

| Chronbach's Alpha | $\alpha \ge 0.9$ | $0.7 \ge \alpha \ge 0.9$ | $0.6 \ge \alpha \ge 0.7$ | $0.5 \ge \alpha \ge 0.6$ | α < 0.5 | |
|----------------------|------------------|--------------------------|--------------------------|--------------------------|--------------|--|
| Internal consistency | Excellent | Good | Acceptable | Poor | Unacceptable | |

CHAPTER 4 RESULTS AND DISCUSSION

The questionnaires are designed to collect data regarding the planning practice of local contractors in Federal Public Road Construction Projects of Ethiopia, as well as the major factors affecting their planning practice. A total of valid and completed 29 questioners were received and collected out of 32 respondents took the questionnaire, solicited as shown in the Table 4.

| Sample Members | Distributed Questionnaire | Collected Questionnaire | Rate Of Return (%) |
|-------------------|------------------------------|----------------------------|-----------------------|
| Contractor 1 | 4 | 4 | 100.00% |
| Contractor 2 | 4 | 3 | 75.00% |
| Contractor 3 | 4 | 4 | 100.00% |
| Contractor 4 | 4 | 4 | 100.00% |
| Contractor 5 | 4 | 4 | 100.00% |
| Contractor 6 | 4 | 3 | 75.00% |
| Contractor 7 | 4 | 3 | 75.00% |
| Contractor 8 | 4 | 4 | 100.00% |
| Total | 32 | 29 | 90.63% |

Table 4: Response rate

4.1 Respondent General Information

Work experience, of the sampled organizations and personal respondents, in the country's construction industry as well as in the road construction sector is summarised below in Table 5.

Table 5: Experience of respondents

| | Experience in years | | | | |
|---|---------------------|-------|-------|-------|--|
| | 0-5 | 6-10 | 11-15 | >15 | |
| Experience of the organization in Ethiopian construction industry | 24.1% | 13.8% | 10.3% | 51.7% | |
| Experience of the organization in the road construction sector | 48.3% | 27.3% | 13.8% | 10.3% | |
| Experience of respondent/personal in construction industry | 13.8% | 37.9% | 31.0% | 17.2% | |
| Experience of respondent/personal in road construction | 55.2% | 34.5% | 6.9% | 3.4% | |

According to Table 5, about 52% of the organizations considered in this study have more than 15 years of experience in Ethiopian Construction Industry. But, when it comes to road construction sector, only 10.3% of the organizations have more than 15 years of experience. The majority of the organizations (about 48%) have 0 to 5 years of experience in road construction. On the other hand, from the respondents of this study, only 38% of them have the experience between 6 to 10 years and only 17% of them have more than 15 years of experience in the Ethiopian Construction

Industry. When we consider their personal experience in road construction sector, majority of them (about 55%) have the experience between 0 to 5 years.

| Field of specialization | Туре | Total (%) | | |
|---------------------------------------|------------|-------------|-------------|------------|
| Field of specialization | Government | Private | Endowment | 10001 (70) |
| Civil Engineering | 13.3(66.7) | 66.7(43.5) | 20.0(100.0) | 51.7 |
| Highway Engineering | 50.0(33.3) | 50.0(4.3) | 0.0(0.0) | 6.9 |
| Construction Management & Engineering | 0.0(0.0) | 100.0(47.8) | 0.0(0.0) | 37.9 |
| Other | 0.0(0.0) | 100.0(4.3) | 0.0(0.0) | 3.4 |
| Total (%) | 10.3 | 79.3 | 10.3 | 100.0 |

 Table 6: Field of specialization and organizations ownership cross tabulation

Similarly, Table 6 has shown the summarized personal field of specialization of whom ware responded and ownership type of the corresponding organization by relating them. Accordingly, among those respondents who have studied civil engineering about 67% of them are working in privately owned construction organization. Among those respondents who are working in private owned construction organization, 44% studied civil engineering. About 52% of the respondents specialized in civil engineering. 79% of the respondents worked in private owned construction organization.

On the subject of the respondents' level of education, as shown in Figure 5 about 21% awarded in master's degree, 65% in bachelor degree, and 14% in college diploma in civil engineering and related disciplines.



Figure 5: Respondents Level of education

All those indicate that the respondent have enough education and work experience to assure the questionnaire and to provide their feedbacks regarding the planning practice as well as the factors affecting quality of the practice in road construction projects.

4.2 Maturity of Planning in Federal Public Road Construction Projects

Further, the results of this study provide an indication of the Relative Importance Index and Rank for the maturity level of planning practices in Federal Public Road Construction Projects of Ethiopia. Table 8 and Figure 6 show the summary ranking and Relative Importance Index.

| NO | Practice Of Project Planning | Total | RII | T. Rank | G. Rank |
|----|--|-------|-------|------------|------------|
| | General Project Plan | 674 | 0.581 | 2 | |
| 1 | Awareness of organization/ Project mgmt on importance/ benefit of planning | 87.00 | 0.750 | 1 | 1 |
| 2 | Organizations' mgmt support for and participate in project Plan development | 64.00 | 0.552 | 15 | 6 |
| 3 | Availability of organization standard template for project Planning | 63.00 | 0.543 | 18 | 7 |
| 4 | Availability of historical information of previous project (lesson learned) | 51.01 | 0.440 | 25 | 9 |
| 5 | Preparation of long term, medium & short term plan in projects | 86.00 | 0.741 | 2 | 2 |
| 6 | Organizations' provision of periodic training on project management/ planning | 57.00 | 0.491 | 22 | 8 |
| 7 | Preparation of WBS/WBS dictionary to define scope | 47.00 | 0.405 | 29 | 10 |
| 8 | Utilization of computer tools and planning software for projects planning | 77.00 | 0.664 | 4 | 3 |
| 9 | Regular/continuous monitoring/controlling of progress & performance on plan | 71.01 | 0.612 | 9 | 4 |
| 10 | Regular update of project plan | 71.00 | 0.612 | 10 | 5 |
| | Schedule/Time Plan | 362 | 0.624 | 1 | |
| 11 | Effort to show milestones, schedule activities, activity attributes, documentation of all identified assumptions and constraints in project schedule/time plan | 74.00 | 0.638 | 6 | 3 |
| 12 | Effort to show schedule Base line (Fixed start/finish date) in schedule/time plan | 74.01 | 0.638 | 5 | 2 |
| 13 | Utilization of Network scheduling method (such as CPM, or PERT) | 61.00 | 0.526 | 20 | 5 |
| 14 | Identification of activities relationship (dependency, precedence & lead/lag) | 69.00 | 0.595 | 12 | 4 |
| 15 | Estimation of duration for each activity, work package and total project | 83.00 | 0.716 | 3 | 1 |
| | Resource (Human, Material And Equipment) Plan | 324 | 0.559 | 3 | |
| 16 | Effort to plan resource: materials, people, equipment | 74.00 | 0.638 | 7 | 1 |
| 17 | Preparation of organization chart for all positions and human resource needed | 64.01 | 0.552 | 14 | 3 |
| 18 | Effort to track/monitor/record performance of resource: labour/equip/material | 69.00 | 0.595 | 13 | 2 |
| 19 | Special consideration of material resource require long lead-time in planning | 54.00 | 0.466 | 23 | 5 |
| 20 | Addressing materials approval/checking/testing in project resource plan | 62.99 | 0.543 | 19 | 4 |
| | Financial Plan | 253 | 0.545 | 4 | |
| 21 | Effort to show cash flow forecast & analysis performed & funding need in plan | 70.00 | 0.603 | 11 | 2 |
| 22 | Effort to show the budget base line in project financial plan | 64.00 | 0.552 | 15 | 3 |
| 23 | Consideration for effects of exchange rate change, escalation of cost in plan | 47.00 | 0.405 | 28 | 4 |
| 24 | Effort to track/monitor/control cost against baseline (feedback for updating) | 72.01 | 0.621 | 8 | 1 |
| | Risk, Quality, Safety, Communication, and Procurement Plan | 319 | 0.458 | 5 | |
| 25 | Effort to identify/analyze risks, to prepare risk response plan for potential ones | 50.00 | 0.431 | 26 | 4 |
| 26 | Allowing contingency time & budget reserved in plan for potential risk impact | 42.00 | 0.362 | 30 | 6 |
| 27 | Effort of planning quality control of a project | 61.00 | 0.526 | 20 | 2 |
| 28 | Effort of planning Safety (monitoring/controlling to be employed & undertaken) | 63.00 | 0.543 | 17 | 1 |
| 29 | Effort to prepare communication plan of a project | 53.00 | 0.457 | 24 | 3 |
| 30 | Effort of planning the procurement of goods and services needed for project | 49.99 | 0.431 | 27 | 5 |

| Table 7: Summary | y of RII and | l rank of each | activity and | practice of | planning |
|------------------|--------------|----------------|--------------|-------------|----------|
| | | | • | | . 0 |

Based on the RII result seen in Table 8, from each individual practices, the top five that highly practiced and matured practices are "awareness of organizations' management and Projects' management about the importance and benefit of planning" in the first position (RII = 0.750),

"Preparing long term (more than 3 month), medium (1 to 3 month) and short-term (weekly and daily) plan" in the second rank (RII = 0.741), "estimate duration for each activity, work package and total project" in the third rank (RII = 0.716), "Using computer tools and planning software for projects planning" in the forth rank (RII = 0.664) and "preparing base lined schedule (start and finish date of each activity of work are approved and fixed)" in the fifth rank (RII = 0.638).



Figure 6: Maturity planning practices of public road construction projects

Further, the result of the research analysis witnessed that the maturity of project planning practices in Ethiopian federal public road construction projects is positioned at low level development with average RII of 0.555 as seen in Figure 6. Nonetheless, Schedule/Time planning is relatively better matured than others in the first position with RII of 0.624; and in the second place by RII of 0.581 general planning practices is exercised. Far from time and general planning, resource (human, material and equipment) planning and financial planning are ranked in third and forth place with RII 0.559 and 0.545 respectively. Based on the result of the analysis, the least RII value of 0.458 is belonging to the practice of planning for Risk, safety, quality, communication and procurement; which implies that the federal public road construction projects of Ethiopia are more or less neglecting and leaving out the issues, such as risk, safety, quality, communication and procurement, in their project planning process.

4.2.1 Maturity of General Project Planning Practices

As discussed in the above, in federal public road construction projects followed to schedule/time planning practices category, general project planning category is relatively the second better matured practice than others planning practices with RII of 0.581.

