JIMMA UNIVERSITY
JIMMA INSTITUTE OF TECHNOLOGY
SCHOOL OF GRADUATE STUDIES
FACULTY OF CIVIL AND ENVIRONMENTAL ENGINEERING
CONSTRUCTION ENGINEERING AND MANAGEMENT CHAIR

ASSESSMENT OF SCHEDULE CONTROL PRACTICE IN BUILDING CONSTRUCTION PROJECTS: CASE OF ADDIS ABABA CITY.

A Thesis Submitted to School of Graduate Studies, Jimma University, Jimma Institute of Technology, Faculty of Civil and Environmental Engineering in Partial Fulfillment of the Requirement for the Degree of Masters of Science in Construction Engineering and Management**.**

BY

MUHIDIN BESHIR TOLO

January, 2022
Jimma, Ethiopia

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DECLARATION

I announce that this research entitles **"ASSESSMENT OF SCHEDULE CONTROL PRACTICE IN BUILDING CONSTRUCTION PROJECT: CASE OF ADDIS ABABA CITY''** thesis is my work and hasn't been succumbed to any university for the requirement of any degree and all references material used are mentioned.

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As research Adviser, I hereby certify that I have read and evaluated this thesis paper prepared under my guidance, by MUHIDIN BESHIR TOLO entitled "**ASSESSMENT OF SCHEDULE CONTROL PRACTICE IN BUILDING CONSTRUCTION PROJECT: CASE OF ADDIS ABABA CITY**" and recommend and would be accepted as a fulfilling requirement for the Degree Master of Science in Construction Engineering and Management.

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ABSTRACT

Schedule control has a greater influence on the schedule performance of the construction industry. Schedule planning is the main activity that is prepared during the initiation of the project in all construction projects. However, most of the problems that occurred during the implementation phase on the schedule control are the consequence to schedule slippage. In the Ethiopian Construction Industry (ECI), schedule slippage is the major problem due to poor time management practice. The purpose of this study was to assess the practice of schedule control, to identify the factors that affect the schedule control performance, and to identify the techniques and tools used in schedule control in building construction projects, and to recommend the industry as well as succeeding investigators. To achieve these objectives the descriptive survey type was used and data were collected through interview and questionnaire surveys. From the literature review, questionnaires were prepared to evaluate the practice of schedule control, and 54 factors affecting schedule control were identified and distributed to the owners, consultants, and contractors in building construction projects in Addis Ababa(AA) city through a purposive sampling method from the respondents these have knowledge and experience. The collected data quality was checked, coded, and analyzed using the descriptive statics methods by the SPSS version 20 and Microsoft-Excel. The results were then discussed and presented in tables and charts.

The finding of the study revealed that there is a practice of schedule control but there is a limitation on the uniformity to focus on the controlling systems in all parties in the building construction projects. The major factors that affected schedule control in building construction projects were Design changes (0.809), Ineffective schedule control of information system (0.786), lack of schedule control plan (0.782), improper time management for activity (0.782), improper project feasibility studies and insufficient data before design. Again, the critical path method (CPM) and Gant bar chart are techniques used for schedule control as well as Microsoft Project and Microsoft excel are used tools by all firms in the building construction projects in AA city. It is recommended that there should be an integration and communication flow among the project team and stakeholders entire the organization throughout the project life cycle. Again, the accuracy of the schedule plan must be considered and all stakeholders should review the master schedule before commencement, the training should be given to the project team on updated knowledge of the schedule control techniques and tools as well as there should be a practice of developing and applying the outcomes of modern technology throughout the firms.

Keywords: - Construction Industry, Project Management, Schedule Control,

TABLE OF CONTENTS

LIST OF FIGURE

LIST OF TABLE

ABBREVIATION

AA	Addis Ababa
AR	Augmented Reality
CI	Construction Industry
CPM	Critical Path Method
ECI	Ethiopian Construction Industry
ECPMI	Ethiopian Construction Project Management
EVA	Earned Value Analysis
FIDIC	International Federations of Consulting Engineers
GBC	Gant Bar Chart
MDB	Multilateral development bank
PERT	Program Evaluation and Review Technique
PMBOK	Project Management Body of Knowledge
PPA	Public Procurement Agency
SCC	Special Condition of Contract
SPSS	Statistical Package for the Social Sciences
TM	Time Management
UK	United Kingdom
VR	Virtual Reality

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

In today's world, the construction industry plays a great role in the development of the nation's economy. It is implemented by different organizations in a given nation such as public and private. The public projects are constructed and authorized by government bodies whereas the private sector projects are constructed and authorized by the single person owned entity and Share companies. The project implemented under the public body includes road and public building which serves the community. The private sector mostly includes the building and residential house buildings and share companies are the construction projects executed mostly by a financial institution such as a bank, insurance, and micro-financial institution(Jr, 2021).

The construction industry in its nature is filled with different challenges and uncertainty. These challenges and uncertainty affect the performance of the industries. Again, three key indicators such as time, cost, and quality indicate the performance. The problems that are faced in the industry also affect these key indicators unless there is proper project control practice. The deficiency in the project control method grasped in Construction Industry (CI) and difficulties in implementing the methods is the reason for time overrun and cost overrun in CI (Y. Olawale and Sun, 2013). To reach the expected plans of the project by overcoming the problem related to these indicators the stakeholders should give attention to schedule control (Lee and Liang, 2014). Each key factor has its effect on each other if they are not controlled in a good manner, for example, Memon *et al.*, (2014**)** stated that a schedule affects the profit if it is not finished in a planned schedule. The other researchers called Michael *et al*., (2018) conclude that to accomplish a given construction project in terms of planned budget, the quality required, and time planned the important tasks that should have to be carried out are planning an effective schedule, implementation of the schedule according to the plan and control throughout the project phase. The other scholars Solis-Carcaño and Corona-Suarez, (2016) also explained that to achieve strong schedule performance; schedule

control has a greater influence than schedule planning. Generally, Schedule is major concerning construction planning and management(Bi et al., 2015).

In a developing country, construction is highly characterized by poor schedule performance that affects key indicators of project performance. This means no attention is given to the schedule control that leads the project to delay. The study result founded by Islam and Suhariadi (2018) in Bangladesh shows that one of the critical factors that cause a delay is the lack of proper management by owners and improper planning and schedules. Again Sha *et al.*, (2017) have been identified inaccurate time estimates and improper planning and scheduling from some of the critical delay cases in Nepal CI. The other study in Nigeria by Michael, et al., (2018) states performances of schedule hindered by different factors such as lack of expertise to develop schedule and monitor and poor managerial decision take place and inaccurate estimates of human resources. Again in Ethiopia, Desta,(2015) states lack of consistent project planning, lack of coordinated execution, and monitoring system developed to guide the creation, development, and implementation of the projects that some of the factors that highly shown in the CI that lead to a schedule overrun and poor schedule performance. Therefore, this shows that most of developing country faced improper project management on time especially on schedule controlling that include monitoring the progress with by preparing the real schedule that helps the project to reach schedule goal or project time completions.

In Ethiopia, the study shows there is a poor performance of schedule that publicizes the industry by slippage of schedule. A recent study by Ayalew, et al., (2016) states that in ECI Schedule slippage is 61-80% of the planned cost due to poor time management practice. Again study report that is done by a collaboration of the World Bank and ECPMI in 2017 by Tadesse *et al.*, (2017) shows that the average schedule slippage in ECI is 124% when compared to the UK. These studies identify the factor that leads to slippage is the lack of adapting general project management procedures, project management functions, tools, and techniques is poor as well as happened at the early stage of project due to ineffective contract implementation that includes risk management and performance monitoring practice. Hence, to identify the problem concerning schedule performance in Ethiopia, it was very important to assess the schedule control practices in capital, Addis Ababa. Since, there are a lot of

building construction projects in the city, which were being implemented under the supervision of governmental sectors and financial institution such as a bank, insurance company and micro-financial institution.

Generally, the study focuses on the practice of the schedule control in construction projects in AA city and determines the factor that affects schedule control to point out the possible solution to the problem.

1.2. Statement of the Problem

In the Ethiopian construction industry, most of the time the issue outstays is time completion as the problem is raised with time concerns. However, before that, every stakeholder in the construction industry must deal with the issue that highly indicates the delay occurrence such as schedule performance management. Because, the level of practice of the Ethiopian construction industry was found very low in terms of time management (Ayalew, et al., 2016)

As observed in most public construction in Ethiopia on the tendering phase, the contractor prepares the schedule and the schedule with the shortest time completion is selected without any consideration only for competition evaluation. Thus, owners and consultants are not controlling and checking this selected schedule.

The schedule control function is to plan and schedule, monitor, track and report, and control throughout the project life cycle (Arcuri & Hildreth, 2007). Nevertheless, due to poor control of the schedule by the client and consultant, the contractors may not carry out functions throughout the project life cycle.

The other problem in the ECI is practices of schedule control are varying from organization to organization depending upon the efficiency of the management body and project teams**.** Therefore, it is significant to study schedule control practice in AA city to point out the problem relating to the scheduling problem that influences the performance of CI.

Furthermore, ECI is characterized by schedule performance problems. As Ayalew, et al., (2016) states that in ECI Schedule slippage is 61-80% of the planned cost due to poor time management practice, and a study report that is done with a collaboration of the World Bank and ECPMI by Tadesse *et al.*, (2017) shows that the average schedule slippage in ECI is 124% when compared to the UK.

From the point of view, since AA is the capital of the country there are many construction projects owned by the government and non-governmental institutions those could care for schedule completion such as financial projects where different projects take a long time to be completed as well as there are different public buildings, which were in progress. Consequently, it is very significant to identify the practices of controlling schedule in such an area because the probability of acquiring reliable data is possible to draw a conclusion and share the experience with the rest of the industry.

The study aimed to assess the practice of schedule control and the challenge affect controlling in AA city building construction projects supervised and budgeted by the public body and the bank and insurance and or macro-financial institution.

1.3. Research Questions

1) Does the schedule control practice exist in building construction projects in Addis Ababa city?
2) What are the factors that affect schedule control in building construction projects in Addis Ababa city?
3) What are the tools and techniques used for schedule control in building construction projects in Addis Ababa city?

1.4. Objectives of the Study

1.4.1. General Objective

The major objective of this research was to assess the schedule control practice in building construction projects in Addis Ababa city.

1.4.2. Specific Objectives

- ✓ To identify the schedule control practice in building construction projects in Addis Ababa city
- ✓ To identify the factor affecting the schedule control in building construction projects in Addis Ababa city.
- ✓ To identify the tools and techniques used for schedule control in building in Addis Ababa city

1.5. Significance of the Study

The significance of this study is to address the issue related to schedule control in building construction projects in Addis Ababa city. These are, to assess the schedule control practice, stating the availability of schedule control practice, to identify and rank the factor that affects the schedule control practice, to identify the techniques and tools used for the schedule control systems in building construction projects. Furthermore, to forward the possible recommendation for the construction projects regarding schedule control practice and the tools and techniques and how to overcome the factor affecting the schedule control for the parties involved in the construction industries and to recommend the next researchers who have the interest to study broadly about the construction schedule.

1.6. Scope of the Study

The scope of this research was geographically covered the building construction projects those were on implementation in Addis Ababa city those were authorized and invested by public authority and financial institutions such as banks and insurance. Again, thematically the research was covered the ongoing building construction projects for the ease of data availability and accessibility of an organized system of stakeholders.

1.7. Limitation of the Study

The study was limited due to some limitations faced in data collecting in the selected area. The first and core limitation was there is no organized secondary data that helps the researcher to conclude broadly other than interview and questionnaire. The second limitation was the global phenomenon which is the covid-19 pandemic to cover all the projects in the city since some of them did not allow entry due to fear of the pandemic therefore it was difficult to reach all the ongoing projects and limit the sample size.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

Time management in construction projects is a vital activity to overcome the challenges that happened in the construction industry. This may include a scheduling process that encases schedule planning and schedule controlling. To achieve the success of time management (TM) each party who is responsible must be included in the activity throughout the project life cycle (Solis-Carcaño et al., 2016).

From the very beginning to understand the role of controlling schedule in construction industries, it is very important to discuss the management and its' function. The researcher has selected the point that issues and strength his point of view on schedule controlling that helps to address the problem. Generally, the researcher has discussed the definitions and concepts and highlighted the factors that affect schedule control and the practice.

2.2. Management

Management is defined in different ways according to the Merriam-Webster dictionary it is "the act or art of managing or the conduction or supervising something like business or enterprises." As well as Collin's dictionary defines management as "is the control and organizing of a business or other organization". However, according to different books, it can be defined as a process that has continuity in a given organization or company. For instance, according to Essential of management book by DuBrin, **(**2010**)** "management is the way in which organizational objective is achieved through planning, organizing, and staffing, leading and controlling by using organizational resources". According to this definition, the main activity that should be carried out in the organization to achieve organizational goals is planning, organizing, staffing, leading, and controlling. Therefore, it is essential to deal with these functions to understand the significance of management and project management.

2.2.1. Function of Management

The one with the skill of manager carried out several functions in every organization to achieve the goal of an organization. These management roles must be controlled throughout

the project cycle to overcome the problems that affect the key indicators of a given organization such as time, cost, and quality. Managers of the organization govern the effectiveness of these functions. As DuBrin (2010) states in his book there are four main functions of management that managers necessitate to use the organizational resource (human resource, financial resources, physical resource, and information resources) to attain an organizational goal. These are planning, organizing, staffing, leading, and controlling**.**

2.2.1.1. Planning

Planning is the benchmark for every action. Without planning nothing can be done which means whether it is empirical or ideal the one is going to achieve a goal whether an organization or personal goal planning must be carried out. Kumar (2008) in the industrial engineering and management book states as the first stage at which we should have to contemplate before implementation proceeds and the step at which definition of objectives, a setting of goals, formulation of program and policy, and creations of schedule and procedure is carried out.

Again, it has been defined in various ways as usual. 'collins COBuild dict.' declares planning as" a method of achieving something that you have worked out in detail beforehand". As well as it is also defined as it is "the process of setting a goal and figuring out the way to attaining the set goal"(DuBrin, 2010)**.**

The managers point out the methods to achieve a goal after setting the goal during experiencing the management in each organization. Then he/she passed to the rest vital activity to strengthen planning. In this stage schedule, development/planning is the major activity for the manager or for the one who deals with planning to attain the goals at the required time (Kumar, 2008).

2.2.1.2. Organizing and staffing,

In management, the other vital function is organizing and staffing that helps to simplify the controlling. DuBrin (2010) and Kumar (2008) states Organizing and staffing the function of management that manager should be carried out by grouping the activities per the resource that going to be used and allocating the duties and responsibilities of the human resource that helps to execute the task to be done as well as assigning the physical resource and cost.

2.2.1.3. Leading

Leading is a catalyst for all other purposes of management. It is how managers leverage subordinates to achieve the objectives of the organization. DuBrin (2010) explained leading as a means of influencing the manpower that includes directing, coordinating, motivating, and persuading others as well as creating the visions to attain the goal established. The PMBOK Guide,(2017) is also defined as monitoring the progress of activities depending upon the project management plan and the project performance baseline and recommending preventive action to the problems.

Supervising of all key indicators is done in this stage. This includes the time or schedule performance is supervised according to the baseline as well as the physical resource and information assigned for the grouped activity also provided and the sequence of implementation sorted (Kumar, 2008).

2.2.1.4. Controlling

The other most valuable function of management is controlling which a manager must exercise. Kumar,(2008) states controlling as the "core of managers' works" on industrial engineering and management p.598.

It is defined as a function of management disciplines that helps to lead the fault in the working sequence or procedure, monitoring the change during the implementation from the plan, and taking corrective measures to realize organizational goals(Kumar, 2008). The other scholar Williams, (2008) also explains it as "all about understanding how you're doing, tracking your progress, and adapting to changing circumstances". Plus (DuBrin, 2010) declares as it is how the actual plan and original plan are compared to dictate the problem and revise the actual one to take corrective measures.

Every activity in a given organization must be controlled effectively during implementation to govern the key indicators of the projects. It is difficult to attain the objectives of the organization. So, effective controlling helps to maintain the schedule of the work, cost overrun could be governed, physical resource consumed less, the scope of the project could be achieved, and motivation and sense of responsibility of manpower could be high and the delay and error become avoided(Kumar, 2008).

2.2.2. Project Management

It is very important to discuss the project to vividly the application of the management in projects. The project goal could be achieved through effective management. If effective management could not apply properly to the project; the efficiency, as well as the effectiveness of the project, could not be realized. To achieve this objective the organization divides the work to be carried out into programs and the program into projects. So, Many projects come together to form a program (Mubarak, 2010).

Besides, the project could be defined as "the temporary endeavor that has a beginning and Ending time which is undertaken to establish the unique product, service or result."(Institute, 2017)**.** For instance**,** CI as an industry executes different types of tasks such as residential building, public building, and industrial building that have defined beginning and ending time through organization these have partaken in construction. These tasks are the project that is why it is called a construction project.

People have no clue about project management and there is confusion including a client who intends to hire the project manager (Sezer, 2016). Project management is the basic requirement in CI to meet the industry's objectives through applying the knowledge and skill as well as techniques of the management. PMBOK guidebook defines project management as "the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements". Again the guide vivid it is an achievement that needs suitable ''application and integration'' of the project management processes that are grouped into five namely; initiation, planning, execution, monitoring and controlling, and closeout.

Effective Project management can prevent and resolve the conflict between the quality and cost and cost and time (Sezer, 2016). The Project that is effectively controlled ensures the project finish on time within budget and achieves other project objectives(Y. Olawale & Sun, 2013).

