



ADDIS ABABA UNIVERSITY, SCHOOL OF COMMERCE

SCHOOL OF GRADUATE STUDIES

**Assessment of Construction Project Management Control Practice:
The Case of Grade One Building and General Contractors in Addis Ababa**

By:

Hiwot Alemayehu Abera

B.Sc. (Civil Engineering, Addis Ababa University, 2011)

A Project Submitted to the School of Graduate Studies in Partial Fulfillment
of the Requirements for the Degree of Master of Arts

In

Project Management

Advisor:

Worku M. (Ph.D.)

August, 2018

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Undertaking

I, the undersigned, certify that this project work titled “**Assesment of Construction Project Managment Control Practice: The case of Grade One Building and General Contractors in Addis Ababa**”is my original work performed under the supervision of my research advisor **Dr.Worku M.** and has not been presented else where for assessment and for a degree in any other university.All sources of materials used for this thesis have also been duly acknowledged.

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Date:August 2018

Abstract

Construction industry in developing countries is struggling from different challenges that can affect the industry from achieving the intended objective which is to complete the construction works on time, as per the budget and desired quality. From the different process that help the industry to be successful, the construction control practice of contractors contributes a fair share in the success of the projects. As per the reviewed literatures, there exist a gap in the construction control practices in Ethiopian construction industry. Bearing this in mind, this research is conducted to assess the current construction controlling tools and techniques used by grade one contractors with respect to the tools and techniques described in PMBOK. The research is of descriptive type and uses questionnaire and interview as an instrument to collect data. The analysis of the research shows the percentage and frequency of used construction controlling techniques. Also in order to rank the techniques that the contractors use, RII is used as a method of analysis. The finding of the research elaborates that mostly used tools and techniques are project management software to control time and cost of projects and inspection to control the quality of construction projects. Also, the finding revealed that different types of controlling techniques are not used by most of the contractors. Furthermore as per the research, even though there exists a lack of usage of different construction controlling tools and techniques, the professionals in the construction firm perceive that they have a good construction controlling system. From the finding of the research the researcher recommends the contractors to practice different controlling techniques that best fit their construction projects.

KEYWORDS: PROJECT, CONSTRUCTION, CONTRACTORS, MANAGEMENT, CONTROL, TIME, COST, QUALITY, BCI, GCI

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List of Abbreviations and Acronyms

AC	Actual Cost
BC	Building Contractor
CPM	Critical Path Method
CVR	Cost Value Reconciliation
EV	Earned Value
EVM	Earned Value Management
GC	General Contractor
GTP	Growth and Transformation Plan
MOFED	Ministry of Finance and Economic Division
MOUD	Ministry of Urban Development
PERT	Program Evaluation and Review Technique
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
PV	Planned Value
RC	Road contractor
RII	Relative Importance Index
SC	Specialized Contractor

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

The construction industry is a sector of the economy that transforms various resources into constructed physical economic and social infrastructure necessary for socio-economic development. It embraces the process by which the said physical infrastructure is planned, designed, procured, constructed or produced, altered, repaired, maintained, and demolished.

Construction industry which is continuously booming in Ethiopia plays a vital role in the socio-economic development of the country. As per the Growth and Transformation Plans (GTP I and GTP II) of the nation, major emphasis has been given to this sector, particularly in the dimensions of physical infrastructure in order to achieve the overall outlined growth target (Ministry of Finance and Economic Development (MoFED, 2010); and National Planning Commission, 2015). Construction industry encompasses construction of buildings, roads, railways, airports, dams and other related infrastructure. However, in many developing countries, this industry suffers from different problems that range from planning (pre-construction phase) of projects to completion and handing over. Theoretically, these problems can be rectified by the various contributions of the stakeholders in the industry.

These stakeholders of the industry comprised of organizations and persons who include companies, firms, and individuals working as consultants, main contractors, and sub-contractors, material and component producers, plant and equipment suppliers, builders and merchants and it has a close relationship with clients and financiers. In addition to this, the government is involved in the industry as purchaser (client), financier, regulator, and operator.

From the different methods that help manage the problem of the construction industry, the proper management system can be considered as one of the key methods for successful completion of construction projects. During the life of construction projects, different stakeholders play a vital role in the success. It is about controlling key aspects of construction that makes it successful. However, the document itself cannot manage deliverables, relationships, finances and benefit realization, managing interactions between parties/people, adapting to changing conditions,

aiming far through continuous systematic planning, efficient contract formulation, maximizing operational and financial performance. Successful construction management is most effective if upstream or pre-award activities are properly carried out. But at the same time, the importance of post-award construction management should not be underestimated and shall be resourced appropriately (Construction Management Association of America, 2014).

Building construction work is developing in Ethiopia but a continuous improvement on the work process, rules and stakeholder relationship are needed to uplift the standard of management. Stakeholders, particularly contractors, give due attention to managing contracts at the pre-award stage. However equal emphasis has to be given to contracts after award, i.e. during the construction stage up until completion. The issues of managing contracts and construction work after contract signing has not received sufficient attention. Some of those issues include: controlling the construction work based on the planned schedule and budget; interacting and building a relationship with other stakeholders; managing variations and risks; forecasting demand and continuous improvement of the works.

The aim of project control is to ensure projects completion on time, within budget, to the desired quality and to achieve other project objectives. It is a complex task undertaken by project managers in practice, which involves constantly measuring progress; evaluating plans; and taking corrective actions when required (Harold, 2009). During the last few decades, numerous project control methods, such as Gantt Bar Chart, Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM), have been developed .A variety of software packages have become available to support the application .Despite the wide range of these methods and software packages in practice, many construction projects in Ethiopia still suffer from time overruns, cost overruns and quality problem .As per the previous studies conducted in the construction industry ,much attention is not given to the assessment of construction control techniques applied by the stakeholders. Therefore, it is necessary to do detail study and research on this issue for the betterment of the management system of the construction sector.

1.2. Statement of the Problem

Managing building construction works has its own set of processes that, if not properly handled, could cause problems in the aspects of schedule, budget, quality and possibly lead to delay, unnecessary dispute and variation works that adversely affect the smooth progress of projects. Previous, research works by Adams (1997), Long et al.(2004) and others have indicated the poor managerial capability of contractors to be one of the critical problems of the construction industry in developing countries. Also the study conducted by Abioudn (2017), which concentrates on the factors that affect the performance of contractors in Nigeria stated that the improvement of control and administrative system of contractors contributes to the improvement of contractor's performance.

The study which is conducted by Belay, Tekeste and Ambo (2017) on the top factors that affect the success of construction work in Ethiopia shows that the construction controlling and monitoring is ranked third from the list of factors that affect the construction work. Contractors which carry out the actual construction activity in such projects ought to conduct their construction works according to the prescribed schedule, budget and specification to achieve an elevated level of contract management. Their contract management practice contributes a fair share to their own success as well as to the betterment of the construction industry.