Figure 7 has suggested that about 40% of the respondents believed that there is midlevel maturity of general planning practice in road projects. Further, 37% of the respondents have said that general planning practice is matured in low level and 5% of the respondents have said that it is

matured highly. However, 18% of the respondents believed that general planning practice in road projects is not at all matured.

| | | C |)rdina | <u>l Scal</u> | e | | | | |
|----|--|------|--------|---------------|-----|-------|-----|------|------|
| NO | Prostice Of Consul Project Dispring | 4 | 3 | 2 | 1 | Total | RII | Т. | G. |
| nu | Practice Of General Project Planning | High | Mid | Low | N/A | Total | (%) | Rank | Rank |
| | | (%) | (%) | (%) | (%) | | | | |
| | General Project Plan | 5 | 40 | 37 | 18 | 674 | 58 | 2 | |
| 1 | Awareness of organization & Project mgmt about importance and benefit of planning | 17 | 66 | 17 | 0 | 87 | 75 | 1 | 1 |
| 2 | Organizations' mgmt support for and participate in project Plan development | 3 | 38 | 34 | 24 | 64 | 55 | 15 | 6 |
| 3 | Availability of organization standard template for project Planning | 3 | 38 | 34 | 21 | 63 | 54 | 18 | 7 |
| 4 | Availability of organization compiled historical information of previous projects; which show scope, WBS, cost, schedule & performance measurement baselines, project calendars, schedule network diagrams, a risk registers & lesson learned from success/failure; in order to use the information as input for project planning | 0 | 24 | 28 | 48 | 51 | 44 | 25 | 9 |
| 5 | Preparation of long term (more than 3 month), medium (1 to 3 month) and short-term (weekly and daily) plan in projects | 21 | 59 | 17 | 3 | 86 | 74 | 2 | 2 |
| 6 | Provision of periodic training (formal /informal) on project mgmt particularly planning for Project Mgmt & engineers | 0 | 21 | 55 | 24 | 57 | 49 | 22 | 8 |
| 7 | Preparation of WBS and WBS dictionary (providing description of work, code of accounts identifier, responsible department, resource required) to define scope during planning as the first activity or step | 0 | 10 | 41 | 48 | 47 | 41 | 29 | 10 |
| 8 | Utilization of computer tools and planning software such as Microsoft project, Primavera, Excel etc) for projects planning | 0 | 66 | 34 | 0 | 77 | 66 | 4 | 3 |
| 9 | Regular/continuous monitoring controlling of progress & performance (cost/time) on plan to provide feedback for updating plan | 0 | 48 | 48 | 3 | 71 | 61 | 9 | 4 |
| 10 | Regular update of project plan | 7 | 34 | 55 | 3 | 71 | 61 | 10 | 5 |

| Table 8: | RII and | rank of eacl | ı general | project | nlanning | practices and | activities |
|-----------|----------|--------------|-----------|---------|----------|---------------|------------|
| I abic 0. | itti anu | Tank of cach | i generai | project | pranning | practices and | activities |

As seen in Table 9, about 66% of the respondents believed that there is midlevel awareness about the importance and benefit of planning recognized by their organization management and project management. However, 17% of the respondents have said that there is high level awareness about the importance and benefit of planning; and the remaining 17% have supposed that their organization as well as project management have low level awareness. Based on this, the analysis result witnessed that "Awareness of the organizations' management and Project management about the importance and benefit of planning" is relatively the most matured practice ranked as the first from all by scoring RII of 0.75. In general, Ethiopian federal public road construction projects and construction organizations participating in these projects have adequate awareness on the importance and benefit of planning.



Figure 7: Maturity level of general project planning practices

Similarly; the practice of "preparing long term (more than 3 month), medium (1 to 3 month) and short-term (weekly and daily) plan for projects" that ranked second from the category group as well as from all by RII 0.74 and "utilizing computer and planning software during planning of projects" that ranked third from general planning practices but forth from all by RII 0.66, are relatively better matured practices following to awareness on importance and benefit of planning. With respect to these, from all respondents; preparing long, medium and short term plan is practiced in midlevel said by 59%, highly by 21%, low level by 17% and not at all by 3% of respondents; and also 66% utilized computer and planning software medially and 34% lowly.



Figure 8: RII of each general project planning practices and activities

Moreover; based on the result of RII seen in Figure 8 and Table 9, maturity level of "regular update of project plan", "support and participation of organization management in project planning", and "availability of organization standard template for project planning" are ranked fifth, sixth and seventh from the general planning practices by RII of 0.61, 0.55 and 0.54 but as a whole they ranked eleventh, eighteenth and twentieth respectively. Concerning the support and participation of their organization management in project planning, 24% of the respondents have reviled that they don't at all provide, and the remaining said there is support and participation in different degree, as seen in the table high level 3%, midlevel 38% and low level 34%. Too, 21% of the respondents have also disclosed that their organization doesn't have standard template for project planning.

In contrast, "giving periodic training (formal or informal) on project management particularly on the project planning for its Project Management team and planning engineers", which is not at all practiced by 24% of respondents' organization while 55% practiced in low level with 21% in midlevel; and "Preparing WBS and WBS dictionary to define scope of the project at the beginning of planning", which is practiced but at low level in 24% as well as midlevel in 28% of respondents' organization even as not at all practiced in 48% organizations; and more, they are the clusters of the most immature practices which are placed at the least bottom six position as they ranked ninth and tenth from general project planning and also twenty fifth and twenty ninth as a whole by RII 0.44 and 0.41 respectively.

4.2.2 Maturity of Project Schedule/Time Planning Practices

The result of the research analysis witnessed that, the relative maturity of schedule/Time planning practice of Ethiopian federal public road construction projects is better developed than their exercise on other categories of planning practices as it ranked first with RII of 0.624. Correspondingly, Figure 9 has shown that about 47% of the respondents believed that there is midlevel maturity of schedule/time planning practice in road projects and other 47% of respondents believed that there is low level maturity. Further, 3% of the respondents have said that schedule/time planning practice is matured highly. Conversely, the remaining 3% of the respondents believed that schedule/time planning practice in road projects is not at all matured.



Figure 9: Maturity level of schedule/time planning practices

Table 10 has suggested that about 72% of the respondents are said there is medium level practice to estimate duration for each activity, work package and total project prepared. About 66% of the respondents have disclosed that, during schedule/time planning in their organization/project, there is low level effort of practice to identify the relationship between activities, such as their dependency, precedence and lead/lag, and their dependency. Based on 55% of the questionnaire respondents practice, network scheduling method, such as CPM, PERT, etc, is utilize and employed in their organization/project at degree of low level; in fact, about 17% of respondents

have suggested that there is no experience in their organization regarding using network scheduling method.

| | | Ordinal Scale | | | | | | | |
|----|--|---------------|-----|-----|------------|-----|-----|------|------|
| NO | Practice Of President Schedule/Time Dianning | | 3 | 2 | 1 | Tot | RII | Т. | G. |
| NU | Fractice Of Froject Schedule/Time Flamming | High | Med | Low | N/A (%) | 100 | (%) | Rank | Rank |
| | Schedule/Time Plan | 3 | 47 | 47 | 3 | 362 | 62 | 1 | |
| 1 | Effort to show milestones, schedule activities, activity attributes, documentation of identified assumptions & constraints in schedule/time plan | 0 | 55 | 45 | 0 | 74 | 64 | 6 | 3 |
| 2 | Effort to show schedule Base line (Fixed start & finish date of each activity) in plan | 3 | 48 | 48 | 0 | 74 | 64 | 5 | 2 |
| 3 | Utilization of Network scheduling (CPM/PERT) | 0 | 28 | 55 | 17 | 61 | 53 | 20 | 5 |
| 4 | Identification of relationships among activities (dependency, precedence, lead/lag) & sequence. | 3 | 31 | 66 | 0 | 69 | 59 | 12 | 4 |
| 5 | Estimation of duration for activity/work package | 7 | 72 | 21 | 0 | 83 | 72 | 3 | 1 |

Table 9: RII and rank of each schedule/time planning practices and activities

On the other hand, during time planning, level of effort to show the schedule Base line and to fix and approve start and finish date of each activity of work is practiced highly by 3%, medially by 48% and lowly by 48% of respondents' organization/project. Likewise, degree of effort to show milestones, schedule activities, attributes of activity, and all identified assumptions and constraints is practiced medially by 55% and lowly by 44% of respondents' organization/project.





Based on the result of analysis illustrated in Figure 10 and Table 10, the practice of estimating duration of each activity, work package and total project is ranked first from the listed activities of time planning practice and also third from all the listed practices by scoring RII of 0.72. Next to this by RII of 0.64, effort to show the schedule base line with fixed and approved start and finish date of each activity of work in project schedule/time plan is ranked second from its group and fifth from the whole. With nearly similar RII value of 0.64, effort to show milestones, schedule activities, activity attributes, documentation of all identified assumptions and constraints in project schedule/time plan is ranked third from its group and sixth from the whole. Further, identification of relationships among each activities (their dependency, precedence, and

lead/lag) and their sequence is medially matured in RII of 0.59, and practiced in forth rank from the group but twelfth from all listed activities. However, from the group the least matured with RII value of 0.54 and rank of fifth is the practice of utilizing Network scheduling method (such as CPM, or PERT) and which is also twentieth from all the planning practices listed in this research.

4.2.3 Maturity of Project Resource Planning Practices

In federal public road construction projects, following to the two categories of planning practices discussed in the above, maturity of project resource (human, material and equipment) planning practices category is ranked in the 3rd place with RII of 0.559. Likewise, Figure 11 has shown that about 53% of the respondents believed that there is low level maturity of resource planning practice in road projects. Further, 33% of the respondents have said that resource planning practice is matured in midlevel and 1% of the respondents have said that it is matured highly. However, 12% of the respondents believed that resource planning practice in road projects is not at all matured.



Figure 11: Maturity level of resource planning practices

As can be seen in Table 11, about 55% of the respondents have said that there is medium level practice in putting effort to plan resources which involves in identifying the type and estimating of resource needed, levelling resource, and scheduling their acquiring and using time table. Whereas, about 45% of the respondent have suggested that the level of practice in planning resource is very low in their organization/project. About 69% of the respondents have believed that there is low level practice in preparing project organization chart though 7% of the respondents believed that project organization chart has not been prepared at all in their organization/project. About 59% of the respondents have suggested that there is medium level practice in putting effort to tack, monitor and record performance of the project resource thought about 34% of the respondents have agreed that their organization has medium level experience in tacking, monitoring and recording performance of project resource. Concerning the consideration of material resources and critical items requiring long lead-time during project resource planning,

about 38% of the respondents have disclosed that their organization don't have the experience while 38% said there is a low level practice and the remaining 24% of respondents supposed that there is medium level practice. About 14% of the respondents have disclosed that their organization don't have the experience of addressing resources particularly martial which require approval, check and test in the project resource plan whereas 55% said there is a practice but in low level and 31% said there is medium level practice.

| | | (| Ordina | l Scale | | | | | |
|----|--|------|--------|---------|-----|-------|-----|------|------|
| | Practice Of Project Resource (Human, Material And | 4 | 3 | 2 | 1 | Total | RII | Т. | G. |
| NO | Equipment) Planning | High | Med | Low | N/A | Total | (%) | Rank | Rank |
| | | (%) | (%) | (%) | (%) | | | | |
| | Resource (Human/Material/Equipment) Plan | 1 | 33 | 53 | 12 | 324 | 56 | 3 | |
| 1 | Effort to plan projects resource; which involves in estimating of resource needed, levelling resource, and scheduling acquiring and using time table | 0 | 55 | 45 | 0 | 74 | 64 | 7 | 1 |
| 2 | Preparation of organization chart (hierarchy, skill requirement, roles & responsibility) | 3 | 21 | 69 | 7 | 64 | 55 | 14 | 3 |
| 3 | Effort to track, monitor and record performance of the project resources, their productivity, maintenance cost, time worked, and use the records as planning information | 3 | 34 | 59 | 3 | 69 | 59 | 13 | 2 |
| 4 | Special consideration of material resources requiring long lead-time, and critical items in project resource planning | 0 | 24 | 38 | 38 | 54 | 47 | 23 | 5 |
| 5 | Addressing materials approval, checking and testing in project resource plan as required | 0 | 31 | 55 | 14 | 63 | 54 | 19 | 4 |