Furthermore, according to PMBOK guides, (2017), project time management is the process required to manage the timely completion of the project and includes the various phases. the first phase is plan schedule management to establish the policies, procedures, and documentation for the planning, developing, managing, executing, and controlling of the

project schedule. Again, develop a schedule to analyze activity sequences, durations, resource requirements, and schedule constraints to create the project schedule model. Lastly, control schedules to monitor the status of project activities to update project progress and manage changes to the schedule baseline to achieve the plan.

Kim & Kim, (2014**),** also state the project time management as a means of project control by project schedule estimating to ensure on-time project delivery, and project managers track the status and trends of project performance and predict possible project outcomes so that informal control decisions can be made in timely money.

2.3. Schedule

The schedule is the critical activity in every project especially in CI it is crucial that needs attention since it governs the economics of the specific projects as well as greatly interrelated with planning.

If the definition of scheduling is overlaid with the definition of planning, it can be seen that there is an exact correlation between the two. The schedule can be said to be the tool with which contractors accomplish planning, both in the long term and in the short term. Additionally, the schedule is the communication tool with which contractors convey their plans for the performance and completion of the project, to all concerned (Rounds & Segner., 2011)(page 238-239)

Furthermore, Kumar (2008) also defined the schedule as a "particular sequence of the works and the time of actual performance and time phasing of jobs is done at a comparatively lower level of the organization."

2.3.1. Importance of Scheduling

In construction planning and management, the key activity is scheduling (Bi et al., 2015), and it is a key index for measuring project success and a critical aspect of construction project management (Fu & Liu, 2018). Therefore, the schedule is a very important activity to measure the performance of the project.

Moreover, to focus on the controlling of the schedule it is very necessary to know about the importance of the schedule in construction projects. Unless there is initiation about leading the schedule or measuring the schedule performance from the beginning, it is difficult to

achieve the project goal successfully. The most important use of schedule is project control (Mubarak, 2010).

Many scholars stated the purpose of scheduling in different ways. Mubarak, (2010) states the purpose of scheduling separately for contractors and project owners. Accordingly, for the contractors, to estimate the project completion date for the liquidated damage or rewards, to compute the start or end of a specific activity, to manage conflict between subcontractors trades, to estimate cash flows, to increase work efficiency, to control the project, to assess the effects of changes, and to prove claims that lead due to delay. Again, for project owners, it assists to get an idea of the project's expected finish date, ensuring the contractor's proper planning for a timely finish, predicting and calculating cash flow, evaluating the effects of changes, and verifying delay claims.

Furthermore, another author Kumar,(2008) generalizes the purpose of scheduling as it is an important task to execute proper possible informal assigning/staffing and scheduling, to maintain proper sequencing, and minimize the idle time for getting work of the job.

2.3.2. Schedule Updating

Construction schedules can be carried out by using the experience/ experience-based schedule, which is called heuristic scheduling, and update time receiving the early and late schedules of the project activities according to actual progress, which is called schedule updating. Again, updating consists of rescheduling the activities with a set of constraints that have been revised by removing constraints that are no longer valid (Pultar, 1990)**.**

All of the concerned project participants can reschedule construction projects dynamically. Subcontractors must be had an idea about scheduling and general contractors accommodate subcontractors to coordinate the schedule (Alemayehu, 2016).

One of the outputs of the schedule control process is schedule updating. Updating is not a one-time activity it is routine activity throughout the project life cycle. This means a scheduling controller correcting the change that may occur during planning and execution. it can be defined as a means of integrating the change in planning and rescheduling during operation (Kumar, 2008).

During execution, different changes could occur due to time overestimation or underestimation such as activities not done in time due to accident, some activities done due to extra human resources, and due to outbreak of natural clam. Consequently, due to these changes, the schedule update is important to identify critical activities to change the critical path and Project completion (Kumar, 2008).

2.3.3. Schedule Control

Scheduling controlling and schedule planning are activities those performed during scheduling. To achieve the purpose or goal of scheduling, schedule control is the major activity that is tracked during the implementation of the project. As Solis-Carcaño and Corona-Suarez (2016) stated schedule control has a greater influence on schedule performance than schedule planning; it resulted in a stronger relationship with project schedule performance**.**

According to the definition on the PMBOK guide, (*2017),* a control schedule is "the process of monitoring the status of project activities to update project progress and manage changes to the schedule baseline to achieve the plan". Again, the concern of schedule control in a construction project as stated in this guide is a process that influences the factor that creates schedule changes, to ensure that change is agreed upon, to determines the schedule has changed, to managing the actual changes when and as they occur. Again, it integrated carefully with other control processes as shown in following figures.

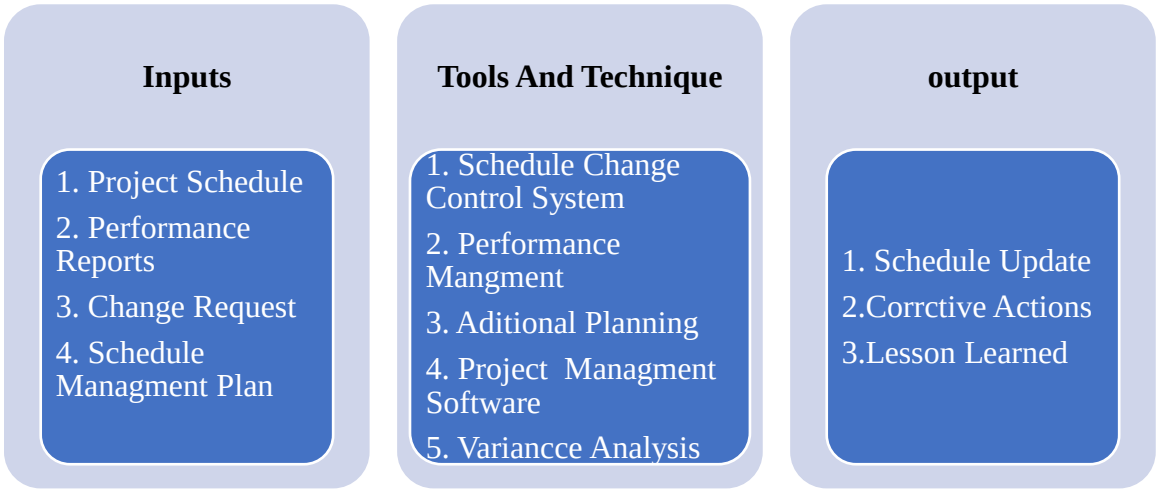

Figure 2.1: Schedule Control Output

In the project management process improvement Wysocki,(2004) book is categorized schedule control by the level of characteristics. These characteristics are described as follows:

- **Schedule Control-Level 1 Characteristic:** Schedules are managed and controlled at the project level using whatever means they select, Schedule performance tracking is inconsistent, Schedule performance reports are prepared in an ad hoc manner and are not consistent across projects and there is no documented approach to schedule control.
- **Schedule Control- Level 2 Characteristics:** A process is documented for the control of schedules including a change control process, A schedule reporting system exists, and Schedule baselines exist, as do planned versus actual reports.
- **Schedule Control-Level 3 Characteristics:** There is a documented standard for change control, schedule reporting, and cost/schedule control that is used on all projects, and Schedule performance against the plan is monitored and managed.
- **Schedule Control Level 4 Characteristics:** A comprehensive cost/schedule control system is used for management decisions, Lessons learned and best practices are captured and made available to other teams.
- **Schedule Control Level 5 Characteristics:** A process is in place to capture schedule performance and improve the process, Lessons learned and best practices are used for schedule control process improvement.

The key to a capital facilities project success is developing a sound project plan or schedule and then carrying out the project according to plan. This decent project plan is developed by construction professionals in the construction industry to achieve schedule goals. They develop a reasonable schedule baseline, to overcome difficulties in accomplishing the schedule goal and should focus on (Han et al., 2017). According to this author, Dividing up activities that exceed 30 working days, Creating or managing a schedule containing multiple lags, Initially using unique task names, Assigning at least one predecessor and successor to an activity or milestone, and Developing a schedule mainly through a finish to start a relationship is the step in developing project plan.

2.3.4. Methods Used in Schedule Control

Controlling the schedule is difficult without using some tactic that helps to overcome the problem faced during the progress of the construction. Hence to check the progress of the schedule there are several methods in the CI. The major one is using the schedule control plan in schedule control. SCP describes the system and procedures proposed for planning, sequencing scheduling, controlling, and reporting on the schedules. (Ollmann, 2015)

Moreover, To realize the project objectives and prevent time-related problems the time control and project planning, there are several techniques is used in the construction industry such as Gant chart, Critical path network methods, Milestone data programming techniques, Program evaluation (PERT) as well as software packages used are Microsoft Project, Asta-power project, Primavera (Y. A. Olawale & Sun, 2010)

Furthermore, to apply the project management practice, there are tools and techniques used to overcome the problem related to it. Some of these protect management practice tools and techniques are CBA- cost benefits Analysis, Gant bar chart, and CPM- critical path Method (Haron et al., 2018).

Application of VR and AR in schedule control is visualizing concepts of designs, Facilitating collaborative design, Design review, Facilitating owner involvement, Planning, and scheduling, Progress monitoring, Off-site training, Operation assistance, Improving coordination among participants(Fu & Liu, 2018)

2.3.5. Factor Affecting Schedule Control

In the construction industry, several factors inhibit both times and cost control during construction projects. These factors are such as design changes, risk/ uncertainties, inaccurate evaluations of project time/duration complexities of works non-performance of subcontractors, lack of proper training and experience of project management, discrepancies in contract administration, Low skilled manpower, Conflicts between project parties. (Y. A. Olawale & Sun, 2010)

Different factors are responsible for time and cost variation during project implementation. as Alemayehu, F. (2016) declared, design change, the actual quantity of activity, greater than planned, shortage of skilled and unskilled labor, the time needed to implement variation

orders, cost of variation order, climate condition in the site are the cause for variation of time as well as cost.

Effective project management requires controlling all aspects of the construction project; quality and quantity of work, cost, and schedule to guarantee the success of the project (Ghanem & AbdelRazig, 2006).

The construction schedules face various risks during implementation such as design quality, design change, design delay, decision efficiency, inaccurate time estimation, error in execution, dispute, poor management and supervision, material and equipment, productivity, qualified labor, labor productivity(Fu & Liu, 2018)

The schedule is one of the outcomes of project success. According to Tabish and Jha, (2012)projects success factors can be affected by success traits such as human factors like god coordination b/n project participants, availability of trained resources, a commitment of all project participants, owner competence, project manager competence, and management action like monitoring and feedback by project participants, regular budget update. Haron *et al.*, (2018) also state a number of factors that can critically influence project success during implementation such as customer satisfaction and competency of the project team as well as a performance of subcontractor's time, cost, and quality. despite these factors influencing the project success the other main factor that affects project success are customer satisfaction, effective planning, and controlling, financial attributes, realistic costs, time estimation, the competence of project teams.

The construction industry faces a major problem to carry out schedule goals absence of a reasonable schedule baseline (Han, *et al*., 2017). Again, the schedule is one of the components of the contract document in tendering evaluation criteria. The contract document underperformed in CI especially in ECI. The factors that lead to underperforming of the construction industry are an adequate contract management system, failure to treat a project as a single system in its entirely i.e. low level of overall integrated project cycle management system knowledge and application. Less attention is given to the earlier stages of the project cycle, including risk identification and management (study report, 2017).

Management challenge in time scheduling, cost, risk resources, and safety management is common. These challenges are lead due to poor practice of project management tools and techniques and lack of adopting project management procedures and its' practice are unsatisfactory (Ayalew et al., 2016).

The other scholar Larsen et al. (2016) deal with factors affecting schedule delay and stated lack of project, funding, errors or omission in consultant material, errors or omission in construct works as the other potential factor that commonly occurs in public construction projects.

Alferd, (2014), states that in work that tries to extract some critical factor that leads to poor project performance in a construction project that related to project scheduling such as inadequate planning of the project, suspension due to either party, effective strategies to mitigate effective project scheduling, effective time management practices.in his studies. He also tries to categorize into different factor groups depending upon their consequences as planning-related factors, client-related, technical-related, resource-related, cost-related, and site-related.

2.4. Practice of Schedule Control

Construction industry is the huge industry that includes different stakeholders these governed with law and contract. The responsibility of these stakeholders is deployed according to the document involved in the industries. The standard document such as FIDIC and PPA are the main contract document those specify internationally and nationally the responsibility of stakeholders in the project life cycle.

2.4.1. Schedule Control in an International Contract

In Ethiopia, the international procurement system is done through MDB-Fidic, which is prepared by the development bank in2006. This shows schedule controlling in concepts of the program under sub-clause 8.3.

After receiving the notice for the commencement date, the contractor should submit the detailed time program within 28 days and the Contractor shall submit a revised program whenever the previous program is inconsistent with actual progress or with the Contractor's obligations.

Each time program must include the order in which the contractor intends to carry out the works, including the anticipated timing of each stage of design (if any), contractor's documents, procurement, manufacture of plant, delivery to site, construction, erection, and testing, each of these stages for work by each nominated subcontractor. The sequence and timing of inspections, tests specified in the contract, and a supporting report, which includes a general description of the methods which the contractor intends to adopt. Besides, the major stages, in the execution of the works, and details showing the contractor's reasonable estimate of the number of each class of contractor's personnel and of each type of contractor's equipment, required on the site for each major stage.

On responsibility and duty of the engineer stated under the same clause unless the engineer, within 21 days after receiving a program, gives notice to the contractor stating the extent to which it does not comply with the contract, the contractor shall proceed by the program, subject to his other obligations under the contract. The employer's personnel shall be entitled to rely upon the program when planning their activities. The contractor shall promptly give notice to the engineer of specific probable future events or circumstances that may adversely affect the work increase the contract price or delay the execution of the works. The engineer may require the contractor to submit an estimate of the anticipated effect of the future event or circumstances, and/or a proposal for variation procedure. Again, it states that if at any time, the engineer gives notice to the contractor that a program fails (to the extent stated) to comply with the contractor to be consistent with actual progress and the contractor's stated intentions, the contractor shall submit a revised program to the engineer in accordance with this sub-clause.

Generally, this condition of the contract states there is mutual responsibility and duty to control the time program to avoid the delay in the schedule of construction projects. Again, there is legally encased by the condition of the contract to control the progress of the schedule.

2.4.2. Schedule Control in Ethiopian in Local Contract

In business firms, procurement is the main activity to acquire affordable services. The construction industry is one of the business firms that involve procurements. One of the well-

known procurement in construction industries is a contract that helps to achieve affordable service with legal bounds.

The Ethiopian construction industry is also governed by a construction contract that is prepared by a public procurement agent that holds responsibility and accountability to the contracting stakeholders. This document states the Ethiopian context duty of the contracting party in every single activity.

PPA states the duty of schedule control in construction projects. From the very beginning, it states on clause 2.1 (b) contractor is appointed with the required schedule strictly while entering into the contract. Again, it states the duty of engineers is that they shall issue contract administration and instruction that includes the schedule management on clause 30.5. Additionally, it states the duty of controlling and supervision to the contractor with approval of the engineer on clause 37, and the program of implementation must be breakdown by month and activity. Such as order of implementation, time limit by nature of the activity, and methods of execution shall be submitted to the engineer for approval and the wish of the engineer applied and approved as this document stated on the clause 41.
Furthermore, according to clause 41.3, the contractor shall notify the update time that can affect the program of the implementation and engineer approve reasonably and each report is submitted on time as on SCC of the contract.

Generally, according to PPA in the Ethiopian construction industry, the mandate of controlling the schedule is given to contractors and engineers. the contractor submits a reasonable schedule and the engineer approve depending upon the clients and controlling as per the specific contract signed.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Study Area

The study has been carried out in Addis Ababa. Addis Ababa is the capital city of Ethiopia and is located at the center of the country relatively. The city is positioned at an altitude of 2,355 m (7,726ft) and latitude and longitude are 9^0 1'48" North and 38^0 44'24" East respectively. It is one of the most populated cities in Ethiopia. According to the 2007 national census, Addis Ababa city has a total population of 2,739,551 urban and rural inhabitants with the density of the city populations are 5165.1/ km^2. In addition, the city is dived into 10 sub-cities and the chartered area of the city is 527km^2(203sq mi).

Architecturally, Since the city is the capital there are different types of construction especially financial construction such as Nib international bank, the headquarter of the commercial bank of Ethiopia, zemen bank,Hibret bank, Amhara credit, and saving share company and Niyal insurances are among building construction in the city. Thus, the city construction office also constructing different types of structures for social service like the police stations, mixed-use buildings like meskel square. Again, since the city is encased the regional and continental capital there are different construction by this side too.