Building construction in Ethiopia is suffering from different problems that affect the construction process and stakeholders' relationship. The finding of the study of Ayalew, Dakhli, and Lafhaj (2016) indicate that the level of application of general project management functions, tools & techniques and that of adapting construction project management procedures are unsatisfactory. However, many contractors' do not give due emphasis to construction control system in Ethiopian building construction works.

With this in mind, this research asses the construction control practices of Building contractors (BCI) and General contractors (GCI) in Addis Ababa which participate in a major building construction works in order to investigate their practices and problems in their construction system in relation to delay, budget overrun and substandard quality. This research also tries to

investigate if there exists responsible entity for the controlling tools and techniques used by this contractors, the perception of professionals about their company construction controlling status and their recovery techniques of cost, time and quality problems.

1.3. Research Questions

- Which type of time, cost and quality controlling tools and techniques do BCI and GCI use the most?
- Which set of time, cost and quality control practices do BCI and GCI having time overrun, cost overrun and quality problem use the most?
- What are the construction control recovery techniques used by GCI and BCI?
- Which department is responsible for the construction controlling in the organizational structure of BCI and GCI experiencing project control problem?
- What is the perception of the professionals about their company in relation to project management control?

1.4. Objectives

1.4.1. General Objectives

- To assess the construction control practices of BCI and GCI contractors in Addis Ababa.

1.4.2. Specific Objectives

- To examine the time, cost and quality management control practices of BCI and GCI in Addis Ababa.
- To inspect the time cost and quality management control practices of BCI and GCI in Addis Ababa that experience delay, cost overrun and quality problem in the completion of their construction projects.
- To investigate the construction control recovery techniques used by BCI and GCI.
- To examine the responsible entity of construction controlling.
- To explore the perception of the professionals about their company's construction management control system.

1.5. The Scope of the Research

The scope of the study is limited to assessing and analyzing the construction management practices of grade I General (GCI) and Building Contractors (BCI) located in the city of Addis Ababa. The study focuses on the construction controlling practices of these contractors mainly in their building construction works after award of projects (in execution phase). It is mainly concerned with the time, cost and quality management control practices.

Major emphasis is given on the time, cost and quality control techniques used by the contractors and their effects are studied. The research concentrates on construction control practice of the three-time, cost and quality management practices because they are the key parameters that contribute to the success of the construction project. Controlling techniques discussed in a guide to project management body of knowledge (PMBOK) is used as a reference to map the current state of BCI and GCI contractors in Addis Ababa.

The aforementioned objectives of the research shall be achieved by analyzing primary data which will be gathered through questionnaires and interview responded by BCI and GCI. According to the Ministry of Construction, there are 72 BCI and GCI that participate in the major building construction works as of 2010 E.C.

1.6. Limitation of the Research

While assessing the construction management practice of the sampled contractors, the following limitations shall be kept in mind:

- The research is bound by the construction control practices of BCI and GCI that are located in Addis Ababa and work on Building construction. This has been done intentionally as these contractors are the major contributors to most of the building construction works taking place both in terms of a number of projects and value of projects.
- The research concentrates on the control of construction after award of contract (during construction stage).
- Other parameters are not studied in this research such as scope, risk, communication, procurement, human resource etc.

1.7. Organization of the Research

This research is divided into five major chapters. The first chapter depicts the importance of the project, project management, and construction management in an elaborated manner. A short background of construction management problems of Ethiopian construction industry is presented here followed by problem statement, research questions, and objectives. In addition to this, the scope and limitations of the research are clearly stated. The second chapter will cover an in-depth and elaborative look at relevant previous studies which relate to construction controlling practices. The nature of the required data will be elaborated along with the methods (questionnaire, interview and desk study) of collecting them in the third chapter. This chapter will also outline strategies for achieving the planned objectives and answering the research questions. The methods that will be specified in chapter three will be further discussed and implemented on the set of data gathered and presented in chapter four of this research. In the concluding section of the paper, the main findings from chapter four shall be presented. Remedies and proposals shall also be presented in this chapter. Lastly, the researcher will briefly point out areas of concern for future study as observed from the viewpoint of this research's findings.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

As discussed in the introductory chapter, this study aims to assess the construction control system of contractors in Addis Ababa. The first step of the study is to review previous researches that relate to the objectives and this will be discussed in the upcoming sections of this chapter. In this chapter project management and controlling tools and techniques are discussed. In addition to this, researches that are conducted to assess the construction control system, specifically time, cost and quality control are reviewed and the findings of this research are taken as the input for the study.

2.2. Project Management

According to the definition of Project Management Institute (PMI) (2013), a project is a temporary endeavor undertaken to create a unique product, service, or result. The temporary nature of projects indicates that a project has a definite beginning and end. Many other books are written on management and project management also define a project using similar terms whereas few others resort to other definitions. Regardless, some major points are shared by the majority of these interpretations and therefore, it is possible to state that a project has a defined scope, is constrained by limited resources, involves different professionals with diverse skills and often progressively unfolds throughout its life cycle (Yimam, 2011).

Main attributes that characterize projects include:

- Purpose: a project is usually a one-time activity with a well-defined set of desired end results;
- Life Cycle: different projects have different life cycles from start to completion stages.
- Interdependencies: projects often interact with other projects being carried out simultaneously by their parent organizations.
- Uniqueness: every project is very likely to have some elements that are unique to it.

- Conflict: The members of a project team are in almost constant conflict for the project's resources and for leadership roles in solving project problems (Meredith & Mantel, 2003).

Project management is generally perceived as a method and a set of technique based on the accepted principles of management used for planning, estimating, and controlling work activities to reach the desired end result on time, within budget, and according to specification (Weiss & Wysocki, 1992). Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements.

Ten core knowledge areas of project management are identified in the Project Management Body of Knowledge (PMBOK). These are scope, time, cost, risk, quality, human resources, communications, stakeholder, procurement and integration management. Each knowledge area in the PMBOK is composed of processes that are expected to be addressed to attain the objective of the knowledge areas. The knowledge areas provide detailed descriptions of the process inputs and outputs along with a descriptive explanation of tools and technique most frequently used within the project management processes to produce each outcome.



Figure 2.1:Key Process Groups (Stages) of Project Management

Project management is significantly different from general management. Every project is planned, budgeted, scheduled, and controlled as a unique task but for non-project (general) management, almost everything is routine. Unlike non-projects, projects are often multidisciplinary and usually have a considerable need to cross departmental boundaries for technology, information, resources, and personnel.

For instance, construction project management involves the planning, execution, and control of construction operations for any type of physical construction to optimize the interrelated primary objectives: cost, quality and time/schedule within a reasonable framework of the client's requirement. Construction management or construction project management is the overall planning, coordination, and control of a construction process from beginning to completion. Construction project management is aimed at meeting a client's requirement in order to produce a functionally and financially viable project.

2.3. Major Stakeholders in Construction Industry

Construction is the recruitment and utilization of capital, specialized personnel, materials, and equipment on a specific site in accordance with drawings, specifications, and contract documents prepared to serve the purposes of a client. In order to achieve this goal, different stakeholders contribute to the success of construction projects these stakeholders are shown in *Figure 2.2* below. Other literature may be referred with regards to the responsibilities of these stakeholders.