Table 10: RII and rank of each resource planning practices and activities

Generally as seen in Table 11 and Figure 12; ensuing to the analysis of the research, their effort to plan projects resource (materials, people, equipment) which involves in estimating of resource needed, levelling resource, and scheduling their acquiring and using time table (details what, how much and when) is ranked first from other resource planning activities and also seventh from all listed practices by scoring RII of 0.64. Following to this practice; "their effort to track, monitor and record performance, productivity, maintenance cost, time worked and other important parameters of the project resources (manpower, equipment and material), and also to use the records as planning information" has the second rank from its group and thirteenth from the whole by the RII value of 0.59. On the other hand, by RII value of 0.55, "preparation of project organization chart that defines hierarchy, skill requirement, roles and responsibilities for all project positions and human resource needed" is ranked third from the group and fourteenth from the whole. Further, "addressing materials approval, checking and testing in project resource plan as required" is matured below medium level by RII of 0.54, and practiced in forth rank from the group but 19th from all listed activities. However, from the group the least matured with RII value of 0.47 and rank of fifth is the practice of utilizing Network scheduling method (such as

CPM, or PERT) and which is also twenty third from all the planning practices listed in this research.



Figure 12: RII of resource planning practices

4.2.4 Maturity of Project Financial Planning Practices

In federal public road construction projects, project financial planning is among the slightest matured practice of planning which is positioned in forth rank by scoring the analysis RII result of 0.545. In addition, Figure 13 has suggested that about 47% of the respondents believed that there is low level maturity of financial planning practice in road projects. Further, 32% of the respondents have said that financial planning practice is matured in midlevel and 3% of the respondents have said that it is matured highly. Yet, 19% of the respondents believed that financial planning practice in road projects believed that financial planning practice is not at all matured.



Figure 13: Maturity level of financial planning practices and activities

Based on the results in Table 12, about 52% of the respondents have believed that their organization experience in preparing financial plan that show cash flow forecast and cash flow analysis performed, and details of how much and when funding is needed in project is low and 45% said medium, though about 3% of the respondents have experience that their organization don't have the experience of preparing financial plan containing cash flow forecast and cash flow analysis performed, and details of how much and when funding is needed. Concerning the effort to show the budget base line which is the budget allocated to work packages and resources with time table in project financial plan, in most projects there is a practice in different range as belongs to high 4%, to medium 31% and to low 48%; but in the projects of remaining 17% of respondents it is not practiced at all.

| | | | Ordina | l Scale | | | | | |
|----|--|------|--------|---------|-----|-------|-----|------|------|
| NO | Prostice Of President Financial Planning | 4 | 3 | 2 | 1 | Total | RII | Т. | G. |
| NU | Fractice Of Project Financial Flamming | High | Med | Low | N/A | Total | (%) | Rank | Rank |
| | | (%) | (%) | (%) | (%) | | | - | |
| | Financial Plan | 3 | 32 | 47 | 19 | 253 | 55 | 4 | |
| 1 | Effort to show cash flow forecast/analysis performed, and details of how much and when funding is needed in financial plan | 0 | 45 | 52 | 3 | 70 | 60 | 11 | 2 |
| 2 | Effort to show budget base line (budget allocate to work package &resource with time table) in project financial plan | 4 | 31 | 48 | 17 | 64 | 55 | 15 | 3 |
| 3 | Consider for effect of change in exchange rate/cost escalation (labour/mat) in plan | 3 | 7 | 38 | 52 | 47 | 41 | 28 | 4 |
| 4 | Effort to track, monitor & control cost on baseline regularly (feedback update | 3 | 45 | 49 | 3 | 72 | 62 | 8 | 1 |

Table 11: RII and rank of each financial planning practices and activities

Further, about 38% of the respondents have experienced low level practice in considering the impact of exchange rate, escalation of labor and material cost etc in the process of preparing financial plan and 10% said that there is a practice ranges from medium to high; and nonetheless, about 52% of the respondents have disclosed that the effect of exchange rate, escalation of labor and material cost etc don't considered in preparation of financial plan. For low, medium and high level practice and experience of their organizations in tacking, monitoring and controlling the project cost against the baseline on regular update cycle and feedback provided for updating the plan, about a share of 49%, 45% and 3% of the respondents have believed and supposed, respectively; yet based on 3% of respondents, their project is inactive in practicing it.



Figure 14: RII of financial planning practices and activities

Generally; based on the RII result of the analysis seen in Table 12 and Figure 14, effort of projects to track, monitor and control the project cost against the baseline on regular update cycle, and to provide feedback for updating the plan is ranked first from other financial planning activities and also eighth from all listed planning practices by scoring RII of 0.62. Succeeding to this, the effort projects to show cash flow forecast and cash flow analysis performed, and details of how much and when funding is needed in project financial plan has relative maturity value by

RII 0.60 and also has second rank from its group and eleventh from the whole indirect variables of this section of the research. By RII value of 0.55, the practical effort of the project to show the budget base line (the budget allocated to work packages and resources with time table) in project financial plan is ranked third from the activities of financial planning but fifteenth from all. Further from this group, the least matured financial planning activities with RII value of 0.41 by ranking fifth is the practice of projects in to consider the effects of change in exchange rate, escalation of labour and material cost etc in your financial plan but it has ranked twenty eighth from all the planning practices listed in this section of the research.

4.2.5 Maturity of Risk, Quality, Safety, Communication & Procurement Plan

The result of the research justified that the federal public road construction projects of Ethiopia have low level developed and/or immature practice in planning the project risks, quality, safety, communication and procurement. Further their planning practice related to this group of planning activities is the most immature among the other practices of planning group of activities covered by the research; and consequently it is positioned in fifth rank by scoring below the median or average result with RII value of 0.458.



Figure 15: Maturity level of risk planning

As can be observed in Table 13 and Figure 15, the effort of projects to plan risks, which involve in identifying all risks and analyzing them to categorize the impact, preparation of risk response plan for potential ones and allowing contingency time and budget reserved in project plan for potential risk impact, is very less and even in most projects there is not at all a practice of planning risks. Related to this, 48% of the respondents have said that their organization doesn't put any effort to identify and analyze risk and prepared response plan for potential ones before they cause adverse effect, and also it practiced in low level by 34%, in midlevel by 14% and in high level by 3% of respondents said so; and similarly 62% said, their organization/projects allotting neither contingency time nor reserve budget in project plan for potential risk impact and also it practiced in low level by 3% of respondents said so.

| | Prosting Of Project Bigly Quality | | Ordina | l Scale | - | | | | |
|----|---|-------------|------------|------------|------------|-------|-----|------|------|
| NO | Safety Communication and | 4 | 3 | 2 | 1 | Total | RII | Т. | G. |
| no | Procurement Planning | High (%) | Med (%) | Low (%) | N/A (%) | Total | (%) | Rank | Rank |
| | Risk, Quality, Safety, Communication, and Procurement Plan | 2 | 16 | 45 | 37 | 319 | 46 | 5 | |
| 1 | Effort to identify/analyze risk, plan response (potential ones that cause adverse effect) | 3 | 14 | 34 | 48 | 50 | 43 | 26 | 4 |
| 2 | Allowing contingency time/budget reserved in project plan for potential risk | 3 | 0 | 34 | 62 | 42 | 36 | 30 | 6 |
| 3 | Effort of plan quality control of project | 3 | 21 | 59 | 17 | 61 | 53 | 20 | 2 |
| 4 | Effort to plan Safety (define monitoring, control, activities of safety employed) | 3 | 31 | 45 | 21 | 63 | 54 | 17 | 1 |
| 5 | Plan communication (system/process to handle/control/distribute document) | 0 | 17 | 48 | 34 | 53 | 46 | 24 | 3 |
| 6 | Effort to plan procurement of goods/ service needed to ensure timely delivery of procured items | 0 | 10 | 52 | 38 | 50 | 43 | 27 | 5 |

| Table 12: RII | & rank | of risk. | quality. | safety. | communication | & | procurement | plannin | g |
|---------------|---------------|------------|----------|---------|---------------|---|--------------|---------|---|
| | w runn | 01 1 15159 | quanty, | Burry, | communication | ~ | procurement. | Prannin | 5 |

As seen in Table 13 and Figure 16, about 59% of the respondents have suggested that the experience of their organization in planning quality control in the project is low and more said midlevel by 21% with 3% high; though, about 17% of the respondents have experienced that their organizations don't have the practice in preparing quality control plan in the project.



Figure 16: Maturity of quality planning





Concerning the effort of planning safety to define the actual monitoring and controlling activities of safety to be employed and undertaken by a project seen in Figure 17, about 21% of the respondents have disclosed that their organization don't have the experience while 45% said, there is a low level practice, 31% of respondents supposed that there is medium level practice and the remaining 3% of respondents supposed that there is high level practice.

Further, Figure 18 illustrated that about 34% of the respondents have disclosed that their organization don't have the experience of preparing communication plan of a project in order to address the system or the procedure of handling, controlling and distributing project documents and information whereas 48% said there is a practice but in low level and 17% said there is medium level practice.

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Regarding to the effort of their project in planning the procurement of goods and services needed for your project to ensure timely delivery of procured items as agreed in the contract or as planned, 38% of respondents said not at all practiced, nevertheless, 52% said there is a practice but in low level and 10% said there is medium level practice, as seen in Figure 19.



Figure 20: RII of risk, quality, safety, communication & procurement planning

Consequent to the RII result of the analysis seen in Table 13 and Figure 20, effort in planning safety to define the actual monitoring and controlling activities of safety to be employed and undertaken, for a project is ranked first from this group planning activities and also seventeenth from all listed planning practices by scoring RII of 0.54. Succeeding to this, effort of planning quality control of a project has relative maturity value by RII 0.53 and also has second rank from its group and twentieth from the whole indirect variables of this section of the research. By RII value of 0.46, effort to prepare communication plan of a project in order to address the system or the procedure of handling, controlling and distributing project documents and information is ranked third from the activities of the planning group but twenty forth from all. Further the least matured planning activities; from this group, ranking fifth and sixth, as well as the whole, ranking twenty seventh and thirtieth, with RII value of 0.43 and 0.36 respectively; are the practice and effort of planning the procurement of goods and services needed for your project to ensure timely delivery of procured items as agreed in the contract or as planned and practice of projects in allowing contingency time and budget reserved in project plan for potential risk impact.