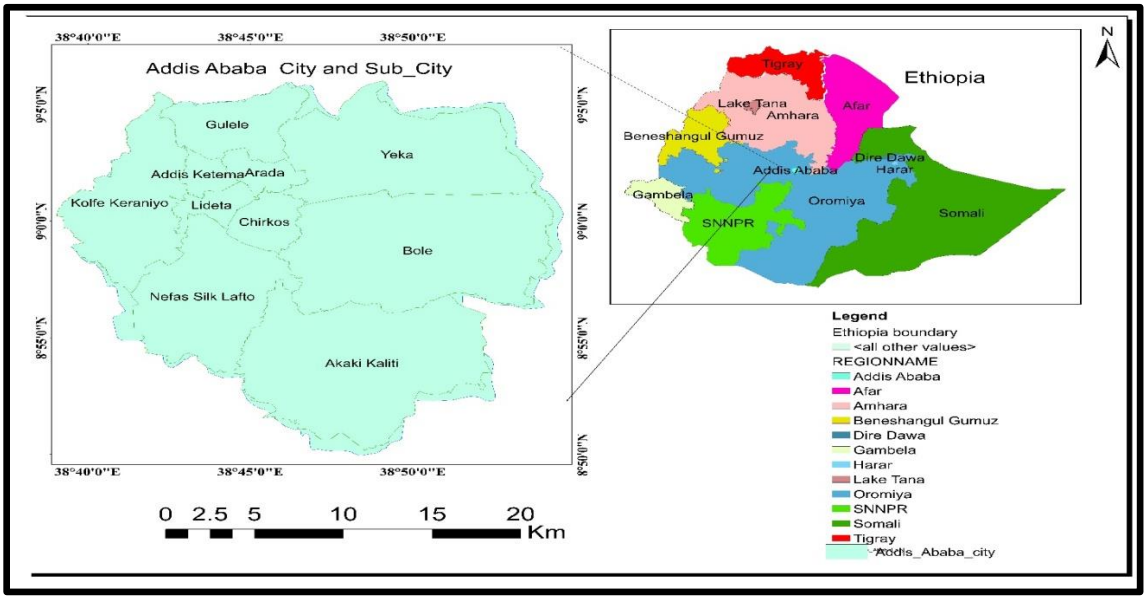

Figure 3.1: Addis Ababa City Map

3.2. Study Design

The research was descriptive survey research that was carried out in the AA city building construction project, which was constructed by the public and financial sector. According to Singh, (2006), the descriptive survey method is a more objective method with vital control to collect the existing situation through point to achieving the goals and objectives and determine the trends and patterns. Therefore, the study covered the stated target group which were engaged by a high-level construction company (i.e. grade one and grade two) by descriptive survey method and hit the objective of the study because it is expected that they concerned with the schedule control.

3.3. Population and Sample Size

The populations of the study mainly focus on the huge construction projects engaged by the grade one to grade three contractors and those owned by the government sectors and financial institutions. The project type was building construction.

There were several projects which were under construction that were owned by the public sectors under the governance of the city administration and other public sectors like state authority buildings as well as those owned by financial institutions such as banks and insurance companies. The total sample size was 44 and from these 28 (63.6%) were from public construction and 16(36.4%) were from financial institution construction projects. Those were selected by the sampling technique, which was discussed under-sampling technique. The distribution of stakeholder (owners, consultants, and contractors) population is as follows on table

Table 3.1: Distribution of Stakeholder Population

Type of the Organizations	Numbers(N)	Percent (%)
Owner	18	40.9
Consultant	12	27.3
Contractor	14	31.8
Total	**44**	**100**

Again, the study focused on the construction project being executed by top-grade contractors or construction companies (i.e. Grade 1, Grade 2, and Grade 3) in order to obtain reliable data because it is expected that high attention is given to the level of construction by the owners or parties. Consequently, from the above 14 contractors, 7(50%) was Grade one, 3(21.4%) was grade two, and 4(28.6%) was grade three contractors these data were collected from.

3.4. Sampling Technique

Acquiring reliable data could not be easy for an ordinary worker of the projects that means it needs deep knowledge and information about the issue to respond the questionnaires. Therefore, the sampling system was a non-probability sampling method and the researcher has been used the purposive sampling technique which means the researcher purposively choose the respondent who monitors the schedule of the construction projects and those who have deep information about the project schedule.

3.5. Study Variables

3.5.1. Dependent Variable

The dependent variable of this study is that influenced by the independent variable, this is:

- ✓ The practice of the schedule control

3.5.2. Independent Variable

The Independent variables of the study are:

- ✓ Factors affecting
- ✓ Tools and Techniques

3.6. Data Collection Process

3.6.1. Data Source

The study acquires the data from two main sources these are primary and secondary data sources. Secondary data sources were from the literature those were previously published on schedule control-related issues in journals, books, and articles through the internet. The primary data sources were outsourced from the population target group through a survey or data collection tools.

3.6.2. Data Collection Method

The type of study was designed to assess broad information from construction projects about schedule control practice. Accordingly, data was collected through a questionnaire survey, and interview that was appropriate to hit the objective of the study.

- **Questionnaire**

The Questionnaire was designed to hit the three objectives of the study that were planned to be responded to by the three parties as attached in the appendix. It contains three part the first part asks for general information, the second parts assess the practice of the schedule control and prepared depending upon the literature review i.e. (Wysocki, 2004), and the part third was collected from different studies done in different parts of the world. The questionnaires were distributed to the building construction project those owned by public and financial construction project contracting parties participating in the execution of the project such as the owner, consultant, and contractors. As follows:

Table 3.2: Questionnaires Distributed and Collected From the Respondents

Respondents Group	Questionnaire distributed	Questionnaire returned	Percentage of returned
Owner	22	18	81.82%
Consultant	15	12	80%
Contractor	17	14	82.35%
Total	**54**	**44**	**81.5%**

- **Interview**

The interviews were collected from the two main groups of the targeted population these are, from public construction project shareholders and from the financial construction project shareholders. The interviews were semi-structured those were prepared for the main influencer of the project to gather sufficient information about the schedule control practice of the organization. The researcher selected the engineer and contract administrator from the owners and the Resident engineer from the consultant side. Again, from the contractor side, the researcher was selecting the site and office engineers who follow the project by collecting actual data from the project and collecting the day-to-day activities from the site. The

interview question encases five main questions regarding the schedule control elements that were prepared depending upon the literature review.

Generally, six owners, five contractors, and three consultant's interviewees were selected to conduct interviews and fourteen respondents have participated in the interview. From these eight of them were selected from the public project and six of them were selected from the financial construction project. These respondents are these have more than five years of experience in the construction project. The interview questions are attached to the appendix.

3.7. Data Analysis Methods

After data has been collected from the three main stakeholders organization type which means Owner, consultant, and contractor those participate in two main groups of the population target group (public and financial construction project) the analysis was preceded. The collected data was quantitative and qualitative data, depending upon the objective of the study it was analyzed by the descriptive statistical analysis system by using statistical package for social science software (SPSS) version 20 and Microsoft- excel 2010 as follows:

- ✓ The questionnaire collected was checked for completeness and the error that may occur by the respondent and the quality controller
- ✓ Then the questionnaire was coded by the keyword of the questions to simplify the data congestion on the software.
- ✓ After coding, the data were categorized to select the measurement level of the data that going to be entered into the software.
- ✓ Then researcher was entered the all data on the SPSS, first by entering the variable by using the code given to each question, then coded data was labeled, the value was set and measurement level was selected depending on up data type on variable view.
- ✓ After the variable was entered in the on data view portion, the response was filled accordingly.
- ✓ The first part of the questionnaire was about general information of the company/organization and respondent profile and analyzed by frequency distribution.

- ✓ The second part of the questionnaire was about the practice of the company on schedule control in the AA city construction project. Consequently, the data were analyzed by using frequency distribution to identify the practice of schedule control in the building construction project. Thus, the highest percentage of frequency of the respondent on a given item implies the practice of the organization regarding the issue raised.
- ✓ The third part of the questionnaire was the factor that affects the schedule control in the organization. These factors were prepared by Likert scale and ordinal data that used to be ranked according to their significance. The rank was calculated by using the relative importance index (RII) formula to identify the most significant factor that can affect the performance of schedule control. Therefore, the frequency of the Likert scale was analyzed by SPSS software and again RII of the factor was calculated by Microsoft excel 2010 and ranked depending upon the value. The RII is computed as follows (Enshassi, et.al, 2009)

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

Where;

- RII = Relative importance index
- W =weight given to each factor by respondent it ranges from 1 to 5
- A = the highest scale which is 5
- N = total number of the sample size which means the respondent

- ✓ After the factor was ranked by using the above formula, the significance of the factor was checked by the non-parameter correlation method, which is the spears man Rho correlation coefficient by the SPSS software because it is used for the data not normally distributed; spears man correlation is appropriate to evaluate the significance correlation. The correlation between all three parties is checked by using the correlation coefficient and the p-value is computed as follows (Forthofer et al., 2007)

$$Rho = 1 - \frac{6 * \sum d^2}{n(n^2 - 1)}$$

Where :

- Rho= spearman correlation coefficient
- d= rank difference
- n=number of the factors

✓ The third objective of the study also was analyzed by SPSS software but the questionnaire was multiple response types of question, analyzed using multiple response analysis methods on the software, and described by the frequency distribution and depending upon the percentage of the respondent it was concluded.

✓ Finally, the finding or output was discussed depending upon the figure by charts, tables, and graphs.

3.8. Data Quality Assurance and Control Methods

The data collector was hired for better performance and time saving. The hired data collectors were distributed the data by supervision of the researcher in order to minimize errors that could occur. Again, the data collectors collected the distributed data under the supervision of the researcher. Then the collectors submitted the collected data to the researcher and a researcher took it by checking the completeness and unreturned questionnaire.

Finally, uncompleted data were not included for analyses, the qualified data was coded, and analysis was done.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1. Introduction

In the first parts, the results of general information were presented to show the profile of the construction project from which the questionnaires were collected as well as the position and experience of the respondent to affirm the data reliability by frequency distribution. Again, three specific objectives of the study are also included under this chapter depending on the frequency of the respondent the first and third research question of the study is analyzed and interpreted by using frequency distribution as well as the second research question also analyzed by the method previously stated, which means RII. RII was computed for each factor affecting the schedule control in building construction projects in AA city depending upon the response collected by the Likert scale method from the three main parties participating in the execution of the construction project and ranked.

Finally, the discussions were done depending upon the figure achieved on the results described briefly.

4.2. General Information

- **Types of the Organization**

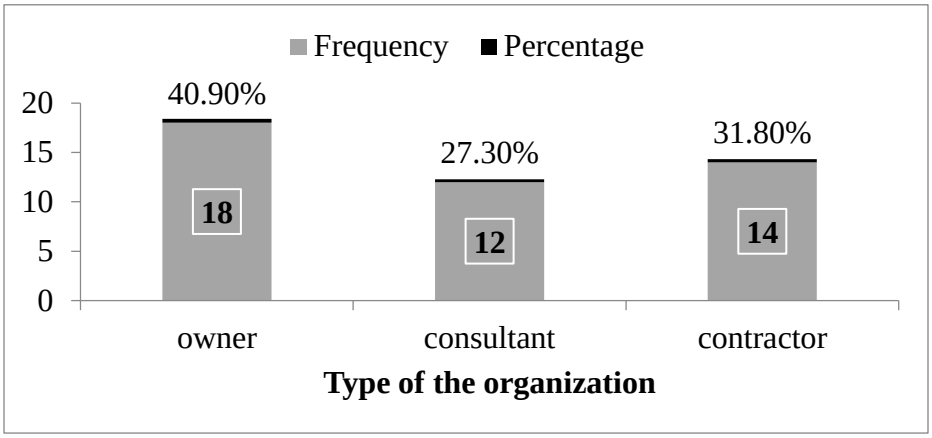

Figure 4.1: Frequency Distribution and Percentage of the Organization Type

➢ **Job Position of the Respondents**

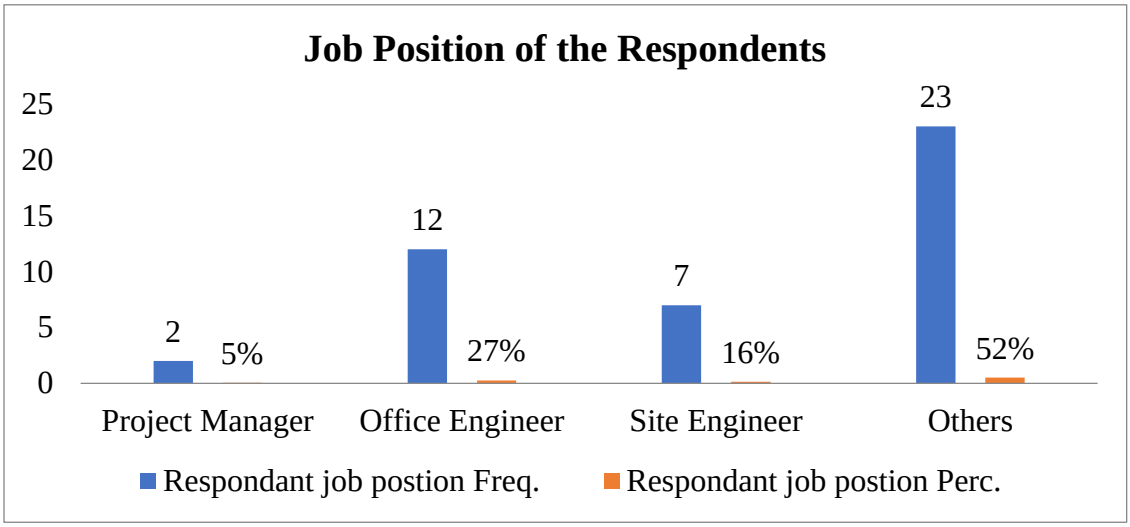

Figure 4.2: Frequency and Percentage of Job Position of the Respondent

➢ **Year of Experience of the Respondent**

From the total respondents, the minimum experience of the respondent was 4 years and the maximum experience of the respondents was 36 again the average experience of the total respondent was 9.82 years.

4.3. Schedule Control Practice in Building Construction Projects

In Addis Ababa, the practice of schedule control is different from organization to organization. For instance, the practice performance between the consultant and contractor is different and between the owners and the contractor is different again, there is the difference between the consultant and owners. Nevertheless, on the same criteria, the performance of practicing the schedule control seems the one another's.

The questionnaires and interviews were covered six main areas of practicing the schedule control practice, these are schedule baseline, milestone, change control, schedule performance metric's, schedule EVA, and schedule report practice as well as the schedule control practice and process that extracted from the past project trend for the corrective action. Again, these areas are entitled into six main categories to cover the schedule control system as schedule control plan, monitoring schedule control, evaluation schedule control, change control, schedule reporting, and decision and best practice.

Generally, depending upon these covered areas the result that gathered from the building construction projects these were under construction in AA city discussed as follows:

4.3.1. Schedule Control Plan

Under this category, the researcher tries to address the schedule control plan practice by asking two main questions by questionnaire surveys these were whether they practiced creating the schedule plan and whether they practiced collecting metrics of schedule such as schedule baselines, schedule plan status, actual status. Accordingly, the result of the analysis is presented as follows in figure 4.3.

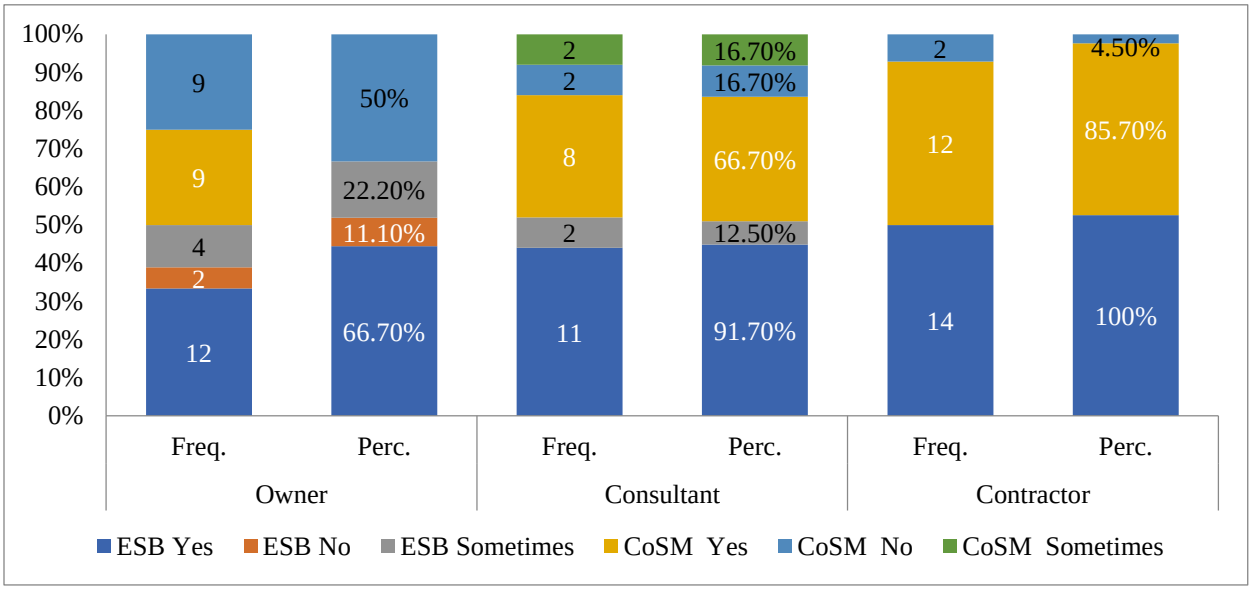

Figure 4.3: Practice of Creating Schedule Control Plan

From the above figure 4.3, the practice of establishing schedule baseline (ESB) according to the owners respondents from the total respondents 12 (66.7%) of them responded as they practice of establishing baseline for the schedule. Again, on the practice of collection of schedule metrics (CoSM) such as baseline, planned status from the total respondents 9 (50%) of them responded they collected the metrics during the plan and 9 (50%) of them responded that no practice of collecting the metrics. This implies that average owners in the building construction projects have the practice of collecting the schedule metrics.

Furthermore, according to the interview carried out in the organization, all interviewees addressed about schedule control plan as they were considering the creating of the schedule

baseline. However, the interviewee mentioned that the schedule baseline was created from the schedule submitted during the tendering phase, which was prepared by the winner contractors.

Secondly, according to the consultant respondents from the total respondents, 11 (91.7 %) of them responded that the schedule baseline was established or created in the organization. Again, the collection of schedule metrics such as baseline, planned status is well appointed according to 8 (66.7%) of respondents from the total respondents. This figure shows that most of the groups responded that they planned a schedule control plan by creating the schedule baseline and collection of metrics in consultant organizations.

In addition to this, from the data assessed through the interview, the interviewees responded that the schedule baseline was created from the schedule prepared and submitted from the contractors during the tendering that incased in the contract agreement.