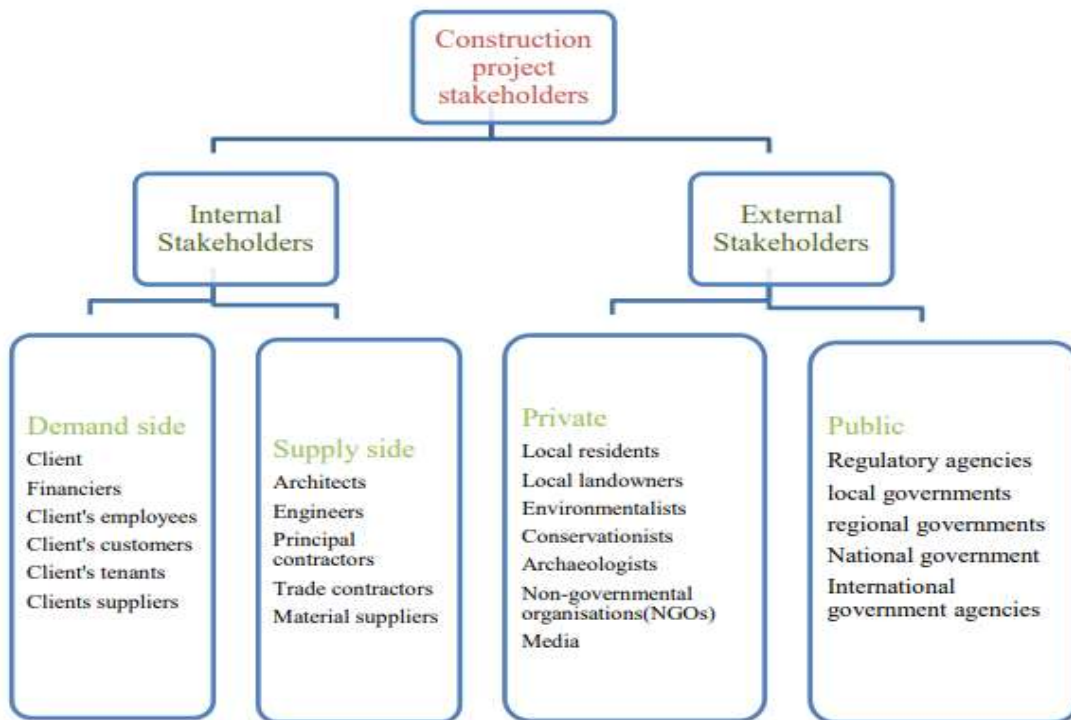


Figure 2.2: Key Stakeholders in the Construction Industry (Source: Winch, 2010)

2.4. Building Contractors and Construction Management Practices

A contractor may be an individual, a sole trader, a self-employed worker or a business owner who carries out, manages or controls construction work and does the actual construction work. They can be either an individual or a company that plan, manage and monitor construction work so that it is carried out without risks. Major project management practices of contractors are listed below:

- Project management - overall detailed planning and implementation of project activities, including a cost, schedule and quality control system.
- Engineering: technical support for all project activities and quality assurance.
- Remedial action: management of construction services for remedial action
- Environmental issues, safety, and health: oversight of all activities to ensure safe performance and compliance with all applicable federal, state, and local regulations.
- Quality assurance: Assuring the quality of work as per the contract.
- Communication: communicating with clients, consultants, and subcontractors for the timely and smooth completion of projects.

Different trends or construction controlling techniques are used by different contractors. However, most commonly used construction controlling practices are derived from the techniques listed in the PMBOK. These techniques are discussed in subsequent sections.

2.4.1. Schedule Control Tools and Techniques

2.4.1.1. Performance Reviews

Performance reviews compare the baseline with the actual results. This comparison can be done by using the following:

- **Trend analysis:** trend analysis examines project performance over time to determine whether performance is improving or deteriorating. Graphical analysis is a common method of trend analysis technique. Trend analysis provides an early warning system and allows managers to take corrective action. Unfortunately, its use may be restricted to long term projects because of the time needed to correct the situation (Harold, 2009).

- **Critical Path Method (CPM):** This method calculates the minimum project completion time and the start and end dates for all project tasks. It identifies the critical tasks that, if delayed, will delay your entire project (Benett, 1978).

The critical path method helps you reduce timelines, manage resources, and compare planned with actual. Comparing the progress along the critical path can help determine schedule status and the variance on the critical path will have a direct impact on the project end date

- **Critical Chain Method:** is a schedule network analysis technique that will modify the project schedule by accounting for limited or restricted resources (Heldman, 2009). Comparing the amount of buffer remaining to the amount of buffer needed to protect the delivery date can help determine schedule status. The difference between the buffer needed and the buffer remaining can determine whether corrective action is appropriate.
- **Earned Value Management (EVM):** is a systematic process that uses earned value as the primary tool for integrating cost, schedule, technical performance management, and risk management. It can be used to assess the present and future risk of projects (kerzner, 2009).The schedule performance measurements such as schedule variance (SV) and schedule performance index (SPI) which are used to assess the magnitude of variation in light of the original schedule baseline. The total float and early finish variances are also essential planning components to evaluate project time performance (PMI, 2013).

2.4.1.2. Project Management Software

Project management software for scheduling provides the ability to track planned dates versus actual dates, to report variances and progress made against the schedule baseline, and to forecast the effects of scope changes and variation orders on the project schedule model (PMI, 2013). This software contains a robust set of features and reporting tools that will serve most projects well. It comes in different types such as Microsoft Project (MS-project), Primavera and the like.

2.4.1.3. Resource Optimization Techniques

Resource optimization techniques involve scheduling of activities and resources required by those activities by taking both the resource availability and the project time into consideration. It is an attempt to eliminate the manpower peaks and valleys by smoothing out the period-to-period resource requirements. The ideal situation of resource optimization technique is done

2.4.1.4. Modeling Techniques

Modeling techniques are used to review various scenarios guided by risk monitoring to bring the schedule model into alignment with the project management plan and approved baseline (PMI, 2013).

2.4.1.5. Leads and Lags

Adjusting leads and lags is applied during network analysis to find ways to bring project activities that are behind into alignment with the plan.

2.4.1.6. Schedule Compression

Schedule compression techniques are used to find ways to bring project activities that are behind into alignment with the plan by fast-tracking or crashing schedules for the remaining work items. It is a form of mathematical analysis that is used to shorten the project schedule without changing the project scope.

2.4.1.7. Scheduling Tool

Schedule data is updated and compiled into the schedule model to reflect the actual progress of the project and remaining work to be completed. It can be done manually or by using scheduling software.

2.4.2. Cost Control Tools and Techniques

2.4.2.1. Earned Value Management

EVM is a methodology that combines scope, schedule and resource measurements to assess project performance and progress. It is a commonly used method of performance measurement for projects. It integrates the scope baseline with the cost and schedule baselines to form the

performance baseline and that helps the project management team in assessing and measuring project performance and progress (PMI, 2013).