4.3 Factors Affecting Planning of Road Construction Projects

The PCA results of this study provide an indication of the PCA loading index and rank of factors affecting quality of planning in federal public road construction projects of Ethiopia.

| Ê | bit 15: Summary of 1 Cri fouring mack and funk of factors | DCA | T () | |
|-----------------|--|---------|--------------|---------|
| No | Factors That Influence Quality Of Planning | PCA | Total | Kank |
| 1 | | Loading | Kank | In Cat. |
| 1 | Unrealistic or short contract duration | 0.75 | 9 | 1 |
| 2 | Unrealistic or short bid period and/or mobilization period | 0.56 | 25 | 3 |
| 3 | Shortage of time for planning or Short time to do the work (planning) | 0.72 | 15 | 2 |
| 4 | Low level of project management knowledge/experience/practice in Ethiopia. | 0.92 | 3 | 3 |
| 5 | Low level construction management capacity/maturity in Ethiopia | 1.00 | 1 | 1 |
| 6 | Shortage of qualified, skilled & professional planner in the country | 0.95 | 2 | 2 |
| 7 | Incomplete, unclear or inadequate details in drawing, specification and BOQ | 0.30 | 30 | 4 |
| 8 | Lack or unavailability of standards for resource output factors and crew formation in the company as well as in the country's industry | 0.73 | 12 | 3 |
| 9 | Lack or unavailability of reference documents related to earlier similar projects' plan, | 0.84 | 5 | 2 |
| 10 | Lack or unavailability of practical standard and template in the company as well as in | 0.86 | 1 | 1 |
| 11 | the country's industry for structuring activities in WBS | 0.80 | 4 | 1 |
| 11 | processes & procedures, and resources supply chain | 0.67 | 19 | 5 |
| 12 | Planner/project manager lack of/incomplete skill to examine/formulate for task outputs and durations | 0.83 | 6 | 1 |
| 13 | Little/no involvement of the people who must do the work in planning process. | 0.81 | 8 | 2 |
| 14 | Disinterest of planner/project managers/management of the company in project | 0.69 | 16 | 3 |
| 15 | Cultural and individual issues such as fire fighting behaviour, short term thinking | | | |
| 15 | poor team work behaviour, etc | 0.62 | 22 | 6 |
| 16 | Planner/project manager lack of/incomplete planning skills in securing commitments, assuring measurable milestones, processing information, and facilitating top management involvement. | 0.69 | 16 | 3 |
| 17 | Planning in too little detail when designing and preparing WBS | 0.73 | 12 | 3 |
| 18 | Planning in too much detail when designing and preparing WBS | 0.50 | 27 | 8 |
| 19 | Giving no or little attention for detail of execution, technological implication of different techniques. & production capacity of machines and labours | 0.69 | 16 | 4 |
| 20 | Giving no or little attention for estimation of activity cost and time | 0.34 | 29 | 10 |
| $\frac{20}{21}$ | Give little attention for sequencing of tasks (dependency, precedence, lead/leg) | 0.34 | 29 | 0 |
| $\frac{21}{22}$ | Giving little attention for working hour, evertime, holly days, non-working days | 0.43 | 20 | 9 |
| 22 | Civing neuer little attention for short term and long term funding requirement | 0.65 | 26 | 1 |
| 23 | Giving no of future attention for sofety requirement during requirement | 0.55 | 20 | / |
| 24 | Giving no or little attention for safety requirement during planning | 0.6/ | 19 | 5 |
| 23 | Giving no or little attention for quality requirement during planning | 0.74 | 10 | 2 |
| 26 | Giving no or little attention for identification & allocation of potential risks | 0.64 | 21 | 6 |
| 27 | Lack of or little awareness on the use of planning software | 0.74 | 10 | 1 |
| 28 | inadequate/little skill & knowledge of planner/project manager to use software | 0.60 | 23 | 3 |
| 29 | Unavailability or shortage of computer as well as software | 0.73 | 12 | 2 |
| 30 | Complexity and difficulty of planning software | 0.58 | 24 | 4 |

| Table 13: Summary of PCA loading index and rank of factor | S |
|---|---|
|---|---|

Based on the result seen in Table 14, from each individual factors, the top five factors that are highly affecting the quality of project planning have included: "Low level construction and management capacity and maturity in Ethiopia construction industry" as the 1st (PCA Loading=1.00); "Unavailability or shortage of qualified planners or skilled professional planner

in the country's industry" as the 2nd (PCA Loading=0.95); "Low level of project management knowledge, experience and practice of the practitioners in Ethiopia construction industry (i.e. on Contract administration, Project planning and Project monitoring capabilities)." As the 3nd (PCA Loading=0.95); "Lack or unavailability of practical standard and template in the company as well as in the country's industry for structuring activities in WBS" as the 4th (PCA Loading=0.86); and "Lack or unavailability of reference documents related to earlier similar projects' plan, work procedure, success and failure" as the 5th (PCA Loading=0.84).

| No | Category of Factors | PCA Loading | Rank |
|----|--|-------------|------|
| 1 | Time Related | 0.6767 | 5 |
| 2 | Management Related | 0.9567 | 1 |
| 3 | Information Related | 0.6825 | 4 |
| 4 | Skill, Knowledge, and Attitude Related | 0.7183 | 2 |
| 5 | Planning Technique, Tool & Process Related | 0.7160 | 3 |
| 6 | Software Related | 0.6750 | 6 |

Table 14: PCA loading index and rank of factors categories

On the other hand, Table 15 and Figure 21 have shown the PCA loading index and rank of category groups of factor affecting quality of planning. Based on the result, management related factors are the most influential category of factors in PCA loading index of 0.9567, which affects quality of planning in the country's road construction projects, as to compare with other categories of factors; and the least influential category of factors is software related factor with PCA loading index of 0.6750. Besides; skill, knowledge and attitude related factors category is rank in 2nd place with PCA loading index of 0.7183; planning technique, tools and process related factor is in 3rd place with PCA loading index of 0.6825; and time related factors category is ranked 4th with PCA loading index of 0.6767.



Figure 21: PCA loading index for category of factors

4.3.1 Time Related Factors

As mentioned in the above, this category of factors has been ranked in 5th from all the 6 category groups of factors that affect quality of planning. With respect to this, the factors listed under this group have little aggregate effect on the quality of planning practice in road construction projects of Ethiopia. And more, the listed 3 individual factors under Time Related Category are analyzed and the PCA loading index of each individual factors are ranked with each other in the group as well as within the whole population of factors. Accordingly, the PCA loading and rank of each time related factors is summarized in Table 16 and Figure 22.

 Table 15: the PCA loading and rank of each time related factors

| | | | | Some | | Not At | | | |
|----|--|--------|-------|-------|--------|--------|------|-------|---------|
| | | Always | Often | times | Rarely | All | | Total | Rank |
| No | Time Related Factors | (%) | (%) | (%) | (%) | (%) | Load | Rank | In Cat. |
| 1 | Unrealistic/short contract duration | 0.00 | 41.38 | 55.17 | 3.45 | 0.00 | 0.72 | 15 | 2 |
| 2 | Unrealistic/short bid period (between | | | | | | | | |
| | date of invitation to submission bid) or | 3.45 | 10.34 | 62.07 | 17.24 | 6.90 | 0.56 | 28 | 3 |
| | mobilization period | | | | | | | | |
| 3 | Shortage of time to plan | 58.62 | 24.14 | 6.90 | 10.34 | 0.00 | 0.75 | 11 | 1 |

In general, as can be seen in Table 16, about 59% of the respondents are saying that shortage of time for planning always happen in their projects and affect quality of planning at all times. On the other hand, about 62% of the respondents have also notified that short bid period is sometimes happen and also creates a problem to have a plan with good quality. Only about 7% of the respondents have believed that short bid period has not occurred in their organization and never pose potential threat on having good plan. 55% of the respondents have noticed that very short contract duration sometimes happen in their organization along with affect planning by similar frequency.



Figure 22: PCA loading index and rank of time related factors

As seen in Figure 22, the result of principal component analysis (PCA) has confirmed that "shortage of time for planning or Short time to do the work (planning)" is the factor that influences planning ranked in the first place from other factors of time related category but in 11th place from all factors with PCA loading index of 0.75. The second important time related

factor is "Unrealistic or short contract duration", but which is ranked in 15th place from overall factors with PCA loading index of 0.72. And the least important factor of time related category is "Unrealistic or short bid period (duration between date of invitation to bid and date of submission) and/or mobilization period (duration between site hand over and commencement date)" but which is ranked in 28th from all factors with PCA loading index of 0.56.

Based on those facts, "shortage of time for planning or Short time to do the work (planning)" is significantly affects the quality of planning, and this justified that allocating and providing enough time for project planning is fatally required from projects in order to improve the quality of the planning process as well as project management. And further, improving the allocated time for planning should be the major target for contractors on top of projects to develop the quality of project planning which leads to finish the work within budgeted cost and time parallel with expected quality and profit. On the other hand, short contract period is one of the middle level significant factors; and short bid period is among less significant, more or less insignificant, factor affecting the quality of planning.

4.3.2 Management Related Factors

Under management related category of factors, three factors are listed; and corresponding to the PCA loading, each of them are ranked within their group and also with a whole factors. According to the result of PCA, the cumulative influence of management related category of factors has been ranked in 1st place from other category groups of factors that affect quality of planning with relative loading index of 0.9567. With respect to this, factors in management related category are the most influential factors on planning and have the most significant effect on the quality of planning practice adopted in road construction projects as to compare with other factors. In general, the PCA loading and rank of each management related factors are summarized in Table 17 and illustrated in Figure 23.



Figure 23: PCA loading index and rank of Management related factor

Table 17 has revealed that about 69% of the respondents have believed that low level of project management knowledge and practice of the practitioners in Ethiopia construction industry has often posed huge problem on having good planning. About 28% of the respondents have said that shortage of qualified planners of skilled professional planner in the country's industry is the common circumstances and always affect the quality of planning.

| No | Management Related Factors | Always (%) | Often (%) | Some times (%) | Rarely (%) | Not At All (%) | Load | Total Rank | Rank In Cat. |
|----|--|---------------|--------------|----------------------|---------------|-------------------------|------|---------------|--------------------|
| 1 | Low level project mgmt knowledge/ experience/practice of Ethiopian practitioner (admin contract, plan & monitor). | 24.14 | 68.97 | 6.90 | 0.00 | 0.00 | 0.92 | 3 | 3 |
| 2 | Low level construction mgmt capacity & maturity of Ethiopia construction industry | 24.14 | 62.07 | 13.79 | 0.00 | 0.00 | 1.00 | 1 | 1 |
| 3 | Unavailability/shortage of qualified/skilled planner in the country's industry | 27.59 | 62.07 | 10.34 | 0.00 | 0.00 | 0.95 | 2 | 2 |

Table 16: PCA loading and rank of each Management related factors

As seen in Figure 23 and Table 17, the results from principal component analysis (PCA) are showing that "Low level construction and management capacity and maturity in Ethiopia construction industry" is the factor ranked first among management related factors as well as the whole population of factors categorized in other groups of factor with the PCA loading index of 1.00; and as a result, it can have the most potential effect on the quality of planning process. Further; "Unavailability or shortage of qualified planners or skilled professional planner in the country's industry" is the factor that ranked second from management related category as well as the whole population with PCA loading index of 0.95, and also "Low level of project management knowledge, experience and practice of the practitioners in Ethiopia construction industry (i.e. on contract administration, project planning and project monitoring capabilities)" is ranked third from the category as well as from all factors with PCA loading index of 0.92; consequently, they can also be considered as the most significant factors that are potentially affecting the quality of planning process. However, all the three management related factors have the highest value of PCA loading index with narrow range of gap, their difference in terms of influence is very close and negligible.