Thirdly, according to the contractor group respondents, all 14 (100%) of the total respondents of the groups responded that the schedule baseline was established or created. Again, the collection of schedule metrics such as baseline, planned status is fully well appointed according to all 12 (85.7%) of the respondents. This figure shows that all of the groups' respondents responded that they planned a schedule control plan by creating the schedule baseline and planned to collect metrics in consultant organizations.

The data from the interviewee also shows that the contractor groups prepared the master schedule during the tendering phase/bidding, collecting and supervising the schedule baseline on the weekly and monthly plan. The schedule is planned and submitted on the bid and encased contractor agreement.

Generally, from the above discussion in each of the three organizations in building construction projects in Addis Ababa, the practice of the schedule control plan is well focused. Thus, 84.1% and 65.9% of the total population in the building construction in AA city were having the practice of the schedule control plan. However, the mandate of preparing the scheduling was given to the contractors. In parallel to this result the PMBOK guide and book by Wysocki,(2004), the schedule baseline is the major process that is the benchmark for managing all project control processes not only the schedule control system.

The measurement and approval of the performance of the project is depending on the schedule baselines. Again, a project management plan is composed of the schedule baseline. Therefore, the schedule control plan developed and initiated by the baseline and collection of the status metrics of the schedule leads to the successful accomplishment of the schedule control plan by all parties.

4.3.1.1. Monitoring of Schedule Control Plan Practice

Under this point, two main categories were analyzed and discussed, these were milestones managing and schedule performance metrics management practice in a building construction project in Addis Ababa city. Accordingly, the results are summarized in Figures 4.4 and 4.1.

a. Milestones Managing Practice

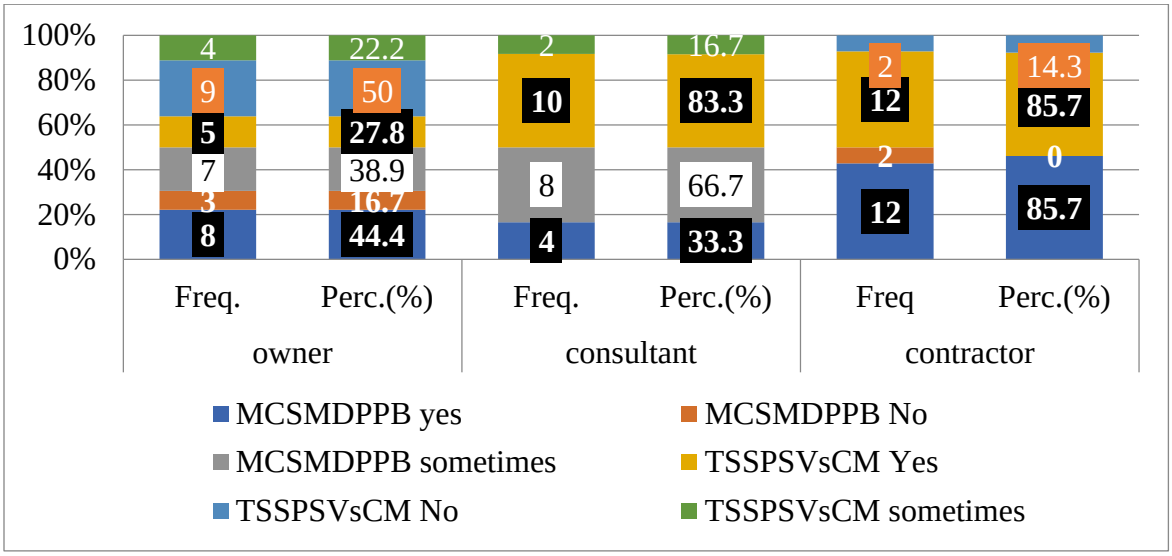

Figure 4.4: Milestone Managing Practice

From the above figure 4.4, 8(44.4%) the respondents from the owners' group manages changes of schedule milestone differently on a project by project basis (MCSMDPPB). Again, 9 (50%) responded as there was no the schedule status tracking using planned versus actual and completed milestones (TSSPSVsCM).

Likewise, the interview result shows that as there is no monitoring plan and there was a collecting of the report from the concerned teams and sometimes that employer supervises the major work that should be done in planned work and more the organization focus on the end-date of the project rather than monitoring every progress daily.

Secondly**,** the consultant's group, 8 (66.7%) manages changes of schedule milestone differently on a project by project basis they incoherently and 10 (83.3%) of the respondents responded that the practice of tracking schedule statues using the milestone planned versus actual and completed available in the firms.

In addition to this, the interview results address that there is no organized monitoring plan for the schedule controlling but there is supervision and report about the performed work. Consequently, by using this report they evaluate the actual and planned schedule for completed milestones and alert the contractor to overcome the scheduling problem.

Thirdly, in the contractors' group from the total respondents 12 (85.7%) responded as there was the management of the schedule changes and the practice of tracking schedule statues using the milestone planned versus actual and completed.

The interview result also shows that there were weekly and monthly work schedules in the project beyond the challenge that may lead the change. The scheduled monitoring of the schedule report is integrated with actual work supervision. Again, the schedule planned for the main activity or milestones is tracked by comparing the actual and planned ones.

Generally, in the building construction project of AA city, there is the practice of managing using the milestones. According to the PMBOK guide and book by Wysocki,(2004), Milestones are the significant event in the project that could identify the status of the schedule. Additionally, it is one of the inputs of the scheduling. The schedule milestone is one component of the schedule data and it should be included in it. Again, it is the components of the schedule performance's measurement criteria and included in project reports or schedule reports. It is included in the master schedule, to show the key milestones. Therefore, to monitor the schedule control plan the milestone is one of the criteria to monitor the schedule control as a project management tool.

b. Schedule Performance Metrics

Under this point, there are different questions raised for the respondents to identify the practice of schedule performance metrics monitoring. Accordingly, the result is analyzed and summarized in table 4.1 below.

Table 4.1: Practice of managing the schedule performance metrics

Schedule performance metrics			**owner**	**consultant**	**contractor**	**Total**
Adhering, and managing schedule baselines	Yes	Freq.	10	7	12	29
		Perce.	55.6%	58.3%	85.7%	65.9%
	No	Freq.	3	0	2	5
		Perce.	16.7%	0.0%	14.3%	11.4%
	Sometimes	Freq.	5	5	0	10
		Perce.	27.8%	41.7%	0.0%	22.7%
Performance metrics monitored and analyzed	Yes	Freq.	9	5	14	27
		Perce.	50%	41.7%	100.0%	61.4%
	No	Freq.	2	1	0	3
		Perce.	11.1%	8.3%	0.0%	6.8%
	Sometimes	Freq.	7	6	0	14
		Perce.	39.9%	50.0%	0.0%	31.8%
Schedule performance metrics tracked informally	Yes	Freq.	5	9	2	16
		Perce.	27.8%	75.0%	14.3%	36.4%
	No	Freq.	8	0	7	15
		Perce.	44.4%	0%	50%	34.1%
	Sometimes	Freq.	5	3	5	13
		Perce.	27.8%	25.0%	35.7%	29.5%
Corrective actions implemented for performance metrics	Yes	Freq.	12	2	14	28
		Perce.	66.7%	16.7%	100.0%	63.6%
	No	Freq.	2	2	0	4
		Perce.	11.1%	16.7%	0.0%	9.1%
	Sometimes	Freq.	4	8	0	12
		Perce.	22.2%	66.7%	0.0%	27.3%

As shown in the above table 4.1 the respondents from the owner group question about adhering, and managing schedule baselines after the schedule control from the total respondents 10(55.6%) of them responded as there was a practice of adhering and managing

schedule milestones. On the other hand, on the monitoring and analysis of performance metrics such as baseline, planned status, the total respondents of the owners' group, 9(50%) responded as they monitored and analyzed the schedule performance. Again, 8(44.4%) of the responded that the schedule performance metrics were not tracked informally which means that they tracked formally the schedule performance metrics. In the same manner about implementing the corrective action for performance metrics, 12 (66.7%) of the total numbers of respondents responded as there were an implementing the corrective action to the performance metrics in monitoring progress to control schedule.

Furthermore, in parallel with the interview result of this discussion, the interviewees mentioned that the established baseline was supervised and managed, and the alert of the schedule was noted to the contractor and consultant if there is a problem. However, since there is no monitoring plan organized for the organization the corrections are done through the report collected sometimes.

Again, as shown in the above table the respondents from the consultants' group 7 (58.3%) of the total respondents adhering, and managing schedule baselines after the schedule control. Similarly, 6(50%) of the total respondents monitor and analyze the performance metrics such as baseline, planned status incoherently.

Again, 9 (75%) of the respondents have tracked informally the schedule performance metrics sometimes. In the same way, 8 (66.7%) implement the corrective action for performance metrics sometimes.

The interview result also shows that there is no monitoring schedule control plan but the baseline is established and the actual and planned schedule informally tracked to provide the report about the change and challenges that affect the schedule baseline to consultants.

Thirdly, as shown in the above table the respondents from the contractors' group 12(85.7%) of the respondents, adhered, and manage schedule baselines. Again, 14(100%) all respondents monitor and analyze the performance metrics such as baseline, planned. Again, about 7 (50%) of the respondents have tracked informally the schedule performance metrics. In the same way about implementing the corrective action for performance metrics, all 14(100%) of them responded as there was a practice of implementing the corrective action.

Furthermore, in an interview that was done in this group, the schedule baseline and monitoring plan, which was integrated with actual works are prepared. Again, there is contract enforcement that they enclosed, they report the challenge belongs to the owner and consultant but the take action for the problem belongs to the contractors, and there was a work plan that was prepared on the weekly basis and formally tracked the schedule metrics.

Generally, from the above discussion, the practice of monitoring the schedule control in building construction, there is a practice of collecting the report of the performed work and supervision of the schedule controlling system in all three parties. However, the owner and consultant firms have no monitoring plans and the consultants have the practice of tracking the schedule informally sometimes. Finally, there is no uniform plan for monitoring the schedule control plan among the organization in the building construction in Addis Ababa city. However, as stated by the PMBOK,(2017) guide and book by Wysocki,(2004), the Performance metric is the trick that helps to evaluate the progress of the schedule during the schedule control. These are such as schedule variance, planned performance, and actual performance. Moreover, performance metrics are tracked in the sometimes gap to update the schedule status of the project. Therefore, there should be a monitoring plan to achieve a successful project schedule.

4.3.1.2. Evaluation of Schedule Control Plan

In table 4.2 below the response of the questionnaire about the evaluation, the schedule control plan has presented. Each response of the organization group about the practice of the schedule control plan evaluation.

Table 4.2: Practice of Evaluation of Schedule Control

Evaluation Of Schedule Control Plan			**Owner**	**Consultant**	**Contractor**	**Total**
Producing a simple variance analysis of schedule status	Yes	Freq.	13	12	10	35
		Perce.	72.2%	100%	71.4%	79.5%
	No	Freq.	0	0	2	2
		Perce.	0%	0%	14.3%	4.5%
	Sometimes	Freq.	5	0	2	7
		Perce.	27.8%	0%	14.3%	15.9%

Calculating the budgeted cost of work scheduled and performed	Yes	Freq.	14	5	11	30
		Perce.	77.8%	41.7%	78.6%	68.2%
	No	Freq.	0	1	0	1
		Perce.	0%	8.3%	0%	2.3%
	Sometimes	Freq.	4	6	3	13
		Perce.	22.2%	50%	21.4%	29.5%
The scheduling support earned-value analysis	Yes	Freq.	15	7	6	28
		Perce.	83.3%	58.3%	42.9%	63.6%
	No	Freq.	3	3	5	11
		Perce.	16.7%	25%	35.7%	25.0%
	Sometimes	Freq.	0	2	3	5
		Perce.	0%	16.7%	21.4%	11.4%
All earned value techniques used to compare project performance to the baseline and make forecasts	Yes	Freq.	8	7	11	26
		Perce.	44.4%	58.3%	78.6%	59.1%
	No	Freq.	5	3	1	9
		Perce.	27.8%	25%	7.1%	20.5%
	Sometimes	Freq.	5	2	2	9
		Perce.	27.8%	16.7%	14.3%	20.5%
Earned value techniques used to update project schedules and to support the determination of project efficiency and effectiveness	Yes	Freq.	12	12	10	34
		Perce.	66.7%	100%	71.4%	77.3%
	No	Freq.	2	0	4	6
		Perce.	11.1%	0%	28.6%	13.6%
	Sometimes	Freq.	4	0	0	4
		Perce.	22.2%	0%	0%	9.1%
Earned value and performance reporting integrated with cost and schedule system for	Yes	Freq.	10	7	7	24
		Perce.	55.6%	58.3%	50%	54.5%
	No	Freq.	3	1	0	4
		Perce.	16.7%	8.3%	0%	9.1%

certain project	Sometimes	Freq.	5	4	7	16
		Perce.	27.8%	33.3%	50%	36.4%

Table 4.2 above displays that 13 (72.2%) of the total owners' group respondents responded simple variance analysis is produced to evaluate the status of the schedule in the organization. The practice of calculating the budgeted cost of work scheduled and performed, 14(77.8%) of the respondents responded that their actual budget and planned budget were calculated in the organization. Again, 15(83.3%) of the total respondents were responded as the planned schedule support earned value analysis. Of the total respondents, 8(44.4%) believed that all earned value techniques were used to compare project performance to the baseline and make forecasts. Similarly, earned value techniques were used to update project schedules and to support the determination of project efficiency and effectiveness their response was the same depending upon the frequency distribution. Finally, earned value and performance reports integrated with cost and schedule system for the certain projects implemented according to the response of 10(55.6%) respondents.

Furthermore, in the interview, the interviewee responded that in public construction the report of actual work was collected from the consultant and the contractors to approve the payment again to compare the planned and actual work performed through progress. Once more, there is the crosscheck to determine the schedule change and budget change, which means there is a determination of schedule efficiency and effectiveness.

The Consultants response in table 4.2 above the display that 12(100%) of all group respondents have a practice of producing the simple variance analysis of schedule status which means simple variance analysis is produced to evaluate the status of the schedule. Again, The response 6 (50%) of all shows most of the consultants did not calculate consistently. The trends whether the planned schedule support earned value analysis was raised, and 7 (58.3%) of the total respondents were responded that the schedule support earned value analysis. Again, of the total respondents, 7(58.3%) of them believed that all earned value techniques were used to compare project performance to the baseline and make forecasts. Similarly, earned value techniques were used to update project schedules and to support the determination of project efficiency and effectiveness according to the response of groups. Finally, in the consultants' groups from total respondents, the response of 7 (58.3%)

of them were integrating the reports of earned value analysis with cost and schedule system for the assured projects.

Additionally, the data achieved from the interview shows that the consultant evaluates the schedule plan by collecting the actual work from the contractors and by cross-checking the actual work performed, as well as reporting the schedule performance to the owners and concerned body. This shows that the consultant performs the calculations of the planned and actual budget and determines the effectiveness and efficiency of the projects. This is done through simple variance analysis.

From the Contractors group response in table 4.2, 10(71.4%) of all group respondents were producing the simple variance analysis of schedule status. The practice of calculating the budgeted cost of work scheduled and performed was according to 11(78.6 %) of the respondents, the actual budget and planned budget were calculated in the organization. The trends whether the planned schedule support earned value analysis was raised and 6 (42.9%) of the total respondents were responded to planned schedule support the earned value analysis. Of the total respondents, 11 (78.6%) believed that all earned value techniques were used to compare project performance to the baseline and make forecasts. Similarly, 10 (71.4%) of the respondents were used earned value techniques to update project schedules and to support the determination of project efficiency and effectiveness. Finally, the contractors' groups from total respondents' responses of 7 (50%) imply that they were integrating the reports of earned value analysis with cost and schedule system for the assured projects.

Furthermore, the data from the interview shows that the contractors evaluate the schedule besides the payment claim schedule, however, there is a weekly plan schedule and monthly plan of the schedule depending upon the schedule there is the collection of change reports from the project team as well as there is evaluation of the critical activity. Again, the interview revealed that there is an evaluation of the cost planned and actual cost by integrating with the schedule planned.

Generally, from the above discussion, all three parties in the AA city building construction project have the practice of evaluating schedule control. However, the majorities of consultants do not have the consistent practice of calculating the actual budget and planned

budget. this is an important practice cause according to the PMBOK guide,(2017) and book by Wysocki,(2004), Information is generated through earned value analysis to update the schedule status and to make decisions. Again, used for report performance and to identify the variance of the schedule. It is a method of evaluating the schedule variation and the original schedule baselines. Therefore, monitor and reporting the project schedule progress and status through earned value analysis is the main activity.

4.3.1.3. Schedule Change Control

The objective of is point is to assess the change control practice on the schedule control plan. Generally, table 4.3 below summarizes the response collected from each group of organizations in building construction projects on schedule change control.