2.4.2.2. Forecasting

Forecasting uses the information that is gathered to date and estimates the future conditions or performance of the project based on what is known when the calculation is performed. Forecasts are based on work performance information (an output from the executing process group) and predictions of future performance. Forecasts are generated, updated, and reissued based on work performance data that is provided while the project is being executed. The work performance information covers the projects past performance and any information that could affect the project in the future.

2.4.2.3. To-complete Performance Index (TCPI)

The to-complete performance index (TCPI) is a measure of the cost performance that is required to be achieved with the remaining resources in order to meet a specified management goal, expressed as the ratio of the cost to finish the outstanding work to the remaining budget.

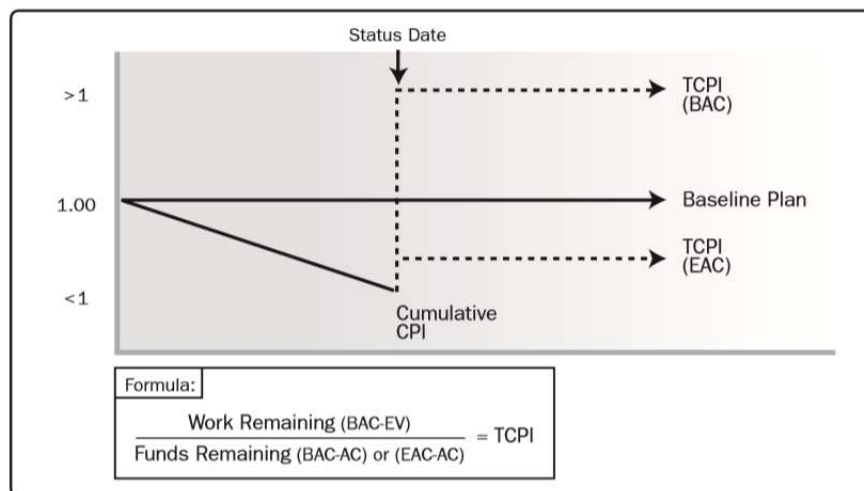


Figure 2.3: To complete performance index (TCPI) (Source: PMI, 2013)

2.4.2.4. Performance Reviews

Performance reviews compare cost performance over time, schedule activities or work packages overrunning and under running the budget as well as estimated funds needed to complete the work at hand.

2.4.2.5. Project Management Software

Project management software is often used to monitor the three Earned value management EVM dimensions Planned value (PV), Earned value (EV), and actual cost (AC) to display graphical trends and to forecast a range of possible final project results.

2.4.2.6. Reserve Analysis

During cost control, reserve analysis is used to monitor the status of contingency and management reserves for the project to determine if these reserves are still needed or if additional reserves need to be requested. As work on the project progresses, these reserves may be used as planned to cover the cost of risk mitigation events or other contingencies. Or if the probable risk events do not occur, the unused contingency reserves may be removed from the project budget to free up resources for other projects or operations (PMI, 2013).

2.4.3. Quality Control (QC) Tools and Techniques

2.4.3.1. The Seven Basic Quality Tools

These are also known in as 7QC Tools in the industry and are used to solve quality-related problems.

Cause-and-effect diagrams: show the relationship between the effects of problems and their causes. This diagram depicts every potential cause and sub cause of a problem and the effect that each proposed solution will have on the problem.

Flowcharts: graphically depicts the relationships between and among steps. They typically show activities, decision points, and the flow or order of steps in a process.

Checksheets: checklists provide a means to determine whether the required steps in a process have been followed. As each step is completed, it is checked off the list. Checklists can be activity specific or industry specific and might be very complex or easy to follow. They provide a mechanism to capture the lessons learned from past projects, They provide a mechanism to document the verification performed on the work package.

Pareto diagrams: are displayed as histograms that rank-order the most important factors such as delays, costs, and defects, for instance by their frequency over time.

Histograms: histograms are typically barred charts that depict the distribution of variables over time. To perform quality control, the histogram usually depicts the attributes of the problem or situation.

Control charts: measure the results of processes over time and display the results in graph form. Control charts are a way to measure variances to determine whether process variances are in control or out of control.

Scatter diagrams: scatter diagrams use two variables, one called an independent variable, which is an input, and another called a dependent variable, which is an output. Scatter diagrams display the relationship between these two elements as points on a graph. This relationship is typically analyzed to prove or disprove cause-and-effect relationships. Scatter diagrams can also help you look for and analyze root causes of problems (PMI, 2013).

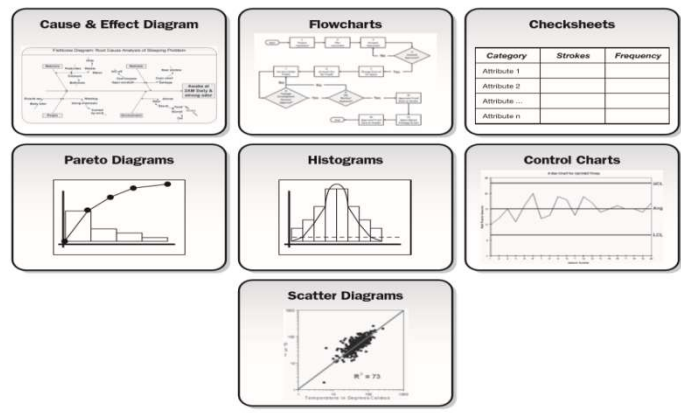


Figure 2.4: The Seven Basic Quality Tools (Source: PMI, 2013)

2.4.3.2. Statistical Sampling

Statistical sampling involves taking a sample of parts from the whole population and inspecting them to determine whether they fall within acceptable variances (Heldman, 2009).

2.4.3.3. Inspection

An inspection is the examination of a work product to determine if it conforms to documented standards. The results of an inspection generally include measurements and may be conducted at any level. Inspections may be called reviews, peer reviews, audits, or walkthroughs. In some application areas, these terms have narrow and specific meanings. Inspections also are used to validate defect repairs.

2.4.3.4. Meetings

Project teams may hold planning meetings to develop the quality management plan. Attendees at these meetings may include: the project manager; the project sponsor; selected project team members; selected stakeholders; and anyone with responsibility for Project Quality Management (PMI, 2013).

2.5. Review of Building Contractors and their Construction Management Practices

The construction industry in Ethiopia exhibits numerous problems. Generally, the current state of the industry is characterized by different challenges that arise from different stakeholders. As the contractors are the main entity that directly contributes to the physical execution of works, they are facing different problems that need to be solved. Some of these problems can be highlighted below:

- Low capacity and capability of contractors and consultants due to weak resource base and inadequate experience and lack of experience in construction management.
- Inadequate and erratic work opportunities, inappropriate contract packaging of works which favor foreign firms in donor-funded projects, low public investment in infrastructure projects and over-dependence on donor funding.
- Inefficient and non-transparent procurement Systems Corruption and financial mismanagement in public/private sectors.