Based on those facts, currently, un-mature construction and management capacity of the industry, and low level project management knowledge with experience and practice of the professionals in the country, accompanied with unavailability or shortage of qualified and skilled professional planners are the most significant factors that affect the quality of planning, and as consequence they challenge the efficiency of project management in general. This shows that, there is a requirement of high level capacity building program to the country's construction industry

practitioners and professional on the area of project management in order to improve the level of project management knowledge, experience and practice. Since all the 3 factors listed in this group of category are among the most significant factors affecting quality of planning, the main stakeholders of Ethiopian construction industry and the country's government should work hard to develop and improve the project management capacity, knowledge, practice and maturity.

4.3.3 Information Related Factors

Under information related category of factors, four factors are listed and each of them is ranked within their group and all factors based on result of the PCA loading index. According to the result, the relative influence of information related category of factors has been ranked in 4th from the total population of 6 categories of factors that affect quality of planning with average relative loading index of 0.6825. With respect, the factors listed under this group have moderately significant aggregate effect on quality of planning in road construction projects.

| No | Information Related Factors | Always (%) | Often (%) | Some times (%) | Rarely (%) | Not at All (%) | Load | Total Rank | Rank In Cat. |
|----|--|---------------|--------------|----------------------|---------------|-------------------------|------|---------------|--------------------|
| 1 | Incomplete/unclear/inadequate details in drawing, spec, BOQ | 0.00 | 20.69 | 62.07 | 13.79 | 3.45 | 0.30 | 30 | 4 |
| 2 | Lack/unavailability of standards for resource output factor, crew formation in the company as well as in the country's industry | 6.90 | 44.83 | 37.93 | 10.34 | 0.00 | 0.73 | 13 | 3 |
| 3 | Lack/unavailability of reference document (earlier project plan, procedure, success/failure) | 27.59 | 41.38 | 20.69 | 10.34 | 0.00 | 0.84 | 6 | 2 |
| 4 | Lack/unavailability of practical standard/template in the company or country's industry for structuring activities in WBS | 44.83 | 34.48 | 20.69 | 0.00 | 0.00 | 0.86 | 4 | 1 |

 Table 17: PCA loading and rank of each information related factors

Based on the percentage share of respondents' opinion with the result of PCA loading and rank of each information related factors that are summarized and seen in Table 18 and Figure 24, about 45% of the respondents have witnessed that lack or unavailability of practical standards and template in the company as well as in the country's industry for structuring activities in WBS is always creating problem on the process of having good plan. 44.83% of the respondents have responded that lack or unavailability of standards for resource output factors and crew formation has often created problem on having good plan.

On the other hand, the PCA result seen in Figure 24 and Table 18 has witnessed that "Lack or unavailability of practical standard and template in the company and in the country's industry for

structuring activities in WBS" takes the first rank to affect planning as to weighed against with the group factors and ranked 4th from all factors by its PCA loading index of 0.86. Next to this; "Lack or unavailability of reference documents related to earlier similar projects' plan, work procedure, success and failure" is ranked 2nd from the group but 6th from overall factors by scoring PCA loading index of 0.84, and also "Lack or unavailability of standards for resource output factors and crew formation in the company as well as in the country's industry" is ranked 3rd from this group but 13th from overall factors by scoring PCA loading index of 0.73. The factor recorded in the last rank as the least influential from this category as well as the whole population of factors is "Incomplete, unclear or inadequate details in drawing, specification and BOQ" with the PCA loading index of 0.30.



Figure 24: PCA loading index of information related factors

The information derived from this result implied that the planning process in federal public road projects is highly suffering due to the lack or unavailability of practical standard and template for structuring activities in WBS which is one of the top five important factors influencing the quality of planning practice in most significantly; and consequently this makes the structuring of activities in WBS as difficult task. By combining it with other information related factors such as the lack or unavailability of standards (for resource output factors and crew formation) and reference documents (related to earlier similar projects' plan, work procedure, success and failure), the industry has to be try to develop standards, templates and reference documents related to these factors. On the other hand incomplete/unclear or inadequate detail in drawing, specification and BOQ is the list important and insignificant factor among all that influence the planning practice.

4.3.4 Skill, Knowledge and Attitude Related Factors

Under "skill, knowledge, and attitude" related category of factors, 6 factors are listed. Each of them is ranked based on result of the PCA loading index. According to the result of PCA, this category of factors has the 2nd rank from all categories of factors with PCA loading index of 0.7183. With respect to this, in aggregate, the factors listed under this group are important and they have significant effect on the quality of planning in road construction projects. The respondents' opinion with the PCA loading index and rank of each of factors in this category are summarized in Table 19 and illustrated in Figure 25.

| | Skill, Knowledge, and Attitude Related | Alwavs | Often | Some times | Rare | Not At All | | Tot. | Cat. |
|----|---|--------|-------|---------------|-------|---------------|------|------|------|
| No | Factors | (%) | (%) | (%) | (%) | (%) | Load | Rank | Rank |
| 1 | Planner/project manager lack of or incomplete understanding on work procedure/ supply chain | 0.00 | 37.93 | 48.28 | 10.34 | 3.45 | 0.67 | 24 | 5 |
| 2 | Planner deficient skill (examine/ formulate output/duration | 0.00 | 37.93 | 48.28 | 13.79 | 0.00 | 0.81 | 8 | 2 |
| 3 | Little/no involvement of people, who do the work, in planning. | 27.59 | 62.07 | 10.34 | 0.00 | 0.00 | 0.83 | 7 | 1 |
| 4 | Disinterest of planner/manager & company's mgmt to plan due to perceived poor returns. | 24.14 | 37.93 | 20.69 | 17.24 | 0.00 | 0.69 | 21 | 3 |
| 5 | Cultural & individual issues (fire fighting, short term thinking& poor team work behaviour) | 13.79 | 48.28 | 24.14 | 13.79 | 0.00 | 0.62 | 26 | 6 |
| 6 | Planner/manager incomplete skill in secure commitment, assure measurable milestones, process information, facilitate top management involvement. | 0.00 | 51.72 | 41.38 | 3.45 | 0.00 | 0.69 | 21 | 3 |

Table 18: PCA loading and rank of skill, knowledge & attitude related factors

Table 19 has shown that about 62% of the respondents have suggested that little or no involvement of the people who must do the work in the planning process is often hindering from having good plan. Also 48.28% of the respondents have disclosed that planners or project managers lack of or incomplete understanding on construction site processes and construction work procedures and materials and other resources supply chain and planners or project managers lack of or incomplete skill to examine and formulate for task outputs and durations have sometimes happened to be obstacle for having effective plan. About 14% of the respondents have agreed that the impact of planners or project managers' lack of or incomplete skill to examine and formulate for task of or incomplete skill to examine and formulate for task of or incomplete skill to examine and formulate for task of or incomplete skill to examine and formulate for task of or incomplete skill to examine and formulate for task of or incomplete skill to examine and formulate for task of or incomplete skill to examine and formulate for task of or incomplete skill to examine and formulate for task of or incomplete skill to examine and formulate for task of or incomplete skill to examine and formulate for task outputs and durations have agreed that the impact of planners or project managers' lack of or incomplete skill to examine and formulate for task outputs and durations on good plan is very rare.

As seen in Figure 25 and Table 19, the result of PCA has viewed that "Little or no involvement of the people who must do the work (such as construction engineers, site engineers, superintendents, etc) in the planning process" has appeared to be the first influential factor

among "skill, knowledge and attitude related factors" but ranked 7th from the whole factors population by PCA loading value of 0.83. The second ranked and influential factor from the category group but 8th from the whole population is "Planners or project managers lack of or incomplete skill to examine and formulate for task outputs and durations" by the result of PCA loading index of 0.81. While, with equivalent PCA loading value of 0.69, both "Disinterest of planners, project managers and management of the company in project planning due to perceived poor returns from its implementation" and "Planners or project managers lack of or incomplete planning skills in the areas of securing commitments, assuring measurable milestones, processing information, and facilitating top management involvement" are ranked as the 3rd influential factor from the category group but 21th from the whole factors. Then again, the result has confirmed that the least influential factors in this group are "cultural and individual issues such as firefighting behavior, short term thinking, and poor team work behavior" and "Planners or project managers lack of or incomplete understanding on construction site processes and construction work procedures, and materials and other resources supply chain", which are ranked 5th and 6th from the category but 24th and 26th as compared to the whole by their PCA loading of 0.67 and 0.62 respectively.



Figure 25: PCA loading index of skill, knowledge & attitude related factors

Based on the result of PCA, the planning process without involvement of the people who must do the work has appeared to be the first influential factor among skill, knowledge and attitude related factors. This shows that, during planning of the projects, projects are bringing down the participation of the people who do or execute the work such as construction engineers, site engineers, superintendents and foremen; and consequently, the performers are forced to do what they are not planed or to do the planned that is not convinced them. Furthermore, poor skill of planners or project managers in the area of examining and formulating task duration with outputs, securing commitments, assuring measurable milestones, processing information and facilitating top management involvement, added with their weak interest on planning the project have appeared to be the influential factor that affect and challenge the planning process of road construction project. In general, all the factors in this category are inputs to management related factors that affect them directly or indirectly, as a result "skill, knowledge and attitude" related factors have to be considered as the most important and highly significant factors comparable with management related factors.