Table 4.3: Schedule Change Control Practice

Schedule Change control			**owner**	**consultant**	**contractor**	**Total**
Introduction of schedule change control concept	Yes	Freq.	11	2	10	23
		Perce.	61.1%	16.7%	71.4%	52.3%
	No	Freq.	3	4	2	9
		Perce.	16.7%	33.3%	14.3%	20.5%
	Sometimes	Freq.	4	6	2	12
		Perce.	22.2%	50.0%	14.3%	27.3%
schedule stat using, a change control form, a change-log, and an issues log/form process in the project	Yes	Freq.	7	1	9	17
		Perce.	38.9%	8.3%	64.3%	38.6%
	No	Freq.	8	4	2	14
		Perce.	44.4%	33.3%	14.3%	31.8%
	Sometimes	Freq.	3	7	3	13
		Perce.	16.7%	58.3%	21.4%	29.5%
schedule change control systems, schedule reporting, and earned value analysis practice by the project team	Yes	Freq.	9	6	8	23
		Perce.	50.0%	50.0%	57.1%	52.3%
	No	Freq.	2	0	2	4
		Perce.	11.1%	0.0%	14.3%	9.1%
	Sometimes	Freq.	7	6	4	17

		Perce.	38.9%	50.0%	28.6%	38.6%
Identification, evaluation, managing of schedule changes/status, and communication to stakeholders	Yes	Freq.	11	10	6	27
		Perce.	61.1%	83.3%	42.9%	61.4%
	No	Freq.	2	1	2	5
		Perce.	11.1%	8.3%	14.3%	11.4%
	Sometimes	Freq.	5	1	6	12
		Perce.	27.8%	8.3%	42.9%	27.3%
Integrating schedule change control system integrated with the organization's control systems, monitoring programs, and risk management process	Yes	Freq.	4	1	12	17
		Perce.	22.2%	8.3%	85.7%	38.6%
	No	Freq.	2	4	2	8
		Perce.	11.1%	33.3%	14.3%	18.2%
	Sometimes	Freq.	12	7	0	19
		Perce.	66.7%	58.3%	0.0%	43.2%

In the above table 4.3, the owners in building construction projects 11(61.1%) of the have practice of the introduction of schedule change control concepts. Again, 8 (44.4%) have no organized format and issue form for the schedule change control process. Afterward, 9(50%) of them have practices of change control systems in scheduling systems, schedule reporting, and earned value analysis by the project team. Again, 11(61.1%) of them responded as there was a practice of identification, evaluation, managing, and communication of the schedule change status in the organization. Lastly, 12(66.7%) of all rarely integrate the change control system with the control system, monitoring programs, and risk management process.

Furthermore, the interview data shows that no attention is given to the schedule plan alone rather there is integration with the overall change control system because the schedule is end-date driven and enforced by the contract. Again, the contractors could claim a change that did not belong to the organization, but if there is, change besides the owners the consultant submitted the change to the project team with a reasonable proposal.

In the consultant groups above 6 (50%) of the respondents, responded as they introduced the concepts of schedule change control sometimes. Again, on the second point, the 7(58.3%) of

respondents rarely use schedule stat using, a change control form, a change-log, and an issues log/form process in the project assessed. Afterward, there was an average practice of schedule change control systems, schedule reporting, and earned value analysis by the project team in the organization. Once more, 10(83.3%) of the total respondents have a practice of identification, evaluation, managing, and communication of the schedule change status in the organization. Lastly, 7(58.3%) of respondents rarely integrate the change control system with the control system, monitoring programs, and risk management process in the consultants firm.

In addition to this, the interviews data from the interviewee in the consultant groups change control for the schedule plan attention not given alone rather it integrated with the overall change control system rarely. The report or claim of change is collected from the contractors with a reasonable proposal. The project team identifies the schedule change by evaluating and alerting through the letter.

In the Contractors group, as shown in the above table 4.3, 10(71.4%) have a practice of introducing the concepts of schedule change control. Again, on the second point, 9(64.3%) of all has schedule stat using, a change control form, a change-log, and an issues log/form process for the schedule change control process. Afterward, 8(57.1%) of the group respondents responded as there is a practice of schedule change control systems, schedule reporting, and earned value analysis by the project team. Again, 6(42.9%) of the total responded sometimes and yes, which means there was an average practice of identification, evaluation, managing, and communication of the schedule change status in the organization. Lastly, in the contractor's groups, 12(85.7%) of respondents agree that there is an integration of the change control system with the control system, monitoring programs, and risk management process.

Additionally, this result is parallel with interview data that revealed the attention is given to the change control due to the liquidated damage that consequences of change and schedule delay due to change. The record of each change is kept on the form and log prepared for the project and evaluated accordingly the correction measure is taken. The change is not communicated always rather it is reported as-needed basis.

Generally, from the above discussion the in all three parties, there were perceptions of schedule change control introduction in the building construction projects. However, there is no consistent practice of schedule change control in consultants while there were consistent practices in the majority of owners and contractors. According to the PMBOK guide and book by Wysocki,(2004), one of the schedule controls is change control throughout the project cycle, these changes occur due to external factors, and some of them are initiated by the client. These changes influence the schedule progress. A documented process is change control for the schedule control. It is the step of controlling after evaluating the progress.

4.3.1.4. Schedule Control Reports

Under this category, the practice of the schedule report in building construction projects is presented, to show the availability of practice of schedule report. Accordingly, the result of the assessment is summarized in table 4.4.

Table 4.4: Schedule Control Report Practices

Schedule Control Reports			Owner	Consultant	Contractor	Total
Schedule reports provided on an as-needed basis	yes	Freq.	12	8	14	32
		Perce.	66.7%	66.7%	100.0%	72.7%
	no	Freq.	1	0	0	1
		Perce.	5.6%	0.0%	0.0%	2.3%
	Sometimes	Freq.	5	5	0	11
		Perce.	27.8%	33.3%	0.0%	25.0%
Summary and detailed schedule reports developed and provided to key stakeholders	yes	Freq.	11	5	14	30
		Perce.	61.1%	41.7%	100.0%	68.2%
	no	Freq.	3	2	0	5
		Perce.	16.7%	16.7%	0.0%	11.4%
	Sometimes	Freq.	4	5	0	9
		Perce.	22.2%	41.7%	0.0%	20.5%
Schedule reports produced from a central system	yes	Freq.	13	9	12	34
		Perce.	72.2%	75.0%	85.7%	77.3%
	no	Freq.	2	3	0	5

		Perce.	11.1%	25.0%	0.0%	11.4%
	Sometimes	Freq.	3	0	2	5
		Perce.	16.7%	0.0%	14.3%	11.4%
Integrating cost, and schedule reports	yes	Freq.	10	11	10	31
		Perce.	55.6%	91.7%	71.4%	70.5%
	no	Freq.	2	0	4	6
		Perce.	11.1%	0.0%	28.6%	13.6%
	Sometimes	Freq.	6	1	0	7
		Perce.	33.3%	8.3%	0.0%	15.9%
Cost and schedule reports integrated with technical reports	yes	Freq.	10	11	10	31
		Perce.	55.6%	91.7%	71.4%	70.5%
	no	Freq.	0	0	2	2
		Perce.	0.0%	0.0%	14.3%	4.5%
	Sometimes	Freq.	8	1	2	11
		Perce.	44.4%	8.3%	14.3%	25.0%

As shown above, in table 4.4 the respondents of the owner group and successively 66.7%, 61.1%, and 72.2% of all responded that they have the practice of providing the schedule report in detail for the key stakeholders from the core of the organization. Again, the practice in integrating the cost and schedule report, and cost and schedule with the technical report was asked and the response was respectively 55.6% and 55.6% responded that the report of schedule is integrated with cost and technical reports.

Furthermore, the interview data show that aligned with a result the schedule report by project teams is done through an oral briefing every week and the change is reported and again the report is produced in detail with a cost and the actual work performed through the payment claim. If there is a problem regarding the project beyond the project team the contractor and consultant alerted again the corrective measure is taken.

The consultants' group practice 66.7%, 41.7%, and 75% of all successively responded that they have the practice of providing the schedule report in detail for the key stakeholders from

the core of the organization. Again, the practice in integrating the cost and schedule report, and cost and schedule with the technical report 91.7% responded that they have.

Additionally, the result from the interview shows that the practices of the schedule plan reports were collected weekly from the resident engineer and the change was reported to the owners if there is a reasonable proposal achieved. Again, during approving the payment for the project the detail and summary of the projects were checked and reported to the key stakeholders.

Thirdly, the practice of the contractors' practice in providing the schedule report as-needed basis for the concerned body, the schedule report from the central system, and detailed summary of the schedule report for the key stakeholder the respondent's data successively 100%, 100%, and 85.7% implies that they have the practice. Again, the practice in integrating the cost and schedule report, and cost and schedule with the technical report was asked and the response was respectively 85.7% and 71.4%% responded that the report of schedule is integrated with cost and technical report.

Furthermore, the data collected from the interview shows that the detailed report is prepared with cost and actual work performed or technical, it is a monthly base report prepared for the key stakeholders. Thus, the report was also collected from the project team for the internal control system as well to govern the change that may occur.

Generally, in the above discussion in all three parties in the building construction, there is a practice of providing the schedule report as-needed basis for the concerned body. but the practice entire the projects were not uniform in all firms. According to the PMBOK guide, (2017) and book by Wysocki,(2004), schedule reporting is a documented standard that should use in all project control. It is the way to collect data of the schedule performance information including the status report, progress measurement, and forecasts. A performance report helps to alert the project team for the problem that may cause in the future. From this point of view, the practice of schedule reporting in the projects is available but not even.

4.3.1.5. The Practice of Developing and Documenting the Best Practice

Under this category, the practice of capturing best practices that were developed and documented for the other projects in building construction projects was assessed. Accordingly, the result summarized as follow in table 4.5.

Table 4.5: Practice of Capturing the Best Practice

The Practice of Developing And Documenting the Best Practice			**Owner**	**Consultant**	**Contractor**	**Total**
Individual project teams and segments of the organization applying their approach to managing and controlling schedules	yes	Freq.	14	4	12	30
		Perce.	77.8%	33.3%	85.7%	68.2%
	No	Freq.	3	2	0	5
		Perce.	16.7%	16.7%	0.0%	11.4%
	Sometimes	Freq.	1	6	2	9
		Perce.	5.6%	50.0%	14.3%	20.5%
A process in place (developed and documented) for managing and controlling schedules	yes	Freq.	17	9	14	40
		Perce.	94.4%	75.0%	100%	90.9%
	no	Freq.	0	2	0	2
		Perce.	0.0%	16.7%	0.0%	4.5%
	Sometimes	Freq.	1	1	0	2
		Perce.	5.6%	8.3%	0.0%	4.5%
A performance measurement process in place (developed and documented) to evaluate project schedule status and take corrective action	yes	Freq.	14	9	14	37
		Perce.	77.8%	75.0%	100.0%	84.1%
	Sometimes	Freq.	4	3	0	7
		Perce.	22.2%	25.0%	0.0%	15.9%
All schedule control processes in place, documented and being used	yes	Freq.	7	5	14	26
		Perce.	38.9%	41.7%	100%	59.1%
	no	Freq.	6	0	0	6
		Perce.	33.3%	0.0%	0.0%	13.6%
	Sometimes	Freq.	5	7	0	12
		Perce.	27.8%	58.3%	0.0%	27.3%
Schedule assessments	yes	Freq.	16	12	10	38

part of the determination of project efficiency and effectiveness		Perce.	88.9%	100.0%	71.4%	86.4%
	no	Freq.	2	0	0	2
		Perce.	11.1%	0.0%	0.0%	4.5%
	Sometimes	Freq.	0	0	4	4
		Perce.	0.0%	0.0%	28.6%	9.1%
A developing and documenting a process that uses schedule assessments and earned value techniques for management decisions during project execution	yes	Freq.	16	5	12	33
		Perce.	88.9%	41.7%	85.7%	75.0%
	no	Freq.	2	4	2	8
		Perce.	11.1%	33.3%	14.3%	18.2%
	Sometimes	Freq.	0	3	0	3
		Perce.	0.0%	25.0%	0.0%	6.8%
The calculating the schedule estimate at completion	yes	Freq.	15	9	12	36
		Perce.	83.3%	75.0%	85.7%	81.8%
	no	Freq.	3	0	2	5
		Perce.	16.7%	0.0%	14.3%	11.4%
	Sometimes	Freq.	0	3	0	3
		Perce.	0.0%	25.0%	0.0%	6.8%
Capturing the best practices and lessons learned to other projects	yes	Freq.	11	8	3	22
		Perce.	61.1%	66.7%	21.4%	50.0%
	no	Freq.	0	0	2	2
		Perce.	0.0%	0.0%	14.3%	4.5%
	Sometimes	Freq.	7	4	9	20
		Perce.	38.9%	33.3%	64.3%	45.5%
a process in place to continuously improve the schedule control process including	yes	Freq.	10	5	9	24
		Perce.	55.7%	41.7%	64.3%	54.5%
	no	Freq.	5	3	3	11
		Perce.	27.6%	25.0%	21.4%	25%

schedule-performance analyses	Sometimes	Freq.	3	4	2	9
		Perce.	16.7%	33.3%	14.3%	20.5%
best practices and lessons learned being used to improve Schedule Control	yes	Freq.	11	6	12	29
		Perce.	61.1%	50.0%	85.7%	65.9%
	no	Freq.	6	1	0	7
		Perce.	33.3%	8.3%	0.0%	15.9%
	Sometimes	Freq.	1	5	2	8
		Perce.	5.6%	41.7%	14.3%	18.2%

Table 4.5 above shows that the 14(77.8%) owners group respondent in the building construction projects, individual project teams, and segments of the organization applying their approach to managing and controlling schedules. Again, 17(94.4%) of the respondents agree that there is a process or procedure developed for managing and scheduling. Similarly, 14(77.8%) of the respondents responded that there is a process that is used for performance measurement to evaluate project status and take corrective action. Again, 16(88.9%) of them agreed that there was a practice of using schedule assessment to determine the project efficiency and effectiveness. Likewise, 16(88.9%) of the respondents responded that there was a practice of developing and documenting a process that was used for schedule assessments and earned value techniques for management decisions. All schedule control processes were documented and being used in the owner's group cause 7 (38.9%) of them responded that they used it. Thus, 15(83.3%) responded that there was the practice of calculating the schedule a completion. The owner data, 11(61.1%), 10(55.7%), and 11(61.1%) respectively shows that there is the practice of capturing the best practices, lessons learned to other projects, a process in place to continuously improve the schedule control, schedule performance analyses, the best practices, and lessons learned being used to improve schedule control.

Additionally, from the assessed interview data even if there is a trend of applying their approach but there was less initiation in the project team to create but the practice of influencing the critical activity to minimize the change occurred and risk associated. However, there is no document as standard to manage the schedule control.

Secondly, table 4.5 shows that the response of the consultants in the building construction project, 6 (50%) of all responded that in managing and controlling the schedule the project teams and segments of the organization apply their approach. Again, 9 (75%) of the respondents agree that there is a process or procedure developed for managing and scheduling. Similarly, 9(75%) of the respondents responded as there is a process that is used for performance measurement to evaluate project status and take corrective action. Again, the practice of using schedule assessment to determine the project efficiency and effectiveness, 12(100%) of the respondents agreed that they used it. Additionally, 7 (58.3%) of respondents responded that they developing and documenting the process that uses schedule assessments and earned value techniques for management decisions. Again, 7(58.3%) of the respondent agree all schedule control processes were documented and being used inconsistently. Similarly, 9 (75%) responded that they calculated the schedule as a completing and capturing experience. Lastly, in consultant groups, there was a practice of capturing and learning and continuously improving the schedule control in the consultants' groups in building construction projects.

Likewise, the interview data collected from the interviewee there is an assessment done by collecting reports from the project teams to minimize the risk of schedule delays. Again, the best practice to control the schedule is tracking the planned schedule with the help of the software package. Even if the effort of improving schedule control practice was available, yet there is no developed standard practice.

Lastly, the contractor in the building construction project, individual project teams, and segments of the organization apply their approach to managing and controlling schedules according to the response of 12(85.7%) of all respondents. Similarly, 14(100%) of the respondents agree that there is a process or procedure developed for managing and scheduling and there is a process that is used for performance measurement to evaluate project status and take corrective action. Again, 10(71.4%) agreed that there was the practice of using schedule assessment to determine the project efficiency and effectiveness. Thus, 12(85.7%) of respondents agree that developing and documenting the process that uses schedule assessments and earned value techniques for management decisions. All schedule control processes were documented and being used since 14(100%) of them responded that

they used it. Similarly, about calculating the schedule estimate at completion in the organization, 12(85.7%) responded that they calculated the schedule completion and capturing experience. Lastly, 9(64.3%) responded sometimes, and 9(64.3%), and 12(85.7%) agree that there is capturing the best practices, lessons learned to other projects and a process in place to continuously improve the schedule control, and schedule performance analyses, as well as best practices and lessons, learned being used to improve schedule control used respectively.

Additionally, in the contractor firm in the schedule, there is no best practice developed and documented to control the schedule. However, to some extent, there is the practice of managing the milestone or critical activity instigation as their firms. again the there's a calculation of the main activity to learn from it to minimize the risk related to schedule delay such as liquidated damage.

Generally, from the above discussion in all three parties, there is the practice of developing and documenting the best practices and lessons for the other projects in the schedule control process. As the PMBOK guide and book by Wysocki,(2004), states one way of improving the practice of project management control is capturing the best experience and lesson learned. The best practice is sharing the idea of the subordinates, external body, and others such as attending the conference. Additionally, it should available to other projects and documented throughout the project cycle but it is minimum at the final stage of the projects. However, the consultant firms have no consistent practice of capturing the best practice in the schedule control process while the majority of the owner's and contractor's data shows that there is a practice.

4.4. Factors Affecting Schedule Control in Building Construction

Under this part, the result of the significant factor affecting the schedule control in building construction projects in the AA city, which is ranked by relative importance index. Accordingly, the result summary presented in charts and tables as follows and the whole result is attached to the appendix parts.