- Lack of supportive institutional mechanisms in terms of financial credit facilities, equipment for hire and professional development.
- Unfavorable donor conditionality which tends to marginalize local construction enterprises.
- Poor working environment, including low standards of safety and occupational hazards on construction sites.
- Weak and non-facilitative policies and regulatory framework.
- Low productivity, quality and low technological base.
- Substandard level of management, especially contract and project management knowledge and practice (low level of contract administration, project planning and project monitoring capabilities).
- Inadequate and inappropriate project organizational structures, which lead to problems in the areas of authority, responsibility handling, communication and coordination; Corruption; and
- Poor working environment, including low standards of safety and occupational hazards on construction sites etc. (MOUD, 2012).

2.6. Research on Major Construction Management Practices of Contractors

Project management capability can significantly contribute to the overall improvement of contractors' performance in delivering projects within the specified cost, time and budget. Previous research works by Adams (1997), Long, et al.(2004) and others have indicated the poor managerial capability of contractors as one of the critical problems of the construction industry in developing countries and also strongly emphasized the importance of improving the management skills of contractors. Thus, further assessment of the construction management practices of contractors is critical in order to advance the construction industry forward.

2.6.1. Time Management Practice

Time management is a vital technique in ensuring the completion of projects within the stipulated timeframe. Without proper time management, inevitable time extension requests which in turn are likely to result in a cost overrun will arise.

Memon, Rahman, Ismail and Zainun (2014) identified commonly used techniques and software packages of time management along with their respective effectiveness level in large construction projects in Malaysia. This research uses data gathered from questionnaires that are distributed amongst practitioners (consultants, contractors, and clients) that are involved in large construction projects of Malaysian construction work. By using the collected data Relative Importance Index (RII) calculation was employed to assess the level of effectiveness for time management techniques and software packages adopted in the construction project. The results that are found from this research indicated that the most common and effective time management technique and software Package in Malaysia is CPM and Microsoft Project respectively. As per the finding of this research, the time controlling technique and software packages that are theoretically implemented by practitioners in most projects have barely shown any improvement in time management. In addition to mostly used techniques, this research showed that program evaluation and review technique (PERT) and simulation techniques are the least used techniques of time control.

Baskar and N (2016) also investigated the time management technique used in India. Data for this research were collected through questionnaire surveys from engineers, contractors, and clients involved in the construction industry of India. The collected data were analyzed using RII and it was determined by this research that CPM, PERT and Gantt chart respectively are the most effective time management technique in the construction industry of India. In addition to this, Primavera, Microsoft Project and Microsoft Excel were the most commonly used software packages used in the construction industry of India as discovered by this research.

Sawalha and Enshassi (n.d) conducted a research to investigate how widely project time management tools and technique were applied by public owners and construction contractors in the Gaza Strip. They also used questionnaire distributed to contractors and owners as a means for collecting data. The survey results of this research indicated that updating the time schedule and Linked bar chart are mostly used techniques for controlling time of construction projects. Also, the study recommended the establishment of a professional industry body such as an Institute of building to review and evaluate existing local project management control practices in the Gaza strip.

In addition to the studies conducted in different countries across the globe, a study conducted in Ethiopia by Zewdu (2016) adopts quantitative and qualitative methods with the help of primary and secondary data to investigate the techniques used to control the time of projects in the construction industry of Ethiopia. Primary data was collected using self-administered questionnaires on 140 respondents (contractors, consultants, and clients) and secondary data was collected through reviewing of related materials. Analysis of the quantitative data was made using SPSS. The study revealed low-level application of techniques and software packages for project planning and time control. As per the contractors' response, mismanagement by contractors is among the top five factors that ultimately result in a delay of construction projects. The study also implied that the contractors' level of applying different techniques and software packages for planning and time control is minimal.

Furthermore, Tefera (2013), who studies the management control of projects in construction industry, concluded that, time mismanagement is one of the basic contemporary problems of the industry that must be improved. Data for this project is collected from the responses of contractors, consultants, and clients. According to the findings of this research which carried out a survey on a sample, 51% of the respondents used a bar chart, 26.7% used CPM, 8.9% used modified network PERT, 26.7% used graphical techniques and 6.7% used mathematical model. Furthermore, the researcher reaches into a conclusion that in consistent application of the control system is caused by lack of professionals within the industry and skill gaps on existing one.

Based on the study of Yimam (2011) which concentrates on project management maturity in developing countries, one third (1/3) of the GC1, BC1, RC1 contractors in Ethiopia do not perform all the practices that are required to attain the time management knowledge area goals. The result showed that on average one third (1/3) of the contractors performed only three out of four PMBOK time management processes that are necessary to achieve the project time management goal. The findings shows, 29% of the contractors performed time management informally, whereas about 40% of the contractors performed time management formally or at a higher level.

2.6.2. Cost Management Practice

Cost management is among the most important components that determine the success of projects and is obviously the most important tool in terms of cost performance of construction projects. As per the research conducted in India, the overall ranking of cost management techniques in India is Cash Flow Forecasting (RII =0.817), Cost Planning and Control (RII=0.808) and Estimate (RII=0.802) respectively (N & Baskar, 2016).

Chigara, Moyo & Mudzenger (2013), explored cost management strategies employed by contractors on building projects and also investigated the challenges that contractors encountered in managing project cost in Zimbabwe. This study is an exploratory research design and employed both questionnaires and interviews to collect data from selected contractors registered in Zimbabwe. As per the study, strategies employed by contractors to manage cost are summarized as follows: cost reports (31.8%); cost estimating and budgeting (36.4%); variance analysis (54.5%); resources management (59.1%); cost value reconciliation (CVR) (31.8%); cash flow analysis and work programs (18.2%); and project meetings (13.6%).

Otim, Nakacwa & Kyakula (n.d), used a total of 130 questionnaires sent to contractors that are found in Uganda, 98 responses were found adequately filled for the study of cost management technique in the country, representing a response of 75 percent and the findings were schedules (16.3%), site inspection (14.1%), the project budget(12.4%), meetings (11.1%), cost and work progress records (13.6%) , reports (10%), monitoring work and cost performance and evaluation using bills of quantities(14.4%) and others (8.1%) .In addition to this, the research identified that the problem of cost management was actually not the techniques used but rather lack of knowledge on implementing the techniques and poor management of the cost control methodology.

A study made on project management maturity in the Ethiopian construction industry by Yimam, (2011) indicated that only 1/3 of grade one contractors (GC1, BC1, RC1) use computer tools for cost estimate preparation and about 2/3 update their budget regularly at least once a month. The result showed that approximately 30% of the contractors' cost management process was incomplete where an average of 2 out of 3 processes required to achieve the goal of project cost

management was performed. About 60% of the contractors are at incomplete practice maturity level, performing on average 3 out of 4 practices expected to be carried out in cost management.

2.6.3. Quality Management Practice

Quality management process is a method by which the quality of the project deliverables is assured. The process involves undertaking a variety of reviews to assess and improve the level of quality of project deliverables and processes.