4.3.5 Planning Techniques, Tools and Process Related Factors

Under "planning techniques, tools and process" related category, 10 factors are listed and each of them are ranked within their group and also within the whole population of the factors. According to the result of PCA, the cumulative loading of planning techniques, tools and process related category of factors has been ranked in 3nd from the six category groups of factors that affect quality of planning with relative loading index of 0.7160. With respect to this, the factors listed under this group are highly significant ones that affect the quality of planning in road construction projects. Similar to result "skill, knowledge and attitude" related factors, the factors in this category are also the inputs to management related factors. Therefore, these may lead the importance and significance of "planning techniques, tools and process" related factors higher than the PCA result. The respondents' opinion with the PCA loading index and rank of each factors in this category are summarized in Table 20 and illustrated in Figure 26.

| No | Planning Techniques, Tools and Process Related Factors | Always (%) | Often (%) | Some times (%) | Rarely (%) | Not at All (%) | Load | Total Rank | Rank In Cat. |
|----|---|---------------|--------------|----------------------|---------------|-------------------|------|---------------|-----------------|
| 1 | Planning in too little detail when designing and preparing WBS | 31.03 | 44.83 | 20.69 | 0.00 | 0.00 | 0.73 | 14 | 5 |
| 2 | Planning in too much detail when designing and preparing WBS | 0.00 | 3.45 | 24.14 | 41.38 | 31.03 | 0.50 | 29 | 10 |
| 3 | Giving little attention(execution detail, technological implication, construction techniques, and production capacity of machines and labours) | 6.90 | 65.52 | 27.59 | 0.00 | 0.00 | 0.69 | 20 | 8 |
| 4 | Giving little attention for estimation of activity cost and time during planning | 3.45 | 13.79 | 68.97 | 13.79 | 0.00 | 0.64 | 24 | 9 |
| 5 | Giving little attention for sequence task (dependency, precedence & lead/lag) | 3.45 | 44.83 | 44.83 | 6.90 | 0.00 | 0.76 | 10 | 3 |
| 6 | Giving little attention for working hour, overtime, holly days, non working days | 41.38 | 37.93 | 20.69 | 0.00 | 0.00 | 0.80 | 9 | 2 |
| 7 | Giving little attention for short term and long term funding requirement | 17.24 | 44.83 | 34.48 | 3.45 | 0.00 | 0.72 | 17 | 6 |
| 8 | Giving little attention for safety req. | 31.03 | 34.48 | 27.59 | 6.90 | 0.00 | 0.71 | 19 | 7 |
| 9 | Giving little attention for quality req. | 37.93 | 31.03 | 27.59 | 3.45 | 0.00 | 0.75 | 11 | 4 |
| 10 | Giving little attention for identification and allocation of potential risks | 48.28 | 37.93 | 10.34 | 3.45 | 0.00 | 0.86 | 4 | 1 |

Table 19: PCA loading and rank of techniques, tools and process related factors

As can be seen in Table 20, about 31% of the respondents have disclosed that planning in too much detail when designing and preparing WBS doesn't pose any threat on planning. However, 41% of the respondents have said that planning in too much detail when designing and preparing WBS rarely happened in planning. About 45% of the respondents have suggested that giving no or little attention for sequencing of tasks and their dependency, precedence and lead and lag during planning has often or sometimes occurred in planning.



Figure 26: PCA loading of techniques, tools and process related factors

Based on the result of PCA seen in Figure 26 and Table 20, from all factors grouped in planning techniques, tools and process related category, "Giving no or little attention for identification and allocation of potential risks during planning" is ranked in the 1st place by PCA loading value of 0.86 and also ranked on 4th place from all factors. As the second ranking and influential factor from the category group where as 9th from all, "Giving no or little attention for working hour, overtime, holly days, non working days and other related issues during planning" is look by the PCA loading index of 0.80. Meanwhile, "Giving no or little attention for sequencing of tasks and their dependency, precedence, and lead and lag during planning", "Giving no or little attention for quality requirement during planning" and "Planning in too little detail when designing and preparing WBS" are among the influential factor affecting quality of planning ranked 3rd, 4th and 5th from the group and 10th, 11th and 14th from all factors with PCA loading 0.76, 0.75 and 0.73 respectively.

Moreover, "Giving no or little attention for short term and long term funding requirement during planning", "Giving no or little attention for safety requirement during planning" and "Giving no or little attention for detail of execution, technological implication of different construction

techniques, and production capacity of machines and labours during planning" are the factor affecting quality of planning in 6th, 7th and 8th rank from the group where as 17th, 19th and 20th from all factors with PCA loading 0.72, 0.71 and 0.69 respectively. On the other hand, the least influential factors of this group are "Giving no or little attention for estimation of activity cost and time during planning" and "Planning in too much detail when designing and preparing WBS", which are ranked 9th and 10th from the category but 24th and 29th as the whole with PCA loading 0.64 and 0.50 respectively.

This fact shows that, currently, "Giving no or little attention for identification and allocation of potential risks during planning" is critically affecting the quality of planning, and then provide enough attention for identification and allocation of potential risks during project planning is fatally required for projects in order to improve the quality of the process. As a significant factor that affects quality of planning," working hour, overtime, holly days, non working days and other related issues" is also required a serious attention and consideration of the planner during planning, in order to enable to improve the quality of planning.

4.3.6 Software Related Factors

Under software related category of factors, four factors are listed and each of them is ranked in their group and also as a whole factors. According to the result of PCA, the cumulative loading of information related category of factors has been ranked in 6th from all categories of factors that affect quality of planning with relative loading index of 0.5448. With respect, in aggregate, the factors listed under this group have insignificant effect on quality of planning in road construction projects. The PCA loading index and rank of each Software related factors are summarized in Table 21 and Figure 27.

| No | Software Related Factors | Always (%) | Often (%) | Some times (%) | Rarely (%) | Not at All (%) | Load | Total Rank | Rank In Cat. |
|----|---|---------------|--------------|----------------------|---------------|-------------------|------|---------------|-----------------|
| 1 | Lack of or little awareness on the use of planning software | 0.00 | 13.79 | 51.72 | 27.59 | 6.90 | 0.70 | 20 | 3 |
| 2 | Inadequate or little skill and knowledge of planners or project managers to operate and use planning software | 6.90 | 31.03 | 44.83 | 17.24 | 0.00 | 0.72 | 15 | 1 |
| 3 | Unavailability or shortage of computer as well as software (due to cost or other reasons) | 0.00 | 0.00 | 24.14 | 37.93 | 37.93 | 0.57 | 27 | 4 |
| 4 | Complexity and difficulty of planning software | 3.45 | 31.03 | 37.93 | 20.69 | 6.90 | 0.71 | 18 | 2 |

Table 20: PCA loading index and rank of each software related factors

Table 21 has confirmed that about 52% of the respondents have said that lack of or little awareness on the use of planning software has created sometimes a problem in planning and the PCA result also confirmed that this factor is the intermediately influential factor on planning. About 7% of the respondents have agreed that complex and difficulty of planning software is not a problem at all. However, about 38% of the respondents have said that complexity and difficulty of planning software has sometimes created a problem on planning.

As seen in Table 21 and Figure 27, from Software related category "Inadequate or little skill and knowledge of planners or project managers to operate and use planning software" is ranked on the 1st place with PCA loading 0.72 but 15st from all factors. On the other hand, "Complexity and difficulty of planning software" is ranked 2nd from this group and 18th from overall factors by scoring PCA loading 0.71. The remaining two factors, "Lack of or little awareness on the use of planning software" and "Unavailability or shortage of computer as well as software (due to cost or other reasons)", are the list significant factors found at the bottom of both group and all factors table ranked 3rd and 4th from the group and 20th and 27th from all with PCA loading 0.70 and 0.57 respectively.



Figure 27: PCA loading index of software related factors

Based on those facts, currently, the main stakeholders of Ethiopian construction industry and the country's government should arrange short term training to practitioners and professionals in order to improve the skill to use and operate planning software and also increase awareness, and as a result to improve the quality of planning.
4.4 Statistical Test of Data and Their Degree of Reliability

The degree of reliability (internal consistency) of the data for both the practices of planning and the factors affecting planning is measured by **Chronbach's alpha** consistency coefficient. Generally the SPSS test of reliability shows that in both cases the internal consistency is excellent and the data is highly reliable and valid.

4.4.1 Reliability of the Data Related to the Factors Affecting Planning

The SPSS test result for the reliability and internal consistency of the thirty factors that influence planning is shown in Table 22 and Table 23. Accordingly, 0.905 Chronbach's alpha for all factors is found. Its consistency is very great.

Table 21: Case processing summary of factors

| | | Ν | % |
|-------|----------|----|-------|
| | Valid | 28 | 96.6 |
| Cases | Excluded | 1 | 3.4 |
| | Total | 29 | 100.0 |

Table 22: Reliability statistics of factors

| Cronbach's Alpha | N of Items |
|------------------|------------|
| 0.905 | 30 |

4.4.2 Reliability of the Data Related to the Practice of Planning

The SPSS reliability and internal consistency test result of the practiced activities is shown in Table 24 and Table 25. Accordingly, 0.945 Chronbach's alpha for all activities is found. As a result, its consistency is very great.

Table 23: Case processing summary of practices

| | | Ν | % |
|-------|----------|----|-------|
| | Valid | 28 | 96.6 |
| Cases | Excluded | 1 | 3.4 |
| | Total | 29 | 100.0 |

Table 24: Reliability statistics of practices

| Cronbach's Alpha | N of Items |
|------------------|------------|
| 0.945 | 30 |

CHAPTER 5 CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The main goal of this thesis research was to assess the maturity of Planning practice of the Federal Public Road Construction Projects (Ethiopia) and identify the factors influencing the maturity and propose intervention actions for improvement efforts. Thus, result of the research study has found the following major findings.

Maturity of the Planning Practice

Generally, the planning practice of local contractors for federal public road construction projects (Ethiopia) is subsisted at low level of maturity. More specifically;

i. General Project Planning Practices: As the whole, maturity of general planning practices of contractors participating in federal public road construction projects of Ethiopia are found to be at low level. But, the relative maturity of their general planning practice is better than other planning practices with the exception of schedule/time planning. With regard to each planning practices, it is activities of general found that most of the contractors/organizations as well as the industry do not have adequately compiled standard template of Planning and historical information of previous projects (which show scope, WBS, cost, schedule and performance measurement baselines, project calendars, schedule network diagrams, a risk registers and lessons learned from the success or failure). Furthermore, most of the contractors are not preparing WBS and WBS dictionary (providing description of work, code of accounts identifier, responsible department, and resource required) in organized manner and as the first activity or step of planning to define the scope of the work adequately during planning their project. On top of these, it is found that majority of the contractors perform planning of their project without following uniformly structured approach or guide line, relying solely on the knowledge and experience of the project manager or project team. Even if the maturity is being existed at low level, most of organizations have weak effort to give training periodically to the project management team and planning engineers for the sake of possible improvement of their management and planning skill as well as the maturity of planning practice. In contrast to those feeble practices; most organizations have relatively better (medium to high level) awareness on the benefit and importance of planning, and also they are trying a

bit to prepare long term (above 3 month), medium (1 to 3 month) and short-term (weekly/daily) project plan but the plans are focused only on time duration without incorporating most of the components.