➢ **Owners' Group**

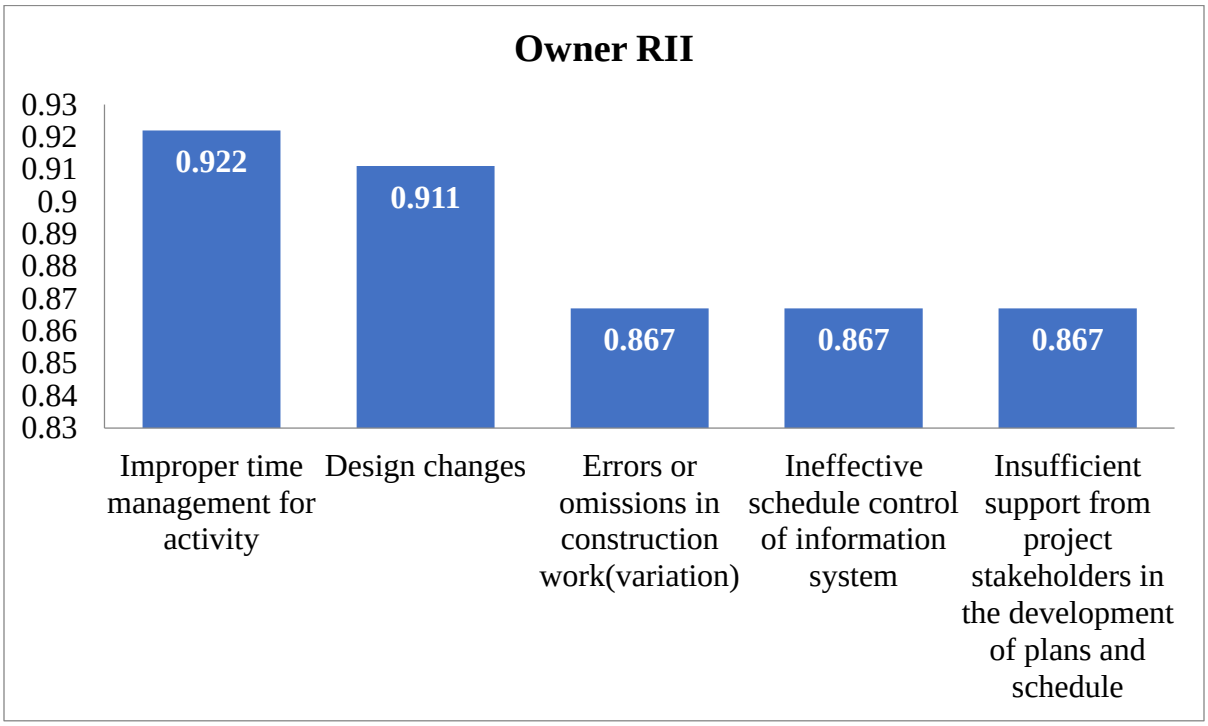

Figure 4.5: Top Significant Factors According to Owner's Respondents

The figure above shows that the ten most significant factors affecting the schedule control in building construction according to the owner respondents the Improper time management for activities is the first ranked with RII = 0.922. This is the same as the finding that Adeyemi and Aigbabvoa, (2018) identified in South Africa as a top inhibiting factor that affects time control.

The design change is also the second-ranked factor that highly occurred with RII =0.911. This means the time management factor that influences the schedule progress control. This is the same as the finding that Olawale and Sun (2010) identified in UK construction projects as a top inhibiting factor that affects time control.

Errors or omissions in construction work (variation), ineffective schedule control information's system, and Insufficient support from the project stakeholders in the development of plans and schedule are other factors that influence schedule control in building construction according to the owner respondents. This is with RII=0.867 ranked on

the third stage. This is in line with the finding that Larsen *et al.*, (2016), Fan et al, (2013) and found as the factor influencing factor of schedule control.

Furthermore, the factors affecting the schedule control in here above listed above were aligned with the data collected with data collected through interview data. For instance, the factors that affect the schedule control that revealed by the interviewee, design change by design teams, change of the design after the commencement of the work, inaccurate time estimation for each activity during the preparation of schedule ineffective time management and contract by the project team, miss management of subcontractors by contractors are some of them.

- **Consultant Group**

Table4.6: Top Significant Factors According to Consultant's Respondents

Factors Affecting Schedule Control	RII	Rank
Delay in payment for extra work/ variations late payment from contractor to subcontractors	0.800	1
Improper project feasibility studies, and insufficient data before the design	0.800	1
Ineffective tracking of in-progress schedule deviations	0.783	3
Ineffective site management	0.783	3
Inaccurate evaluation of project time/duration	0.767	5
Lack of schedule control plan	0.767	5
Inaccurate time and cost estimation by the contractors	0.767	5

According to the consultant respondent in table 4.6, the delay in payment for extra work and Improper project feasibility studies, and insufficient data before the design which is ranked on the top by the consultant as highly influencing factors with RII=0.8. This result is aligned with the result identified by Prasad *et al.*, (2018) and Hussain *et al.*, (2018).

Again, Ineffective tracking of in-progress schedule deviations and ineffective site management is the second factor that affects the schedule control with RII=0.783. This is similar to the finding drawn as the top factors that influence schedule performance in Singapore and Nigeria by Hwang, Zhao, and Ng (2013), and Michael, *et al.*, (2018)

Inaccurate evaluation of project time, Lack of schedule control plan, and Inaccurate time and cost estimation by the contractors are the fifth factors that influence schedule control by RII=0.767, which is similar to the finding drawn by Olawale and Sun,(2010), Ollmann, (2015) and (Islam & Suhariadi, 2018).

Likewise, the factors affecting the schedule control in here above listed above were aligned with the data collected with data collected through interview data. For instance, the factors that affect the schedule control revealed by the interviewee were poor forecasting of the problem by the contractors, the attention given to the problem by the owners, ineffective handling of the site by the contractors, inaccurate time estimation by the contractors, errors on the feasibility study and bureaucracy of the government officials are some of them.

- **Contractors' Group**

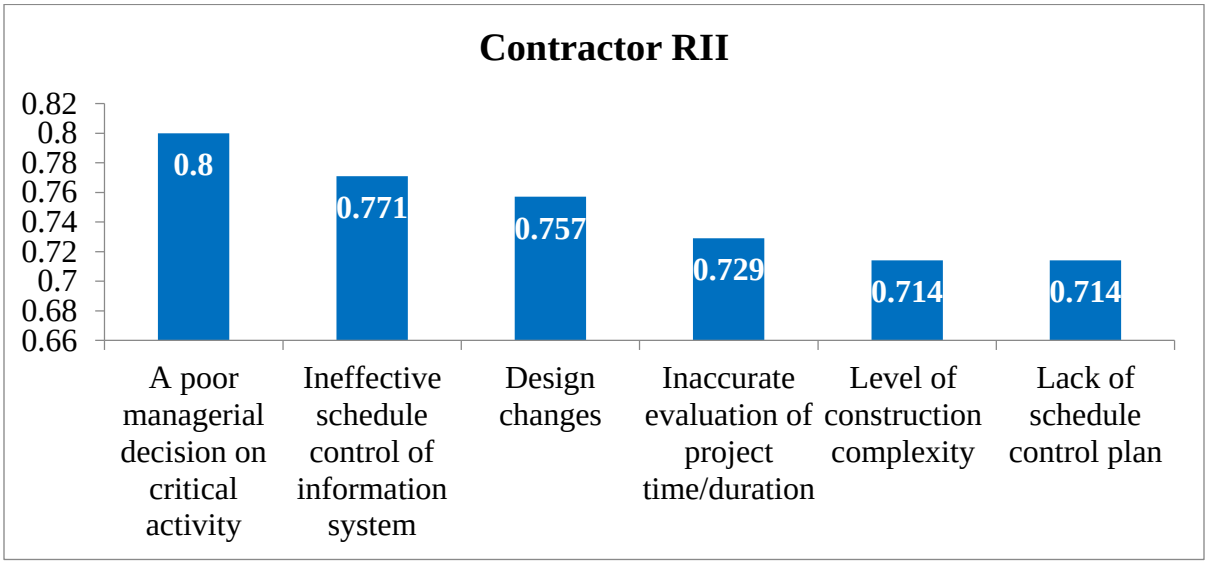

Figure 4.6: Top Significant Factors According to Contractors' Respondents

In figure 4.6 above, the contractors responded to the factor affecting schedule control, and depending upon their response a poor managerial decision on critical activity is ranked at the top by the RII= 0.8. This shows that contractors believe the performance of the project team affects the schedule control process or schedule control performance. This is in line with finding drawn by Michael *et al.*, (2018).

On the second, the contractor respondents ranked ineffective schedule control of information system that affects the schedule control with RII= 0.771. this is the top factor affecting the schedule control which is the same as with result drawn by Fan *et al*., (2013)

Design changes and Inaccurate evaluation of project time/duration are the factors that ranked on the third and fourth by RII= 0.757 and RII= 0.729 respectively, which is in parallel with the finding of Olawale and Sun (2010).

Level of construction complexity and lack of schedule control plan are the factors that ranked on the fifth top significant factors that affect the schedule control in building construction project with RII= 0.714according to the contractor response, which is similar to the finding drawn by Cho et al., (2009) and Ollmann, (2015)

Likewise, the factors affecting the schedule control in building construction projects similar to the above interview data. For instance, incompetence of the project team member from the owner, no integration of the stakeholders on decision-making, the time to prepare the bid is not enough to prepare the accurate schedule, and bureaucracy of the government office to decide and corruption that the contract administrator while approving the payment certificate are results revealed through interview. This is which is parallel with questionnaire results.

- **Relationship Among the Response of Groups**

Table 4.7: The Spearmen's Correlation Coefficient

	Rs	**P-Value**
Consultant and Owner	0.190	0.1688
Contractor and Owner	0.193	0.1629
Contractor and Consultant	0.163	0.2393

Table 4.7 shows the correlation among the parties in the building construction owner and consultant, owner and contractor, consultant and contractors.

According to this the degree of agreement between owner and consultant with correlation coefficient Rs= 0.190 there is a positive relationship between these two groups and it is not significant at the p-value 0.05 but with a p-value of 0.1688, there is a weak relationship which means there is a positive relationship among the responses. Therefore, 83% of the response is related.

Again, the relationship between owner and contractor is medium with Rs =0.193 and p-value 0.1629. Therefore, this figure shows even if there is a weak relationship between the respondents of the owner and contractor but there is a positive relationship on these factors.

However, the relationship between the consultant and contractor is very weak with Rs = 0.163 and the p-value is 0.2393. This figure shows there is a weak relationship between these two groups but a positive relationship is there between their responses.

- **Overall responses**

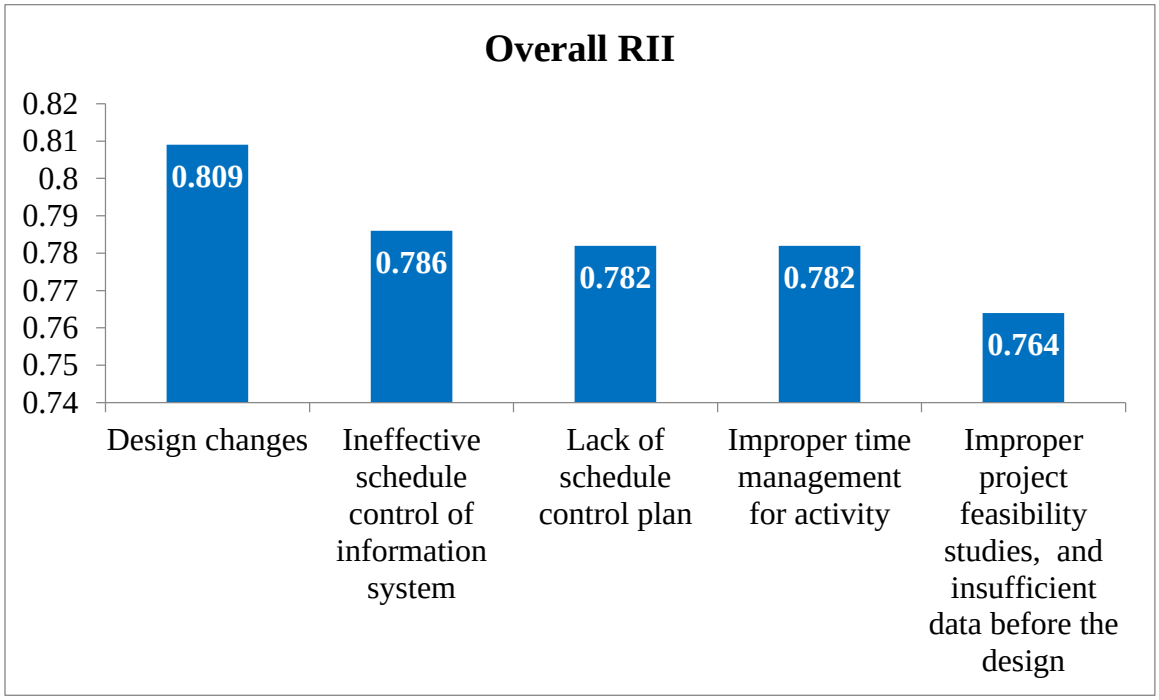

Figure 4.7: Overall Top Significant in Building Construction Projects in AA City

The above figure 4.7 shows that the rank of overall top significant factors that affect the schedule control in the building construction projects according to the response of the owner, consultant, and contractor.

Design changes among the top significant factor that is ranked at the first level with RII = 0.809. This influences the total schedule control processes by influencing each activity with a construction project in the building construction projects of AA city.

Ineffective schedule control of information systems is the factor with RII=0.786 that ranked on the second significant factor affecting the schedule control in building construction

projects according to all three parties involved in the implementation of the construction projects.

Again, lack of schedule control plan and improper time management for activity are the other factors that influence highly schedule control with RII=0.782 and ranked third among all factors listed.

Improper project feasibility studies and insufficient data before design are the other schedule control affecting factors that are ranked fifth according to all respondents with RII=0.764.

4.5. Schedule Control Tools and Techniques

The other specific objective of the study was to identify the schedule control methods in building construction projects in Addis Ababa, which means tools and techniques that the construction project is using in the process of controlling the schedule in construction.

4.1.1. Schedule Control Techniques

In this part, the objective is to identify the techniques used for schedule control in building construction projects. The results from the questionnaires were analyzed through the multiple-response analysis system and presented as follows in figure 4.5.

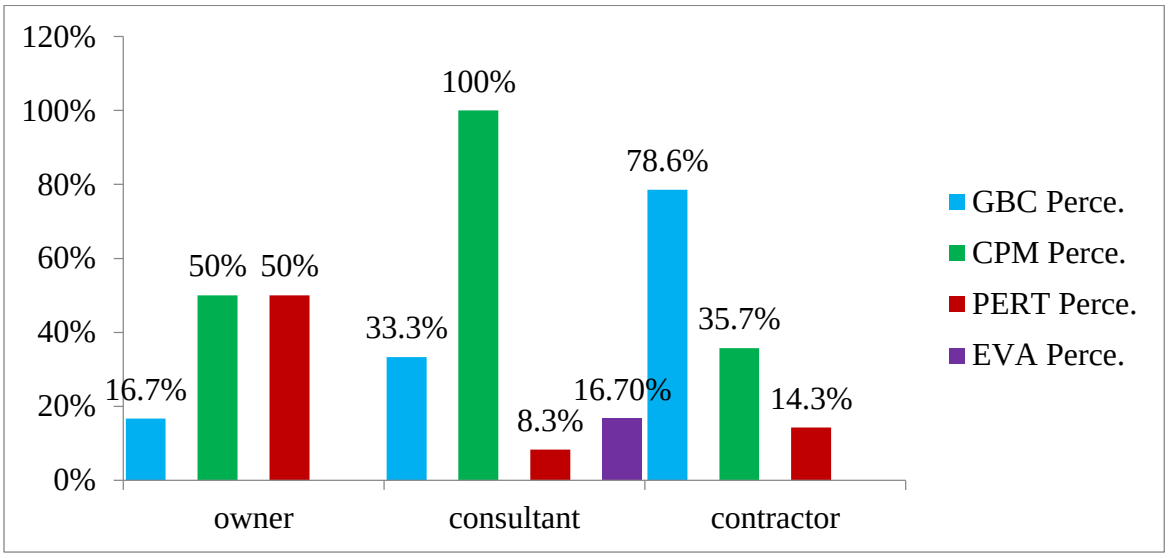

Figure 4.8: Schedule Control Techniques

The above figure 4.8 shows that schedule control techniques in building construction according to the percentage and frequency distribution concepts by multiple response

analysis systems, 50% of owners used critical path method (CPM) and program evaluation and review technique (PERT) to control schedule. Again, 16.7% of owners used Gant bar chart (GBC). Therefore, this implies that the major owners use the CPM and PERT techniques for the schedule control system.

Secondly, in the same figure 4.8, the consultants' group response according to the percentage and frequency distribution by multiple response analysis systems, all the consultants' respondents 100% responded that they use CPM and 33.3% used GBC. Therefore, majority of the consultants uses CPM techniques to control schedule.

Lastly, the contractors' group in building construction as of response by multiple responses analysis systems, GBC was selected 78.6% by the respondent. Again, the CPM was selected 35.7% by respondents. Therefore, this implies that the majority of contractors use the GBC techniques for the schedule control system.

Generally, from the above discussion, the techniques used in the building construction project in AA city, there was no variety of techniques used as collected directly and indirectly analysis of the response from the interview and questionnaire. Again, from the interview data, all three parties use the critical path methods. However, the critical path method is also managed and controlled through earned value analysis system. Therefore, in the building construction projects in AA city technique used for schedule control is the critical path method (CPM).

4.1.2. Schedule Control Tools

This part addresses the tools or applications that simplify the schedule control that is used in building construction projects according to the data collected through the questionnaire. These data were analyzed through multiple response analysis systems and the results are presented as follows by figure 4.9.