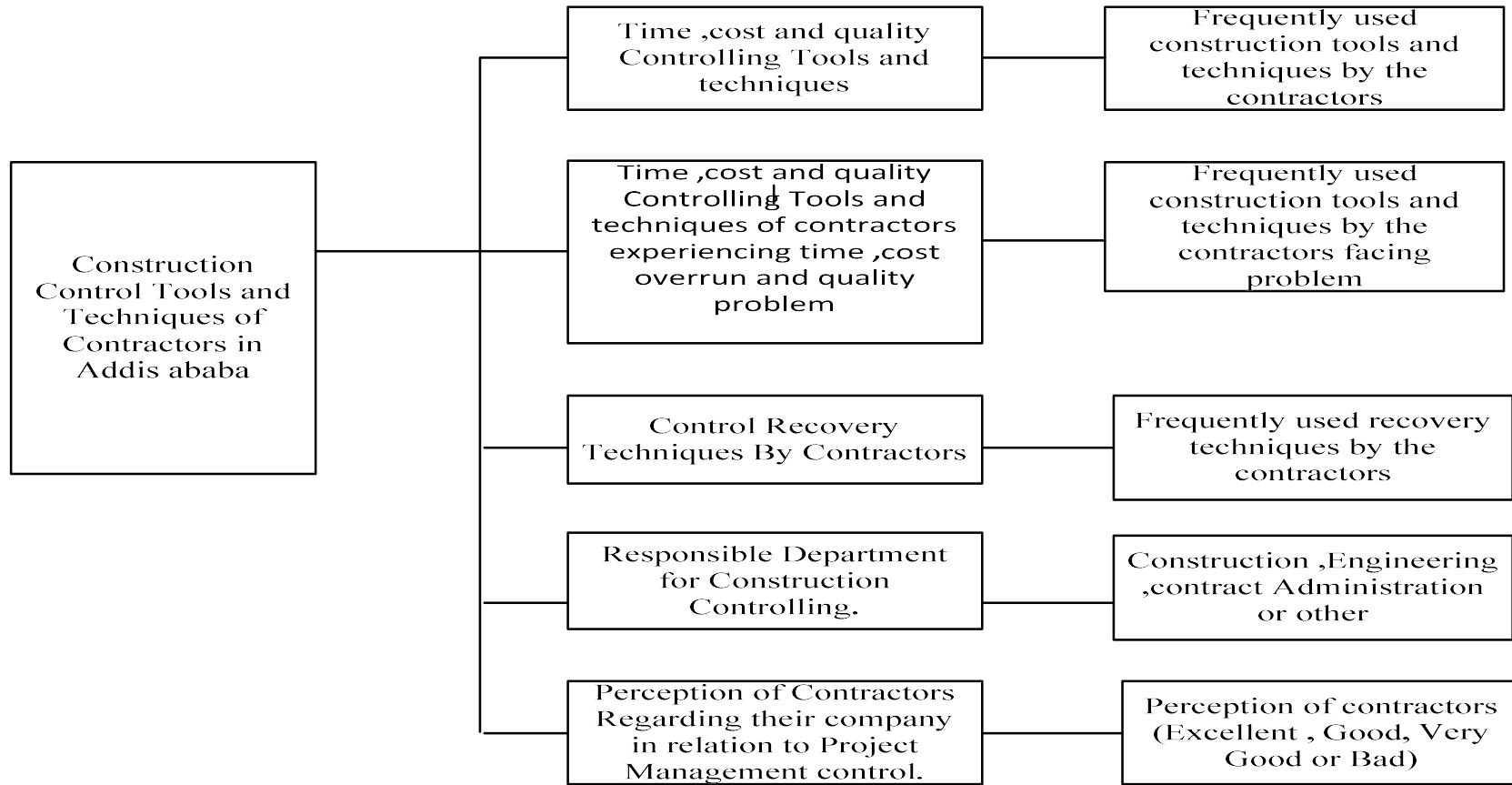
As per Agbenyega (2014), a combination of descriptive (quantitative) and exploratory (qualitative research) survey methods involving a three-stage data gathering approach was used to determine the quality management practices adopted by contractors in Ghana, Accra. Data for the study was gathered from fifteen (15) Contractors in Accra. The main findings of the study revealed that meeting project deadline and quality were the two most relevant parts in project performance measurement. The findings further showed some challenges encountered during the implementation of quality management in Ghana, Accra which include: lack of effective supervision; lack of effective communication; low level of managers' commitment to quality assurance; unavailability of proper equipment for use; and absence of leading quality assurance teams.

As per the study of Yimam (2011), finding showed that about 43% of the sampled contractors performed little or no quality management whereas 24% performed only 2 out of 3 quality management processes that are expected to be carried out to achieve the goal of project quality management. The remaining 33% of the contractors performed quality management formally or at a higher process maturity level.

Based on the literature reviewed, burning issues related with cost, time and quality management practices of BCI and GC1 in Addis Ababa apparently have not been investigated to any significant level, particularly in the framework of PMBOK control tools and techniques. Additionally, the management control system and the success of contractors in relation to the completion of the project as per the schedule, budget and needed quality have not been assessed in relation to construction management techniques. Having noted the aforementioned gap, this project is dedicated to identifying the most and least frequently used time, cost and quality

control processes by grade one general and building contractors that are based in Addis Ababa. Furthermore, the controlling tools and techniques that are used by contractors who face delay cost overrun and quality problem and recovery practices of time cost and quality of projects by the contractors are also studied.

2.7. Conceptual Frame Work



*Figure 2.5:*Conceptual Frame work

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

As discussed in the previous chapters, the objective of this research is to assess the contract management practice specifically the construction control tools and techniques used by BCI and GCI in Addis Ababa. The research methods, design, the procedure for data collection and analysis are discussed in the later sections.

3.2. Research Design

A research design is a plan, structure, and strategy of the investigation so conceived as to obtain answers to research questions or problems. The plan is the complete scheme of the research. It includes an outline of what the investigator will do from writing the hypotheses and their operational implications to the final analysis of data (Kumar, 2011).

Many reference books of research methodology classify research types in different categories. However this research is categorized as descriptive that deploy both qualitative and quantitative data. It is descriptive because:

- It is done to provide a clear picture of the construction management control practice (project controlling methods especially of cost, quality and time control) of BCI and GCI in Addis Ababa with respect to the controlling tools and techniques described in PMBOK.
- It gives a general overview of some valuable points that can be a useful tool in developing a more focused study.
- It can yield rich data that lead to important recommendations in practice and further research.

The research is a quantitative type in which

- Quantifiable data are collected from the sample populations which are BCI and GCI contractors in Addis Ababa.

- The data are collected using the questionnaire and interview as an instrument.
- The collected data was analyzed and findings were generated.

Also, the research is qualitative type in which

- Qualitative information where gathered from secondary data collected by reviewing the studies (literature) related to the main objective of the research.
- In-depth interview was also conducted with selected experienced BCI and GCI respondents to further triangulate data obtained from a questionnaire survey and to further explore the experience of respondents.