- ii. Project Schedule/Time Planning Practices: In general, local contractors in federal public road construction projects are exercising better to develop schedule/time planning practices of public road construction projects are found to be at near to midlevel which is better than all other components of planning practices. Exclusively, it is found that most of the contractors do have medium level practice in estimation of duration for each activity, work package and total project during planning of their project time. In contrast, with all those relatively compelling practices, most organizations have relatively low level practice in connection with identification of relationships among and sequence of each activities based on their dependency, precedence and lead/lag, together with their negligible utilization of network scheduling method such as CPM, PERT, etc.
- iii. Project Resource (Human, Material and Equipment) Planning Practices: Generally, maturity of resource (human, material and equipment) planning practices of local contractors in federal public road construction projects are found close to low level; and yet its maturity is found to be higher all than other components of project planning practices except practices of schedule/time planning and general planning. Above all; it is found that most of the contractors are giving low level attention for preparation of project organization chart which defines hierarchy, skill requirement, roles with responsibilities of all the project positions and human resource needed; and too, they are providing little attention or totally neglect for the consideration of critical materials and other resources that require long lead-time, as well as for the reflection of materials requiring approval, checking and testing.
- iv. Project Financial Planning Practices: Generally, maturity of financial planning practices of the federal public road construction projects are found to be at low level; and analogously the research has investigated that their financial planning practices is less matured than all other planning practices with the exclusion of risk, quality, safety, communication, and procurement planning practices. Principally, among the activities of financial planning, the consideration for effects of change in exchange rate, escalation of labor and material cost etc is totally disregarded by most of the contractors in their project planning. Although, the

research has found in most of the projects practice of financial planning that they have overlooking cash flow forecasting, cash flow analysis and estimating fund requirement with timing, preparing the budget base line (the budget allocated to work packages and resources with time table), and tracking, monitoring and controlling cost against the baseline on regular update cycle.

v. Project Risk, Quality, Safety, Communication, and Procurement Planning Practices: Generally, the planning practices of public road construction projects in the areas of risk, quality, safety, communication, and procurement are established at low level of exercise; and these practices have to be seen as the lowest matured practice than other planning areas. In the course of them, primarily the practice of risk planning is more or less being not performed formally in the majority of projects; and consequently the maturity of risk planning practice is bring into being at lowest level. Furthermore, similar to risk planning, the practices of communication and procurement planning are among the list matured practices, and they are somehow ignored by most of the contractors. On the other hand, the remaining two practices, i.e. planning of quality and planning of safety, are also the least matured and exercised at low level by some of the contractors, but they are practiced relatively better than risk, communication, and procurement planning. By and large, the majorities of the contractors have negligence for and overlook the areas of risk, quality, safety, communication, and procurement planning.

Factors Influencing Quality of Project Planning

Related to the factors influencing the quality and maturity of the planning practice, in general the research has concluded that;

- i. Time Related Factor: The factors listed under this group have little aggregate effect on the quality of planning and insignificant contribution to the immaturity of the practice in road construction projects. But among the individual factors grouped in this category, shortage of time for planning has negative influence on quality and also has sensible contribution to the immaturity of the practice.
- ii. Management Related Factor: The factors listed under this group have very high aggregate effect on the quality of planning in road construction projects. Further, the finding revealed that the Ethiopian construction industry has a low level management capacity as well as maturity. Hence, management is the main factor that is negatively affecting the quality of planning practice and also the main motive for the immaturity of the federal public road construction projects planning practice. Also related to this, the research has found that the projects of Ethiopian construction industry are highly suffering from shortage of qualified planners and skilled professional. Even if few number of professional or practitioners are available in the country, most of them have low level knowledge, experience and practice of project management (contract administration, project planning, project controlling, and the like).
- iii. Information Related Factor: Generally, the factors listed under this group have aggregate effect almost similar to time related factors. However, majority of factors grouped in this category have high degree of influence individually on the quality of planning practice. As regards, the country's most construction companies as well in broad the industry do not have adequately compiled reference documents such as standards for resource output factors and crew formations, practical standards along with templates for structuring activities in WBS, and documents of earlier projects showing the historical information that includes their plan, work procedure, success and failure. Moreover, the factors listed under this group are the main input for planning techniques, tools and process related factors. So, information related factors are considered as the influential factors and among the motives of the immaturity.

- iv. Skill, Knowledge and Attitude Related Factor: Generally; the factors listed under this group have high aggregate effect on the quality of planning in road construction projects. From individual factors, little involvement of the people who must do the work in the planning process is observed. This shows that; during planning, projects are bringing down the participation of the people who do or execute the work such as construction engineers, site engineers, superintendents and foremen; and consequently, the performers are forced to do what they are not planed or to do the planned that is not convinced them, which often hindering from establishing quality and matured practice of planning. And more, concerning the planning skill of project managers as well as planners, their poor skill in the area of examining and formulating task duration with outputs, securing commitments, assuring measurable milestones, processing information and facilitating top management involvement, added with their weak interest on planning the project have appeared to be the influential factor that affect and challenge the planning process of road construction project. In general, all the factors in this category are inputs to management related factors that affect them directly or indirectly, as a result "skill, knowledge and attitude" related factors have to be considered as the most important and highly significant factors comparable with management related factors.
- v. Planning Techniques, Tools and Process Related factor: The factors listed under this group have high aggregate effect on the quality of planning in road construction projects. In general, according to the result of the study, the planning practice of country's contractors in federal public road construction projects is characterized by: their practice of designing and preparing WBS in too little detail; and their little attention for sequencing of tasks based on tasks dependency, lead and lag with precedence, their laxity for formulating short term and long term funding requirement, and also their inconsideration for working with non working hour/days, holly days, overtime and other related issues.
- vi. Software Related factor: The factors listed under this group have the least aggregate effect on the quality of planning in road construction projects. In general, according to the result of the study, there is adequate awareness on the use of planning software and skill to use them, and also computers as well as planning software are easily available in most of federal public road construction projects.

5.2 Recommendation

The low level maturity of planning practice found for the local contractors in Federal Public Road Construction Projects may show how poor the planning practice in the industry overall is. Thus, as the main stakeholder of Ethiopian Construction Industry, local construction organizations (contractors) should work hard to develop and improve the maturity of the industry's project management as well as project planning practice. In this regard, the research forewords recommended actions and interventions to be undertaken by the construction organizations, and also give further studies suggestions for researchers interested on the area of this topic.

Recommendation to Construction Organizations/Contractors Action

Generally; the output of lowly matured practice of planning processes is improperly or inadequately developed project plan; and as the result witnessed, which is the feature of most local contractors of federal public road construction projects in Ethiopian. On the other hand, highly matured planning processes and adequately developed project plan makes available the fundamental instruments of project management that provide basic guide lines to direct, manage, monitor and control the project work. Thus, a higher priority of the planning processes and the development of an integrated project plan defiantly create significantly better conditions for a successful execution of projects. As regards; the construction organizations, as the main actor of construction projects, have to be necessarily striving to improve the deprived maturity of planning practice because the immaturity may cause inefficient performance of projects as well as delay and cost overrun of the construction projects, and may also cause lose in profit. Accordingly, to contractors, this research recommends the following specific actions to be undertaken for the improvement of planning practice.

- a. Contractors should take care when they are nominating and assigning the project managers and project planners/office engineers by ensuring the nominees' proficiency in project management as well as planning and work experience in similar construction projects.
- b. In order to properly plan, implement and manage construction project activities, inter disciplinarily trained manpower is prerequisite. It is important that providing continuous professional training, which extends beyond the regular academic preparation, to the project professional in order to ensure incessant professional developments of the practitioners and professionals. In other words, provide training and mentoring to the

project managers, project planners and other project practitioners leads to improve their project planning knowledge, practice and capacity. In this regard, proper use simultaneously with periodic training of the existing staff and the tuition of new professionals are very essential; and so that, contractors should provide sufficient and continues training for their project key staffs. Generally, parallel to nominating project manager, contractors have to know the importance of developing planning proficiency, in connection with techniques, tools and process, of the professionals and practitioners through short to long term trainings on projects management as well as planning.

- c. In order to produce match more and proficient university graduate construction projects management professionals, Contractors have to lobby the government for a policy that encourages higher education institutes to train continuously construction management professionals with their maximum capacities; and also that support local training institution in facilities and trainers to compete with the changing environment and technologies of the construction industry.
- d. So as to make use of during planning as a reference document; Contractors should compile their previous projects historical information (project files) that show the projects' scope, WBS, cost, schedule with performance measurement baselines, project calendars, schedule network diagrams, a risk registers, and lessons learned from the success or failure. Further, in order to formulate planning as easy and simple task of a project and to fill the gaps (connected with the planning techniques, tools and process), the research has advised contractors to have their own template of planning together with standards for structuring activities in WBS as well as resource output factors and crew formation.
- e. In general, contractors have to allocate adequate time to develop the project plan in order to improve the quality of planning in the construction projects.
- f. Giving special attention to risk planning and management is highly mandatory to the Ethiopian construction projects, as the review of literature showed management of projects in developing countries is extremely constrained by high uncertainty (very volatile environment, extremely fast and less predictable changes); and also the priority of the project risk plan development should be increased together with the priority of financial and schedule/time plan. Thus, for contractors, increasing the priority of the project risk plan development like financial and schedule/time plan by focusing on the planning and

management of risk can significantly help to lower their negative impact, and as a result to improve the performance of projects as well as the usage of resources.

g. Likewise risk planning, the priority of the project quality, safety, communication, and procurement plans development should be increased together with the priority of other components of the project plan. Regards, contractors should give attention to the planning and management of their project quality, safety, communication, and procurement; in order to help the project significantly to lower reworks and rectification, to lower accidents, to ensure timely procurement as well as delivery of procured items, to ensure handling, controlling and distributing project documents and information in structured system or procedure within timely manner; and consequently, projects can improve the performance along with the maturity of project management practices, and more they can achieve their time, cost and quality targets in better way.

Recommendation for Researchers

This research contains certain limitations that should be kept in mind for future research reference. Thus, caution is to be taken concerning the applicability of these findings to project planning practice in the Ethiopian construction industry as a whole since this research targeted projects of the road construction sector at federal level only and not other sectors of the industry such as building, water works, and other physical infrastructures constructions. By considering the limitations and to fill the gaps, the research suggests that future study can be done to assess:

- a. The status of project planning practice in other construction sectors of the industry.
- b. The synchronization of the planned capacity with the actual existing or available capacity (such as resources, capital, technology, etc.) in order to measure the reliability of construction project plans.
- c. The capacity of construction projects to perform and monitor the planned works.
- d. The status of construction projects planning practice with respect to address risk of project, the issues of quality assurance with control, and procurement of the project goods and services.

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APPENDIX QUESTIONNAIRE

Introduction

The purpose of this questionnaire is to obtain information and data for the specified research conducted as a partial fulfillment of academic requirement for Masters of Science (M.Sc.) degree in Civil Engineering sub-specialized with Construction Engineering and Management at Jimma University.

Research Topic

Assessment on the planning practice of federal public road projects in Ethiopia.

Objective

The main objective of the study is to assess and investigate the problems seen on the current planning practice of public road construction projects in Ethiopia during their implementation/execution phase, and more to identify the factors that influence the planning practice in order to foreword recommendation that improve quality and efficiency of the planning practice as well as the delivery of construction projects implemented in the country.

Confidentiality

The collected data and information will be used only for this academic research purpose and will be strictly confidential.

Instruction

Please answer, rate and indicate by ticking (\checkmark) your appropriate choices on the provided place. The questionnaire contains three parts. **Part one** contains company and respondent general information; **part two** contains list of possible factors that may influence the planning practice of construction projects in Ethiopia; and **Part three** contains list of planning practices in order to seek the actual situation of the Ethiopian construction projects. In this regard, your response is highly valuable and contributory to the outcome of the research.

I sincerely thank you for your earnest cooperation in advance.