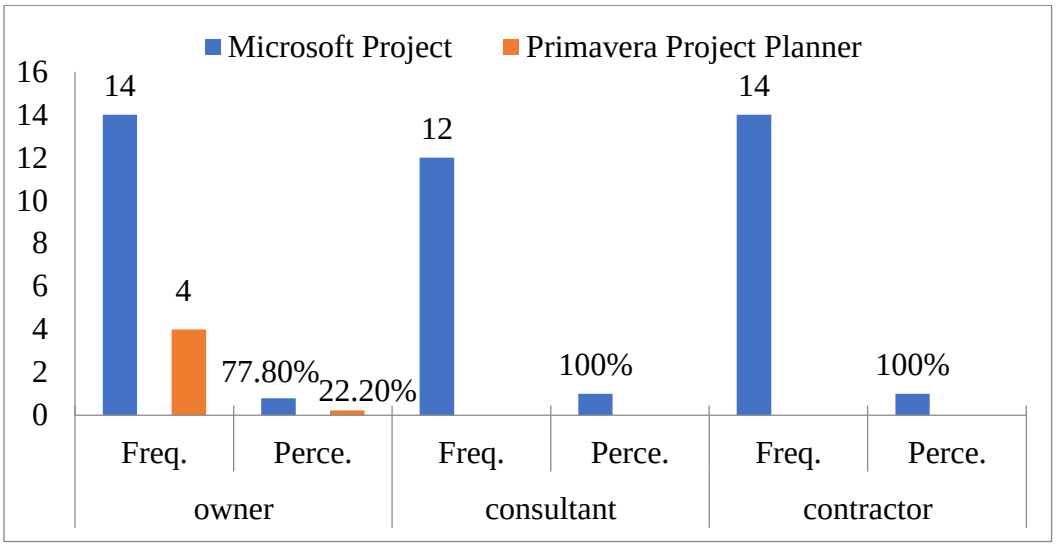

Figure 4.9: Schedule Control Tools

Figure 4.6 shows that schedule control tools in building construction according to multiple responses analysis systems; from the total owner's respondent 12(78.8%) of them selected Microsoft Project and 4 (22.20%) of the selected Primavera Project Planner. Therefore, this implies that almost the entire owner group used Microsoft Project as a tool for schedule control.

Secondly**,** the consultants' group selects the schedule control tools in building construction, from total respondents 12(100%) of them uses Microsoft Project. Therefore, this implies that the consultants' group used the Microsoft Project as a tool for the schedule control system.

Lastly, according to the contractor's group the schedule control tools in building construction by multiple response analysis systems, all 14 (100%) of the respondents use Microsoft Project. This implies that the contractors use the Microsoft Project as a tool for the schedule control system.

Furthermore, the interview data revealed that they use Microsoft Excel in addition to the Microsoft project as tools in using in the schedule control.

Generally, from the above discussion of the techniques used in the building construction project in AA city, there is no variety of tools, which aid the schedule control in construction projects, according to the data from interviews and questionnaires. All three parties use the Microsoft project tools or software package that assists in schedule control in the project progress.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1. CONCLUSION

Schedule control essential exertion in the construction industry to overcome the problem faced related to time management. Consequently, the objective of this thesis was to assess the schedule control practice in building construction projects in AA city. From the data collected through questionnaire and interview, the results were discussed and, finally, the conclusion of the study is drawn as follows:-

The availability of schedule control practice for each of the three parties was assessed and identified and there are practices of schedule control practice in AA city building construction projects. However, the practices of each of the three parties are not the same or uniform and there is less integration of the stakeholder with one another. Again, only the contractors prepare the scheduling and less attention is given to schedule control in owner and consultant.

Secondly, the significant factors that hindered the schedule control in building construction projects were identified. The top-ranked factors in the building construction project among 54 factors identified are Design changes (0.809), Ineffective schedule control of information system (0.786), lack of schedule control plan (0.782), improper time management for activity (0.782), improper project feasibility studies and insufficient data before design (0.764). Thus, the relation of the rank responses of each party has a positive correlation to each other.

Finally, the study revealed that the critical path method (CPM) and Gant bar chart are schedule control techniques used in building construction projects by all three parties. Again, the tools that are used are Microsoft project and Microsoft excel that aids the schedule control. Again, there is no practice of using updated tools and techniques used in the industry, which upgraded with the advancement of technology.

5.2. RECOMMENDATION

In parallel with the problem assessed regarding the schedule the researcher forwards control practice in the building construction project in AA city the following recommendation:

- ☞ There should be integration and communication flow among the project team and stakeholders entire the organization throughout the project life cycle, and competent team members or labor should be assigned to the position right to minimize the schedule risk and to make a uniform control system.
- ☞ The accuracy of the schedule plan must be considered and all stakeholders should review the master schedule before commencement to minimize the risk.
- ☞ The training should be given to the staff and project team in the organization about schedule control systems and various techniques of schedule control should be introduced to all parties. All construction projects stakeholders should have updated knowledge of the software package that helps for the schedule control and there should be a practice of developing and training with modern technology outcomes.

- **For the owners**
  - ☞ The owners should focus on the schedule control and prepare the scheduling before commencement and should compare with the schedule prepared by the contractor to minimize the shortcoming in schedule control as well as should focus on monitoring the schedule progress and take corrective action thoroughly.
- **For the consultant**
  - ☞ The consultant should have a focus on schedule control, monitor, and evaluate throughout the project cycle separately to attain an effective project schedule with an effective time as well as design should be checked before proceeding.
- **For the contractors**
  - ☞ The contractor should submit a reasonable time during the bidding stage rather than focusing on the winning of the tender.
- **For next researcher**
  - ☞ For coming researchers, the researcher recommended that it is better to assess the level of the schedule control practice and the impacts of schedule control problems on overall project control. and detailed study using the other method to prepare the models that aid the ease of tracking the schedule control and to simplify schedule control that could make a uniform system of controlling all over the construction industry.

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APPENDICES

Appendix-A:- General Information of Population Size

1. Frequency and percentage of the contractors grade level

Grade of contractor	**Frequency**	**Percentage%**
Grade one	7	50%
Grade two	3	21.4%
Grade three	4	28.6%
Total	14	100%

Appendix-B:- Summary of the Finding of Schedule Control Practice

		owner	**consultant**	**contractors**	**Total**
	Schedule control plan				
1	Establishing schedule baselines	-	-	-	-
2	Collection of metrics (schedule baseline, planned status)	AV	-	-	-
	Milestones managing practice				
3	Managing changes of schedule milestones differently on a project by project basis	-	S	-	-
4	Tracking the schedule statues using planned versus actual and completed millstones	N	-	-	-
	Schedule performance metrics				
5	adhering, and managing schedule baselines	-	-	-	-
6	performance metrics monitored and analyzed	-	S	-	-
7	schedule performance metrics tracked informally	N	-	N	-
8	corrective actions implemented for performance metrics	-	S	-	-
	Evaluation of schedule control plan				
9	Producing a simple variance analysis of schedule status	-	-	-	
10	Calculating the budgeted cost of work scheduled and performed	-	S	-	
11	The scheduling support earned-value analysis	-	-	-	-
12	All earned value techniques used to compare project performance to the baseline and make forecasts	-	-	-	-
13	Earned value techniques used to update project schedules and to support the determination of project efficiency and effectiveness	-	-	-	-
14	Earned value and performance reporting integrated with cost and schedule system for certain project	-	-	AV	
	Change control				
15	Introduction of schedule change control concept	-	S	-	-
16	schedule stat using, a change control form, a change-log, and an issues log/form process in the project	N	S	-	-
17	schedule change control systems, schedule reporting, and earned value analysis practice by the project team	-	AV	-	-
18	Identification, evaluation, managing of schedule changes/status, and communication to	-	-	AV	-

	stakeholders				
19	Integrating schedule change control system integrated with the organization's control systems, monitoring programs, and risk management process	S	S	-	-
	Schedule control Reports				
20	Schedule reports provided on an as-needed basis	-	-	-	-
21	Summary and detailed schedule reports developed and provided to key stakeholders	-	AV	-	-
22	Schedule reports produced from a central system	-	-	-	-
23	Integrating cost, and schedule reports	-	-	-	-
24	Cost and schedule reports integrated with technical reports	-	-	-	-
	The practice of developing and documenting the best practice				
25	Individual project teams and segments of the organization applying their approach to managing and controlling schedules	-	**S**	-	-
26	A process in place (developed and documented) for managing and controlling schedules	-	-	-	-
27	A performance measurement process in place to evaluate project schedule status and take corrective action	-	-	-	-
28	All schedule control processes in place, documented, and being used	-	S	-	-
29	schedule assessments part of the determination of project efficiency and effectiveness	-	-	-	-
30	A developing and documenting process that uses schedule assessments and earned value techniques for management decisions	-	-	-	-
31	Calculating the schedule estimate at completion	-	-	-	-
32	Capturing the best practices and lessons learned to other projects	-	-	-	S
33	A process in place to continuously improve the schedule control and schedule performance analyses	-	-	-	-
34	Best practices and lessons learned being used to improve Schedule Control	-	-	-	-

Appendix-C:- Raw Data of Factors

a) Owners

Factors affecting schedule control	Degree of Occurrences					RII	Rank
	1	2	3	4	5		
	By a very low amount	By a low amount	By a medium amount	By a high amount	By a very high amount		
Level of construction complexity	3	-	3	-	12	0.800	15
Technical details of construction	3	-	5	9	1	0.656	47
Construction method	-	10	3	4	1	0.556	52
Inaccurate evaluation of project time/duration	-	5	3	4	6	0.722	32
Lack of proper progress Monitoring and feedback by project participants	-	3	-	5	10	0.844	6
Lack of good coordination among various parties	3	4	6	1	4	0.589	48
Insignificant control and reporting system Between management levels	-	7	9	1	1	0.556	52
Errors or omissions in construction work(variation)	1	-	3	2	12	0.867	3
Design changes	1	-	-	4	13	0.911	2
Ineffective schedule control of information system	-	1	3	3	11	0.867	3
Lack of a regular schedule of the inspection and acceptance system	-	2	7	1	8	0.767	23
Lack of schedule control plan	-	-	4	6	8	0.844	6
Ineffective tracking of in-progress schedule deviations	-	3	8	4	3	0.678	42

Lack of identification of needs	-	7	1	2	8	0.722	32
Use of wrong project scheduling techniques	-	4	4	2	8	0.756	25
A poor managerial decision on critical activity	2	3	1	1	11	0.778	21
Poor communication among contracting parties	-	3	1	5	9	0.822	11
Incompatibility of planning methods with the project schedule's nature	-	-	4	7	7	0.833	9
Incompetency of the project team	-	5	-	7	6	0.756	25
Lack of expertise in scheduling and the inaccurate estimate of human resources required	-	4	-	11	3	0.744	27
Delay or long process times caused by other authorities and bruecracy	-	1	3	9	5	0.800	15
Inefficient materials management	-	6	1	6	5	0.711	36
Improper time management for activity	-	-	-	7	11	0.922	1
Ineffective site management	-	2	5	3	8	0.789	18
Site constraint's	2	1	4	4	7	0.744	27
Lack of virtual collaboration	-	1	-	11	6	0.844	6
Poor subcontractor performance by the contractor	-	-	6	3	9	0.833	9
Lack of resource leveling in the schedule	2	1	7	-	8	0.722	32
Risks/uncertainties	3	3	1	7	4	0.667	46
Managing with end-date-driven schedules	-	-	4	8	6	0.822	11

Lack of Commitment of all project participants	1	-	3	11	3	0.767	23
Financial difficulties of the owner	5	-	1	7	5	0.678	42
Delays in progress payments	2	-	7	4	5	0.711	36
Tendering process	6	4	3	3	2	0.500	54
Lowest bidder selection	2	1	8	-	7	0.700	40
Late procurement of materials	2	5	7	-	4	0.589	48
Scarcity of skilled, and highly experienced workers	2	-	7	4	5	0.711	36
Lack of effective leadership	-	-	6	7	5	0.789	18
The small stage of construction leadership ability	2	5	3	-	8	0.678	42
Improper planning and scheduling	-	-	3	10	5	0.822	11
Insufficient support from project stakeholders in the development of plans and schedule	-	-	1	10	7	0.867	3
Contractors' cash flow problem during construction	2	1	1	11	3	0.733	29
Delay in payment for extra work/ variations late payment from contractor to subcontractors	2	-	1	6	9	0.822	11
Inaccurate time and cost estimation by the contractors	-	2	6	6	4	0.733	29
Improper project feasibility studies, and insufficient data before the design	-	-	8	2	8	0.800	15
Time given to contractors to prepare their bid	2	-	8	5	3	0.678	42

Project scope definition completion when the bid is invited	2	-	7	5	4	0.700	40
Owner's administrative load	3	-	13	1	1	0.567	51
Delay in settlement of claims by the owner	2	-	4	4	8	0.778	21
Quality issues and errors	1	5	-	7	5	0.711	36
Extreme weather conditions	-	3	4	7	4	0.733	29
Ineffectiveness of labor productivity	2	1	4	-	11	0.789	18
Lack of Establishing measurable milestones	2	-	5	7	4	0.722	32
The flexibility of work scope	3	-	10	5	-	0.589	48

b) Consultants

Factors Affecting Schedule Control	Degree of occurrences					RII	Rank
	1	2	3	4	5		
	By a Very Low Amount	By a Low Amount	By a Medium Amount	By A High Amount	By a Very High Amount		
Level of construction complexity	4	2	2	-	4	0.567	48
Technical details of construction	4	2	2	2	2	0.533	53
Construction method	-	3	5	-	4	0.683	24
Inaccurate evaluation of project time/duration	1	-	5	-	6	0.767	5
Lack of proper progress Monitoring and feedback by project participants	3	3	2	2	2	0.550	51
Lack of good coordination among various parties	1	1	4	6	-	0.650	29
Insignificant control and reporting system Between management levels	1	4	3	-	4	0.633	38

Errors or omissions in construction work(variation)	-	4	2	6	-	0.633	38
Design changes	-	3	1	6	2	0.717	17
Ineffective schedule control of information system	1	0	6	3	2	0.683	24
Lack of a regular schedule of the inspection and acceptance system	1	2	4	3	2	0.650	29
Lack of schedule control plan	0	1	4	3	4	0.767	5
Ineffective tracking of in-progress schedule deviations	0	1	4	2	5	0.783	3
Lack of identification of needs	0	3	5	2	2	0.650	29
Use of wrong project scheduling techniques	1	3	4	0	4	0.650	29
A poor managerial decision on critical activity	0	3	5	0	4	0.683	24
Poor communication among contracting parties	2	3	2	3	2	0.600	46
Incompatibility of planning methods with the project schedule's nature	0	5	2	3	2	0.633	38
Incompetency of the project team	2	4	0	2	4	0.633	38
Lack of expertise in scheduling and the inaccurate estimate of human resources required	0	3	1	4	4	0.750	8
Delay or long process times caused by other authorities and bruecracy	2	0	4	2	4	0.700	20
Inefficient materials management	0	4	2	4	2	0.667	27
Improper time	0	3	2	3	4	0.733	15

management for activity							
Ineffective site management	0	3	2	0	7	0.783	3
Site constraint's	1	4	2	1	4	0.650	29
Lack of virtual collaboration	3	2	3	2	2	0.567	48
Poor subcontractor performance by the contractor	0	2	3	3	4	0.750	8
Lack of resource leveling in the schedule	0	2	4	4	2	0.700	20
Risks/uncertainties	2	3	1	4	2	0.617	42
Managing with end-date-driven schedules	0	2	1	7	2	0.750	8
Lack of Commitment of all project participants	2	3	5	0	2	0.550	51
Financial difficulties of the owner	2	1	0	5	4	0.733	15
Delays in progress payments	2	0	1	5	4	0.750	8
Tendering process	4	0	1	5	2	0.617	42
Lowest bidder selection	4	0	4	2	2	0.567	48
Late procurement of materials	0	1	6	3	2	0.700	20
Scarcity of skilled, and highly experienced workers	0	0	5	5	2	0.750	8
Lack of effective leadership	0	2	3	3	4	0.750	8
The small stage of construction leadership ability	0	3	5	2	2	0.650	29
Improper planning and scheduling	0	0	5	7	0	0.717	17
Insufficient support from project stakeholders in the development of plans and schedule	2	0	0	7	3	0.750	8
Contractors' cash flow problem during	2	0	2	6	2	0.700	20

construction							
Delay in payment for extra work/ variations late payment from contractor to subcontractors	0	0	2	8	2	0.800	1
Inaccurate time and cost estimation by the contractors	0	1	4	3	4	0.767	5
Improper project feasibility studies, and insufficient data before the design	0	0	4	4	4	0.800	1
Time given to contractors to prepare their bid	4	2	4	0	2	0.500	54
Project scope definition completion when the bid is invited	0	1	8	1	2	0.667	27
Owner's administrative load	2	1	3	4	2	0.650	29
Delay in settlement of claims by the owner	2	1	3	6	0	0.617	42
Quality issues and errors	1	1	2	6	2	0.717	17
Extreme weather conditions	3	0	5	2	2	0.600	46
Ineffectiveness of labor productivity	0	1	7	4	0	0.650	29
Lack of Establishing measurable milestones	2	1	3	6	0	0.617	42
The flexibility of work scope	0	1	7	4	0	0.650	29

c) contractors

	Degree of occurrences						
	1	2	3	4	5		
Factors affecting schedule control	By a Very Low Amount	By a Low Amount	By a Medium Amount	By a High Amount	By a Very High Amount	RII	Rank
Level of construction complexity	2	0	4	4	4	0.714	5
Technical details of construction	2	0	8	4	0	0.600	32
Construction method	4	0	0	6	4	0.686	8
Inaccurate evaluation of project time/duration	2	2	0	5	5	0.729	4
Lack of proper progress Monitoring and feedback by project participants	2	4	3	0	5	0.629	26
Lack of good coordination among various parties	2	0	5	3	4	0.700	7
Insignificant control and reporting system Between management levels	2	2	4	2	4	0.657	19
Errors or omissions in construction work(variation)	2	0	7	2	3	0.657	19
Design changes	2	0	0	9	3	0.757	3
Ineffective schedule control of information system	2	0	1	6	5	0.771	2
Lack of a regular schedule of the inspection and acceptance system	2	2	6	0	4	0.629	26
Lack of schedule control plan	2	0	4	4	4	0.714	5
Ineffective tracking of in-progress schedule deviations	0	2	5	7	0	0.671	14
Lack of identification of needs	2	2	7	3	0	0.557	40
Use of wrong project scheduling techniques	2	0	7	4	1	0.629	26
A poor managerial decision on critical activity	2	0	2	2	8	0.800	1
Poor communication among contracting parties	2	0	4	8	0	0.657	19
Incompatibility of planning methods with the project	5	0	0	9	0	0.586	35

schedule's nature							
Incompetency of the project team	5	0	0	2	7	0.686	8
Lack of expertise in scheduling and the inaccurate estimate of human resources required	2	3	2	5	2	0.629	26
Delay or long process times caused by other authorities and bruecracy	2	3	6	1	2	0.571	38
Inefficient materials management	2	0	9	2	1	0.600	32
Improper time management for activity	2	3	2	4	3	0.643	23
Ineffective site management	2	3	2	6	1	0.614	30
Site constraint's	5	0	6	3	0	0.500	50
Lack of virtual collaboration	2	3	2	7	0	0.600	32
Poor subcontractor performance by the contractor	2	3	6	2	1	0.557	40
Lack of resource leveling in the schedule	2	5	2	4	1	0.557	40
Risks/uncertainties	0	5	0	7	2	0.686	8
Managing with end-date-driven schedules	2	2	6	4	0	0.571	38
Lack of Commitment of all project participants	2	5	1	6	0	0.557	40
Financial difficulties of the owner	3	6	0	4	1	0.514	48
Delays in progress payments	3	6	2	0	3	0.514	48
Tendering process	9	0	2	2	1	0.400	54
Lowest bidder selection	7	0	5	2	0	0.429	53
Late procurement of materials	3	3	2	6	0	0.557	40
Scarcity of skilled, and highly experienced workers	2	2	0	9	1	0.671	14
Lack of effective leadership	0	4	3	6	1	0.657	19
The small stage of construction leadership ability	2	0	3	9	0	0.671	14
Improper planning and scheduling	0	5	4	5	1	0.671	14
Insufficient support from project stakeholders in the development of plans and schedule	2	3	2	6	1	0.614	30