Aiming to assess the current management practice of BCI and GCI in Addis Ababa and project accomplishment in relation to time, cost, and quality of projects, this research is designed to investigate their current construction control tools and techniques used for the successful completion of the construction projects. In order to do so the chosen research design, the procedure to assess the construction management practices and examine the time, cost and quality management practices of BCI and GCI in Addis Ababa are discussed in the following sections.

3.2.1. Research Design to Study the General and Specific Objectives

Highlighted in previous chapters, the general objective of this research is to assess the construction control practice used by BCI and GCI in Addis Ababa. Mainly the study concentrates on the project control tools and techniques as described by PMBOK. Because of the limitation of the researchers conducting time, the research focused on the three parameters of project management; time, cost and quality. These parameters can be defined as follows:

- Cost control: managing the construction processes to achieve the best value for money and ensuring that the final cost does not exceed the budget.
- Time control: managing the construction processes so that the project is completed on or before the agreed completion date.
- Quality control: ensuring that the quality and performance of the completed project meets the project original objectives.

These parameters are the essential elements of good project management. Their successful management and control are the source of many construction project successes. Considering these, the research examined the methods used to control the project schedule, budget, and quality (stated in article 2.4 of this paper) and also looked at the history of the construction project completed by the contractors to examine the overall construction controlling system and success of the companies under research.

From the different types of research that are used to study the needed subject and classified in Figure 3.1, it can be stated that this research is categorized as a descriptive type of research in which the method of construction management practice of BCI and GCI in Addis Ababa is studied. Descriptive type of research is defined by Kumar (2011) as attempts to describe systematically a situation, problem, phenomenon, service or program. It is aimed to provide an accurate and valid representation of the overall condition of the point under study. When this particular definition is linked to the research objective, it examined the construction management practice of BCI and GCI that reside in Addis Ababa with respect to the project management controlling tools and techniques described in PMBOK concentrating on the three management functions; cost quality and time.

Also, the research is of a quantitative nature. It is based on measurement of quantity, amount or phenomena that can be expressed in terms of quantity. The primary purposes of the quantitative study are to measure, make comparisons, examine relationships, make forecasts, test hypotheses, construct concepts and theories, explore, control and explain (Kothari, 2004). Therefore for this specific case, quantitative data were collected through a questionnaire to examine the construction management practice of BCI and GCI in Addis Ababa by collecting primary data.

From the above classification, the state of this research is quantitative - cross-sectional. It is a cross-sectional study that it investigated the project controlling practice of BCI and GCI in Addis Ababa at a specified time that is as per the questionnaire was given to the selected contractors, the practice of the company was based on the current management and project controlling experience. Project management data were collected regarding the project record. Therefore, it is categorized as cross-sectional research.

3.3. Research population, Sample and Sampling Techniques

3.3.1. Population (Universe) of the Research

From the different stakeholders that contribute to the success of the construction industry, contractors play a significant role as they are directly related to the works. Having this as a key milestone, this research is done by making its population the group of contractors that are situated in Addis Ababa.

All contractors in Ethiopia need to be registered before undertaking any construction work in the country. According to the law: the requirements for licensing and registration of contractors in Ethiopia have the option of registering as a contractor in any one of the following categories:

- General Contractors (GC): These are contractors who are qualified to undertake a variety of construction works such as buildings, roads, railways, bridges, etc.
- Building Contractors (BC): These are contractors who are qualified to undertake building construction and related works.
- Road Contractors (RC): These are contractors who are qualified to undertake construction of roads and other related civil engineering works.
- Specialized Contractors (SC): These are contractors who are qualified to undertake construction activities in specialized trades such as electro-mechanical installation works, painting and decorations, sanitary installation works, wood and metal works and landscaping and other related activities.

As per MOUD (2005), classification there are 10 grades which are categorized accordingly based on the construction cost of the project that the contractor is seeking to undertake. General Contractors, Building Contractors, and Road Contractors can be categorized in the ten grades based on the criteria listed in the below table.

Table 3.1: Contractors Grade Categorization in Ethiopia

Categories	Grade	Construction Cost (Birr)		
		BC	RC	GC
(GC, BC, RC)	1	Above 210,000,000	Above 300,000,000	Above 350,000,000
(GC, BC, RC)	2	Up to 210,000,000	Up to 300,000,000	Up to 350,000,000
(GC, BC, RC)	3	Up to 160,000,000	Up to 225,000,000	Up to 270,000,000
(GC, BC, RC)	4	Up to 110,000,000	Up to 154,000,000	Up to 185,000,000
(GC, BC, RC)	5	Up to 54,000,000	Up to 76,000,000	Up to 100,000,000
(GC, BC, RC)	6	Up to 27,000,000	Up to 38,000,000	Up to 45,000,000
(GC, BC, RC)	7	Up to 11,000,000	Up to 15,000,000	Up to 18,000,000
(GC, BC, RC)	8	Up to 5,400,000	Up to 7,500,000	Up to 9,000,000
(GC, BC, RC)	9	Up to 3,000,000	Up to 4,200,000	Up to 5,000,000
(GC, BC, RC)	10	Up to 1,000,000	Up to 1,500,000	Up to 1,800,000

Source: MOUD (2005)

The target population of this research is chosen from the list of contractors classified in the above classification of MOUD. The decision to limit the scope of the study only to Grade-1 building and general contractors is made for six main reasons.

- Because of the time limitation of the study, only one type of contractor can be assessed. Considering this building contractor and general contractors were chosen as they participate in major building construction works in Addis Ababa that have a major contribution to the development of the country.
- From these contractors Grade-1 contractors (the highest-level contractors in Ethiopia) usually undertake most of the large projects given to local contractors; therefore, by studying the project control system of this contractors impact of any improvement achieved will significantly contribute to the overall improvement of the construction industry performance.
- Grade-1 contractors have better organizational, human and financial capability than contractors at a lower level; hence they are better suited for starting efforts of project management development and improvement in the industry.
- Contractors at lower grade were excluded from the study mainly because of the time limitation and considering the gap between those contractors of grade I and the lower grade contractors in terms of capacity and project management capability. Thus, it was thought that this will create difficulty in generalizing the research result.
- It is assumed that the result found in grade one contractors can be the benchmark for further study of the lower grades.
- Sampling is restricted to contractors that reside in Addis Ababa, that are registered on the list of the ministry of construction by considering the fact that almost all Grade -1 contractors are registered in the capital city.

Considering the above classification, contractors that took part in the research were selected based on the basis of registration confirmation on the year 2010 E.C of Ministry of Construction professionals' company and construction machinery industry development and regulatory bureau. From this list, it is found that the number of BCI and GCI that registered, renewed and upgrade to BCI and GCI in 2010 E.C budget year in Addis Ababa are 72 construction firms of which 53 are BCI and 19 are GCI. These firms are taken as the target population of this research.