Regards,

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| 1.1 Name (optional) | | | | | | | | |
|---|--|--|--|--|--|--|--|--|
| 1.2 Name of the organization (optional) | | | | | | | | |
| 1.3 Position | | | | | | | | |
| 1.5 Type and ownership of your organization: p | lease, tick $[\checkmark]$ on box and specify: | | | | | | | |
| GOVERNMENTAL | PRIVATE | | | | | | | |
| GOVERNMENTAL & PRIVET PARTNER | Other, please specify | | | | | | | |
| 1.6 What is the grade of your organization? | | | | | | | | |
| Grade-1(GC1/BC1/RC1) | Grade-3(GC3/BC3/RC3) | | | | | | | |
| Grade-2 (GC2/BC2/RC2) | Other, please specify | | | | | | | |
| 1.7 Work experience of the organization in: | | | | | | | | |
| 1.71 Ethiopian construction industry (in year | rs) in general | | | | | | | |
| \Box 0 – 5 years | 6 - 10 years | | | | | | | |
| $\Box 11 - 15 \text{ years}$ | More than 15 years | | | | | | | |
| 1.72 Road construction sector of the industry (| in years) | | | | | | | |
| \Box 0 – 5 years | 6 - 10 years | | | | | | | |
| $\Box 11 - 15 \text{ years}$ | More than 15 years | | | | | | | |
| 1.8 Your professional Careers and work experie | ence | | | | | | | |
| 1.81 What is Your Educational status? | | | | | | | | |
| Diploma/Advanced diploma | Bsc. | | | | | | | |
| Msc. | Others; please specify | | | | | | | |
| 1.82 What is your field of Specialization? | | | | | | | | |
| Civil Engineering | Highway Engineering | | | | | | | |
| Construction Management & Eng. | Others; please specify | | | | | | | |
| 1.83 Your work experience in Ethiopian constru | action industry (in years) | | | | | | | |
| 0-5 years | 6 - 10 years | | | | | | | |
| $\Box 11 - 15 \text{ years}$ | More than 15 years | | | | | | | |
| 1.84 Your work experience in Road construction | on sector of the industry (in years) | | | | | | | |
| \Box 0 – 5 years | \bigcirc 6 – 10 years | | | | | | | |
| $\Box 11 - 15 \text{ years}$ | More than 15 years | | | | | | | |

Part I- Company and Respondent General Information

Part II- Factors Influencing Quality of the Planning Practice of Construction Projects

<u>General Direction</u>: Please rate the frequency of occurrence by ticking (\checkmark) on the appropriate column for the following identified factors that influence the quality of planning, based on your knowledge of practice of Project Planning in the projects you are participating or in the organization you are working.

| ;0r | | | Frequency Of Occurrence | | | ccurrence | |
|-------------------------|----|--|-------------------------|-----------|---------------|-----------|-----|
| Categ y | No | Factors That Influence Quality Of Planning | Alwa ys | Oft en | Someti mes | Rarely | N/A |
| ime Related | 1 | Unrealistic or short contract duration | | | | | |
| | 2 | Unrealistic or short bid period (duration between date of invitation to bid and date of submission) and/or mobilization period (duration between site hand over and commencement date) | | | | | |
| L | 3 | Shortage of time for planning or Short time to do the work (planning) | | | | | |
| nt Related | 4 | Low level of project management knowledge, experience and practice of the practitioners in Ethiopia construction industry (i.e. on Contract administration, Project planning and Project monitoring capabilities). | | | | | |
| agem | 5 | Low level construction and management capacity and maturity in Ethiopia construction industry | | | | | |
| Man | 6 | Unavailability or shortage of qualified planners or skilled professional planner in the country's industry | | | | | |
| | 7 | Incomplete, unclear or inadequate details in drawing, specification and BOQ | | | | | |
| ı Related | 8 | Lack or unavailability of standards for resource output factors and crew formation in the company as well as in the country's industry | | | | | |
| formation | 9 | Lack or unavailability of reference documents related to earlier similar projects' plan, work procedure, success and failure | | | | | |
| In | 10 | Lack or unavailability of practical standard and template in the company as well as in the country's industry for structuring activities in WBS | | | | | |
| ated | 11 | Planners or project managers lack of or incomplete understanding on construction site processes and construction work procedures, and materials and other resources supply chain | | | | | |
| itude Rel | 12 | Planners or project managers lack of or incomplete skill to examine and formulate for task outputs and durations | | | | | |
| ill, Knowledge, and Att | 13 | Little or no involvement of the people who must do the work (such as construction engineers, site engineers, superintendents, etc) in the planning process. | | | | | |
| | 14 | Disinterest of planners, project managers and management of the company in project planning due to perceived poor returns from its implementation | | | | | |
| SI | 15 | Cultural and individual issues such as fire fighting behaviour, short term thinking, poor team work behaviour, etc | | | | | |

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| - | - | | | | |
|-----------------|----|---|------|--|--|
| | 16 | Planners or project managers lack of or incomplete planning skills in the areas of securing commitments, assuring measurable milestones, processing information, and facilitating top management involvement. | | | |
| | 17 | Planning in too little detail when designing and preparing WBS | | | |
| _ | 18 | Planning in too much detail when designing and preparing WBS | | | |
| cess Related | 19 | Giving no or little attention for detail of execution, technological implication of different construction techniques, and production capacity of machines and labours during planning | | | |
| nd Proc | 20 | Giving no or little attention for estimation of activity cost and time during planning | | | |
| Tools ar | 21 | Giving no or little attention for sequencing of tasks and their dependency, precedence, and lead and lag during planning | | | |
| hniques, | 22 | Giving no or little attention for working hour, overtime, holly days, non working days and other related issues during planning | | | |
| ng Tec | 23 | Giving no or little attention for short term and long term funding requirement during planning | | | |
| lanniı | 24 | Giving no or little attention for safety requirement during planning | | | |
| ł | 25 | Giving no or little attention for quality requirement during planning | | | |
| | 26 | Giving no or little attention for identification and allocation of potential risks during planning | | | |
| ed | 27 | Lack of or little awareness on the use of planning software | | | |
| Software Relate | 28 | Inadequate or little skill and knowledge of planners or project managers to operate and use planning software | | | |
| | 29 | Unavailability or shortage of computer as well as software (due to cost or other reasons) | | | |
| | 30 | Complexity and difficulty of planning software | | | |

Part III- Project Planning Practice Maturity Questions

<u>General Direction</u>: Please answer all the Questions that follow by ticking (\checkmark) on the appropriate column, based on your knowledge and practice of Project Planning in the projects you are participating or in the organization you are working. Accordingly choose:

High: If your project (organization) practices is come close to the description in high level.

Med: If your project (organization) practice is come close to the description in medium level.

Low: If your project (organization) practice is come close to the description in low level. **N/A: (Not at all):** If it is not at all practiced by your project (organization).

| Group | NO | Practice Of Project Planning | | | Lo w | N/A |
|-----------------------------------|---|---|--|--|---------|-----|
| | 1 | Is there enough awareness about the importance and benefit of planning | | | | |
| | 1 | recognized by your organization management and Project management? | | | | |
| | 2 Does your organization's management provide support for and participate in project Plan development? | | | | | |
| | 3 Does your organization have standard template for project Planning? | | | | | |
| an | 4 | Does your organization have compiled historical information (project files) of previous projects; which show their scope, WBS, cost, schedule and performance measurement baselines, project calendars, schedule network diagrams, a risk registers and lessons learned from their success or failure; in order to use the information as input for project planning? | | | | |
| ect Pla | 5 | Are all; long term (more than 3 month), medium (1 to 3-month) and short- term (weekly and daily) plan prepared in your project? | | | | |
| ral Proj | 6 | Does your organization provide periodic training (formal or informal) on project management particularly on the project planning for its Project Management team and planning engineers? | | | | |
| Gene | 7 | Are WBS (work breakdown structures) and WBS dictionary (document providing description of work, code of accounts identifier, responsible department, resource required etc) prepared to define scope of your project during planning as the first activity or step of planning? | | | | |
| | 8 | Are computer tools and planning software such as Microsoft project, Primavera, Excel etc) used for your projects planning? If yes; Please write the name of tool | | | | |
| | 9 | Is progress and performance (cost and time) of project continuously monitored and controlled regularly based on the plan, and feedback provided for updating the plan? | | | | |
| | 10 | Does your project update the plan regularly? | | | | |
| Plan | 11 | Is a schedule/time plan; which shows milestones, schedule activities, activity attributes, documentation of all identified assumptions and constraints; prepared for your the project? | | | | |
| [ime] | 12 | Is your the schedule base lined? (start and finish date of each activity of work are approved and fixed) | | | | |
| le/] | 13 | Are Network scheduling method (such as CPM, or PERT) used? | | | | |
| chedu | 14 | Are relationships among each activities adequately identified (their dependency, precedence, and lead/lag) and the activities sequenced? | | | | |
| Š | 15 | Is duration estimate for each activity, work package and total project prepared? | | | | |
| : (Human, ial And ent) Plan | 16 | Is there any effort of resource (materials, people, equipment) planning; which involves in estimating of resource needed, levelling resource, and scheduling their acquiring and using time table (details what, how much and when); in your organization or project? | | | | |
| Resource Materi Equipme | 17 | Is project organization chart; which defines hierarchy, Skill requirement, Roles and Responsibilities for all Project positions and human resource needed; prepared in your project resource planning? | | | | |
| | 18 | Is there any effort of tracking, monitoring and recording performance of | | | | |

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| | _ | | _ | | _ |
|----------------------|----|---|---|--|---|
| | | the project resources (manpower, equipment and material), their | | | |
| | | productivity, maintenance cost, time worked etc; and is there any effort of | | | |
| | | using the records as planning information? | | | |
| | 10 | Are resources particularly materials; which requiring long lead-time, and | | | |
| | 19 | nlanning? | | | |
| | | Does your project resource plan addressed for resources particularly | | | |
| | 20 | materials, requiring approval, checking and testing? | | | |
| | | Is a Financial plan; which show cash flow forecast and cash flow analysis | | | |
| | 21 | performed, and details of how much and when funding is needed; prepared | | | |
| lan | | for your project? | | | |
| IP | 22 | Is a base lined budget (the budget allocated to work packages and resources | | | |
| Icia | 22 | with time table) prepared for the project? | | | |
| nan | 23 | Are effects of change in exchange rate, escalation of labour and material | | | |
| Fi | 23 | cost etc considered in your financial plan? | | | |
| | 24 | Is the project cost tracked, monitored and controlled against the baseline on | | | |
| Ŧ | | regular update cycle, and feedback provided for updating the plan? | | | |
| ano | 25 | Is there any effort of identifying and analyze risks, and prepare risk | | | |
| JN, | | effect? | | | |
| atio | | Is contingency time allowed and hudget received in project schedule or | | | |
| nic | 26 | nlan for potential risk impact? | | | |
| mu Mar | 27 | Is there any effort of planning quality control in your project? | | | |
| om at F | 21 | Is there any effort of planning project Safaty, which defines the actual | | | |
| nei C | 28 | nonitoring and control activities to be employed and undertaken; in your | | | |
| ety irei | 20 | project? | | | |
| ality, Safi Procu | | Is Communication planning: which addressed for the system or the | | | |
| | 29 | procedure of handling, controlling and distributing project documents and | | | |
| | | information; performed in your project? | | | |
| Qu | | Is there any effort of planning the procurement of goods and services | | | |
| sk, | 30 | needed for your project to ensure timely delivery of procured items as | | | |
| Ri | | agreed in the contract or as planned? | | | |