Contractors' cash flow problem during construction	2	7	4	0	1	0.471	52
Delay in payment for extra work/ variations late payment from contractor to subcontractors	2	6	0	3	3	0.586	35
Inaccurate time and cost estimation by the contractors	2	0	4	7	1	0.671	14
Improper project feasibility studies, and insufficient data before the design	2	2	2	4	4	0.686	8
Time given to contractors to prepare their bid	5	0	2	5	2	0.586	35
Project scope definition completion when the bid is invited	2	0	4	6	2	0.686	8
Owner's administrative load	5	1	2	6	0	0.529	47
Delay in settlement of claims by the owner	2	3	5	4	0	0.557	40
Quality issues and errors	2	4	4	4	0	0.543	46
Extreme weather conditions	5	2	3	4	0	0.486	51
Ineffectiveness of labor productivity	2	0	5	7	0	0.643	23
Lack of Establishing measurable milestones	2	0	2	10	0	0.686	8
The flexibility of work scope	2	0	5	7	0	0.643	23

d) overall raw data

factors affecting schedule control	Degree of Occurrence						
	1	2	3	4	5		
	By a very low amount	By a low amount	By a medium amount	By a high amount	By a very high amount	**RII**	**Rank**
Level of construction complexity	9	2	9	4	20	0.709	17
Technical details of construction	9	2	15	15	3	0.605	50
Construction method	4	13	8	10	9	0.632	45
Inaccurate evaluation of project time/duration	3	7	8	9	17	0.736	9
Lack of proper progress Monitoring and feedback by	5	10	5	7	17	0.695	26

project participants							
Lack of good coordination among various parties	6	5	15	10	8	0.641	40
Insignificant control and reporting system Between management levels	3	13	16	3	9	0.609	48
Errors or omissions in construction work(variation)	3	4	12	10	15	0.736	9
Design changes	3	3	1	19	18	0.809	1
Ineffective schedule control of information system	3	1	10	12	18	0.786	2
Lack of a regular schedule of the inspection and acceptance system	3	6	17	4	14	0.691	27
Lack of schedule control plan	2	1	12	13	16	0.782	3
Ineffective tracking of in-progress schedule deviations	0	6	17	13	8	0.705	21
Lack of identification of needs	2	12	13	7	10	0.650	39
Use of wrong project scheduling techniques	3	7	15	6	13	0.686	29
A poor managerial decision on critical activity	4	6	8	3	23	0.759	6
Poor communication among contracting parties	4	6	7	16	11	0.709	17
Incompatibility of planning methods with the project schedule's nature	5	5	6	19	9	0.700	23
Incompetency of the project team	7	9	0	11	17	0.700	23
Lack of expertise in scheduling and the inaccurate estimate of human resources required	2	10	3	20	9	0.709	17
Delay or long process times caused by other authorities and bruecracy	4	4	13	12	11	0.700	23
Inefficient materials management	2	10	12	12	8	0.664	33
Improper time management for activity	2	6	4	14	18	0.782	3
Ineffective site management	2	8	9	9	16	0.732	12
Site constraint's	8	5	12	8	11	0.641	40
Lack of virtual collaboration	5	6	5	20	8	0.691	27
Poor subcontractor performance by the contractor	2	5	15	8	14	0.723	14
Lack of resource leveling in the schedule	4	8	13	8	11	0.664	33

Risks/uncertainties	5	11	2	18	8	0.659	36
Managing with end-date-driven schedules	2	4	11	19	8	0.723	14
Lack of Commitment of all project participants	5	8	9	17	5	0.641	40
Financial difficulties of the owner	10	7	1	16	10	0.641	40
Delays in progress payments	7	6	10	9	12	0.659	36
Tendering process	19	4	6	10	5	0.500	54
Lowest bidder selection	13	1	17	4	9	0.577	52
Late procurement of materials	5	9	15	9	6	0.609	48
Scarcity of skilled, and highly experienced workers	4	2	12	18	8	0.709	17
Lack of effective leadership	0	6	12	16	10	0.736	9
The small stage of construction leadership ability	4	8	11	11	10	0.668	32
Improper planning and scheduling	0	4	13	21	6	0.732	12
Insufficient support from project stakeholders in the development of plans and schedule	4	3	3	23	11	0.755	7
Contractors' cash flow problem during construction	6	8	7	17	6	0.641	40
Delay in payment for extra work/ variations late payment from contractor to subcontractors	4	6	3	17	14	0.741	8
Inaccurate time and cost estimation by the contractors	2	3	14	16	9	0.723	14
Improper project feasibility studies, and insufficient data before the design	2	2	14	10	16	0.764	5
Time given to contractors to prepare their bid	11	2	14	10	7	0.600	51
Project scope definition completion when the bid is invited	4	1	19	12	8	0.686	29
Owner's administrative load	10	2	18	11	3	0.577	52
Delay in settlement of claims by the owner	6	4	12	14	8	0.664	33
Quality issues and errors	4	10	6	17	7	0.659	36
Extreme weather conditions	8	5	12	13	6	0.618	47
Ineffectiveness of labor productivity	4	2	16	11	11	0.705	21
Lack of Establishing measurable	6	1	10	23	4	0.682	31

milestones							
The flexibility of work scope	5	1	22	16	0	0.623	46

Appendix-D:- Questionnaire

JIMMA UNIVERSITY
JIMMA INSTITUTE OF TECHNOLOGY
SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

CONSTRUCTION ENGINEERING AND MANAGEMENT CHAIR
(Questionnaire)

ASSESSMENT OF THE SCHEDULE CONTROL PRACTICE IN GOVERNMENT AND FINANCIAL INSTITUTION CONSTRUCTION PROJECT: CASE OF ADDIS ABABA CITY

The objective of this questionnaire is to assess the schedule control practice in government and financial institution construction project in the case of Addis Ababa city. The questionnaires require to be filled with trustworthy and exact data as much as possible. The data included in the questionnaire is will be used only for academic purposes and it is confidential that will not be exposed. The overall result of the study will be given to the participants as feedback after questionnaires are collected and analyzed.

Submitted By:-Muhidin Beshir

Part one:- general information; please tick (√) the space provided appropriately

1. Type of the organization

owner		consultant		Contractor	

2. Typical of the project organizations

Building construction		Road construction		General construction	

3. Company grade if (contractor)

Grade one		Grade two		Grade three		Grade four	

4. Company Business type if (employer)

Public construction		Financial construction	

5. Job position of the respondents

Project manager		Site engineer	
Organization manager		Other (specify)	

6. Year of Experience of the respondent

7. Number of projects executed for the last five years

1 to 5		11 to 15	
6 to 10		>16	

Part two:- Assessment of the Schedule Control Practice.

Dear respondent the questioner below is to some amount to assess the practice of schedule control during the project implementation that concern your office. Please, support me by attending to the question listed in the form of choice blew by circling the choice given appropriately.

All the information you submit will be treated confidentially.

We honestly thank you for your deep support.

Yes if the practice were there in your organization

No if there is no practicing as such at all

Sometimes if rarely or sometimes there is application of these practice.

1. Are individual project teams and segments of the organization applying their approach to managing and controlling schedules?
   a) Yes b) No c) Sometimes
2. Are schedule milestone changes managed differently on a project by project basis?
   a) Yes b) No c) Sometimes
3. Are schedule reports provided on an as-needed basis?
   a) Yes b) No c) Sometimes
4. Is schedule performance (metrics) tracked informally?
   a) Yes b) No c) Sometimes
5. Is there a process in place (developed and documented) for managing and controlling schedules?
   a) Yes b) No c) Sometimes
6. Has the concept of schedule change control been introduced?
   a) Yes b) No c) Sometimes
7. Does the process include items such as schedule stat using, a change control form, a change log, and an issues log/form?
   a) Yes b) No c) Sometimes

8. Are summary and detailed schedule reports developed and provided to key stakeholders?
   a) Yes b) No c) Sometimes
9. Are schedule reports produced from a central system?
   a) Yes b) No c) Sometimes
10. Are schedules and statuses tracked using planned versus actuals and milestones complete?
    a) Yes b) No c) Sometimes
11. Are schedule baselines established?
    a) Yes b) No c) Sometimes
12. Does the organization produce a simple variance analysis of schedule status?
    a) Yes b) No c) Sometimes
13. Are metrics (schedule baseline, planned status, actual status, etc.) collected?
    a) Yes b) No c) Sometimes
14. Are the schedule change control systems, schedule reporting, and earned value analysis processes followed by project teams?
    a) Yes b) No c) Sometimes
15. Are schedule changes/status being identified, evaluated, managed, and communicated to stakeholders?
    a) Yes b) No c) Sometimes
16. Is a performance measurement process in place (developed and documented) to evaluate project schedule status and take corrective action?
    a) Yes b) No c) Sometimes
17. Are schedule baselines established, adhered to, and managed?
    a) Yes b) No c) Sometimes
18. Are cost and schedule reports integrated?
    a) Yes b) No c) Sometimes
19. Are performance metrics (schedule variance, estimates at completion, etc.) monitored and analyzed?
    a) Yes b) No c) Sometimes
20. Are corrective actions implemented for performance metrics?

a) Yes b) No c) Sometimes

21. Are all schedule control processes in place, documented, and being used?
    a) Yes b) No c) Sometimes
22. Is the schedule change control system integrated with the organization's control systems, monitoring programs, and risk management process?
    a) Yes b) No c) Sometimes
23. Are cost and schedule reports integrated with technical reports?
    a) Yes b) No c) Sometimes
24. Are schedule assessments part of the determination of project efficiency and effectiveness?
    a) Yes b) No c) Sometimes
25. For certain projects, is earned value and performance reporting integrated with cost and schedule systems?
    a) Yes b) No c) Sometimes
26. Does the schedule support earned-value analysis?
    a) Yes b) No c) Sometimes
27. Does the organization calculate the budgeted cost of work scheduled and performed?
    a) Yes b) No c) Sometimes
28. Does the organization calculate the schedule estimate at completion?
    a) Yes b) No c) Sometimes
29. Are all earned value techniques used to compare project performance to the baseline and make forecasts?
    a) Yes b) No c) Sometimes
30. Are earned value techniques used to update project schedules and to support the determination of project efficiency and effectiveness?
    a) Yes b) No c) Sometimes
31. Is there a process in place (developed and documented) that uses schedule assessments and earned value techniques for management decisions during project execution?
    a) Yes b) No c) Sometimes

32. Are the best practices and lessons learned being captured and made available to other projects?
    a) Yes b) No c) Sometimes
33. Is there a process in place to continuously improve the schedule control process including schedule-performance analyses?
    a) Yes b) No c) Sometimes
34. Are the best practices and lessons learned being used to improve Schedule Control?
    a) Yes b) No c) Sometimes
35. Which one of the following scheduling control techniques do you use to control the schedule in the case of your project/company. (circle it as many as you like)
    a) Gant bar chart
    b) Critical path method (CPM)
    c) Program Evaluation and Review Technique (PERT)
    d) Earned value analysis
    e) Other please Specify_____
36. Which one of the following software packages used in schedule controlling in the case of your project/company. (circle it as many as you like)
    a) Microsoft Project
    b) Asta Power Project
    c) Primavera Project Planner
    d) Web-based software
    e) Other please Specify_____

Part three:- Identifying the Factor Affecting Schedule Control.

The table below to some amount the factor affecting schedule control in the construction project this also highlights the factor affecting schedule control in the construction project in AA city concerning the project you implement. dear respondent identifies and makes tick ” √” on the factors listed below that affect the schedule control system to your project according to their grade of occurrence.

All the info you submit will be treated in confidence.

I honestly thank you for your deep support.

Grade system

1 = Affecting by a very low amount
2= Affecting by a low amount
3= Affecting by medium
4= Affecting by a high amount
5= Affecting by a very high amount

No	Factors affecting schedule control	Grade of occurrence				
		1	**2**	**3**	**4**	**5**
	Level of construction complexity					
2	Technical details of construction,					
3	Construction method					
4	Inaccurate evaluation of project time/duration					
5	Lack of proper progress Monitoring and feedback by project participants,,					
6	Lack of good coordination among various parties, ,					
7	Insignificant control and reporting system Between management levels					
8	Errors or omissions in constructionwork(variation)					
9	Design changes,					
10	Ineffective schedule control of information system					
11	Lack of a regular schedule of the inspection and acceptance system					
12	Lack of schedule control plan					
13	Ineffective tracking of in-progress schedule deviations					
14	Lack of identification of needs					
15	Use of wrong project scheduling techniques,					
16	A poor managerial decision on critical activity,					
17	Poor communication among contracting parties,					
18	Incompatibility of planning methods with the project					

	schedule's nature.					
19	Incompetency of the project team,					
20	Lack of expertise in scheduling and the inaccurate estimate of human resources required,					
21	Delay or long process times caused by other authorities and bruecracy					
22	Inefficient materials management					
23	Improper time management for activity					
24	Ineffective site management,					
25	Site contraints					
26	Lack of virtual collaboration, ,					
27	Poor subcontractor performance by the contractor					
28	Lack of resource leveling in the schedule					
29	Risks/uncertainties,					
30	Managing with end-date-driven schedules,					
31	Lack of Commitment of all project participants,					
32	Financial difficulties of the owner,					
33	Delays in progress payments,					
34	Tendering process,					
35	Lowest bidder selection;					
36	Late procurement of materials					
37	Scarcity of skilled, and highly experienced workers,					
38	Lack of effective leadership,					
39	The small stage of construction leadership ability,					
40	Improper planning and scheduling,					
41	Insufficient support from project stakeholders in the development of plans and schedule					
42	Contractors' cash flow problem during construction,					
43	Delay in payment for extra work/ variations late payment from contractor to subcontractors					
44	Inaccurate time and cost estimation by the contractors,					
45	Improper project feasibility studies, and insufficient data before the design,					
46	Time given to contractors to prepare their bid,					
47	Project scope definition completion when the bid is invited,					
48	Owner's administrative load,					
49	Delay in settlement of claims by the owner					
50	Quality issues and errors,					
51	Extreme weather conditions					
52	Ineffectiveness of labor productivity					
53	Lack of Establishing measurable milestones					
54	The flexibility of work scope					

Appendix-E:- Interview Question

A) How did you establish the schedule control plan? What were the major considerations you focused on to establish and utilize a successful schedule controlling system

B) How did your company monitoring the progress of the scheduling? What are the methods/ systems used to track the schedule?

C) By what means did your company evaluate the actual schedule of the project? Are there any techniques and tools did used in your company that simplify the schedule controlling system?

D) What is your perception of the Change control management system on schedule control plan in your organization? How did your organization control the change in the schedule plan? Did your organization collect a report of schedule change control continuously?

E) Did your organization collect or prepare the report of schedule plan status for the concerned body? By what gap did the report is collected or prepared and an update of the schedule plan is implemented?

F) Did your organization developed and documented the best practice that may help for the other projects on schedule control system management decisions? Is there any process in place and lesson captured?

G) How much the schedule planned and actual did vary when compared to each other? What were the influences your organization observed and faced during monitoring, evaluating, and collecting reports in the schedule control process?

H) What are the measurements taken to minimize the factors that affect the schedule control by your organization? What is your perception of the measurement taken by your organization?