3.3.2. Sampling Techniques

Sampling can be defined in several terms it may be defined as the selection of some part of an aggregate or totality on the basis of which a judgment or inference about the aggregate or totality is made. As per Kumar (2011) sampling is the process of selecting a few from a big group to become the basis for estimating or predicting the prevalence of an unknown piece of information, situation or outcome regarding the bigger group. Therefore, as per the definitions are given sampling techniques that are suitable for assessing the current construction controlling system of contractors are selected.

In doing a research, there are basically two types of sampling procedure:

- Probability sampling
- Non-probability sampling

Probability sampling: Probability sampling is also known as ‘random sampling’ or ‘chance sampling’. Under this sampling design, every item of the universe has an equal chance of inclusion in the sample. It is, so to say, a lottery method in which individual units are picked up from the whole group not deliberately but by some mechanical process. The results obtained from probability sampling can be assured in terms of probability (Sekran, 2003).

Nonprobability sampling: the elements do not have a known or predetermined chance to be selected. They do not follow the theory of probability in the choice of elements from the sampling population. Non-probability sampling designs are used when the number of elements in a population is either unknown or cannot be individually identified. In such situations, the selection of elements is dependent upon other considerations (Kumar,2011).

Random sampling from a finite population refers to that method of sample selection which gives each possible sample combination an equal probability of being picked up and each item in the entire population to have an equal chance of being included in the sample (Kothari, 2004).

For this specific research simple random sampling is selected for selecting contractors to do the quantitative part of the research as the population size is known choosing probability sampling is

suitable. The questionnaire was distributed to contractors that are selected by simple random sampling because:

- It ensures the law of statistical regularity which states that if on an average the sample chosen is a random one, the sample will have the same composition and characteristics as the universe. In probability sampling, the elements in the population have some known chance or probability of being selected as sample subjects.
- A simple random sample is the simplest way to select participants from a population. In this specific case from the 72 list of contractors, the list is chosen by using Microsoft Excel.
- Using these methods means that each individual contractor in this research has the same chance of being selected for the sample.

Simple random sampling was done using Microsoft Excel as a tool to select the sample. The first step was listing all GCI and BCI exhaustively. The list was found from the construction minister registry of 2010 EC. The list was encoded to Microsoft Excel and lists were generated to get the sample of the contractors.

Also, non-probability purposive sampling was made to select contractors to do the qualitative part of the research (in-depth interview). Purposive sampling (deliberate) was used to select contractors to cross-check the respondent's response with respect to the filled questionnaires and to further investigate the construction control mechanism used by the contractors. While doing this sampling technique, 10 workers of BCI and GCI (5 from each) were chosen to further investigate the data collected from the questionnaires. These contractors were chosen purposively considering the below points:

- Company Construction experience in executing major construction works.
- Project management experience in managing successful projects in relation to time, cost, and quality.
- Well organized organization and construction department structure.

3.3.3. Sample Size

Calculating the most appropriate sample size is an important step in the research process. For this research sample size is calculated by using a formula used by different statisticians in different reference books as indicated further in the below formula.

According to the formula used to determine the sample size by Yamane (1967), a simplified formula to calculate sample sizes is provided. This formula was used to calculate the sample sizes with a 95% confidence level and precision $P = 0.5$ are assumed for this equation.

$$n = \frac{N}{1 + Ne^2}$$

Where:

n = sample size

N = population size

e = Error of 10 %

$$= \frac{72}{1 + (72 * (0.1^2))}$$
$$= 41$$

By using the above sample size determination formula, a sample size of 41 is found. Forty-one questionnaires were distributed to randomly chosen contractors from the list of GCI and BCI construction companies.

3.4. Data Collection

For this research two types of data were collected:

- Primary data - from questionnaires distributed to chosen contractors and interview held with contractors that are purposively selected to triangulate the facts found in the questionnaire with the interview results.
- Secondary data - this data was found in reference books, journals and related articles that concentrate on the construction control mechanism of contractors in different countries and in Ethiopia.

3.5 Research Instrument

For the purpose of collecting the needed data, both questionnaire and interview are used as a research instrument. In the first part of the research data collection process, secondary data were collected from the secondary sources after getting information from secondary data to further correlate the information and find first-hand information in relation to the project control mechanism of contractors. The next step was the data collection process by using questionnaires. However, before distributing the questionnaires to all contractors that are chosen by random sampling technique, the pilot survey was conducted with chosen five contractors having a good project controlling experience in order to revise the questionnaires content, clarity and information expression. Questionnaires were chosen as a means of data collection because:

- The research has a time limitation and distributing questionnaires for 41 contractors through email and personally was found to be less time-consuming.
- The respondents will not be biased when responding to questions that are related to company project performance.
- The results can be easily coded to be used for analysis.

The questionnaire has two parts. part one is open-ended questions of the general type in which project management experience of the company regarding the project schedule completion time, project execution cost and project quality management, organizational construction management responsible entity and the overall company construction management status related questions

were included. In the second section of the questionnaire, questions related to time cost and quality control tools and techniques that are briefed in PMBOK were listed and the contractors were asked to rate the tools and techniques that they use. The questionnaire uses a Likert scale: Likert scale also known as the summated scale is one of the attitudinal scales designed to measure the attitude (Kumar, 2011). Respondent rate the techniques listed in the questioner based on their frequency of use of tools and techniques of cost, quality and time of a construction project.

when using a Likert scale, there is no specific rule on whether to use a two-point scale, three-points scale or scale with still more points. In practice, three to seven points scales are generally used for the simple reason that more points on a scale provide an opportunity for greater sensitivity of measurement (Kothari, 2004). For this research, a five-point Likert scale is used and the respondents rate the techniques that they use as never, rarely, sometimes, very often and always. Using this type of scaling techniques helps the respondents to choose the tools and techniques that they use rather than listing it in their own words. In addition to that, it is easy to administer and do analysis work of such type of responses.

As defined in Kumar (2011), Concurrent validity is comparing the findings of your instrument with those found by another which is a well-accepted instrument. In order to do so (check the validity of the questionnaires), the interview was conducted with 10 contractors. The main purpose was to ensure validity, and the same questionnaire was administered by the researcher through the scheduled interview. In the interview, the respondents were required to verify their response with an explanation of supporting practices, construction completion certificate, payment, contract agreements, and documentation. Analysis of the data showed 90% of agreement of the responses obtained by survey and interview. The 10% difference could be explained as a difference due to a misunderstanding of the question and self-favoring tendency of the respondent during the questioner filling process.

Further, to control the impact of respondent bias, the researcher has delivered most of the survey in person and contacted the rest respondent's through phone call and explained the importance of accurate information given by the respondents for the successful finding of the research.

3.6. Data Analysis

In this research, the collected data from the Likert scaled questionnaire filled by the 41 selected contractors are entered in Microsoft Excel because as it is smaller data sets and the frequency of usage of the construction project controlling techniques is generated by using frequency distribution analysis which is univariate analysis technique. Also using MS-Excel helps to develop charts and diagrams easily from the data collected to show the results in a simplified manner.

According to the reviewed literature which is discussed in chapter two of this research descriptive analysis is one of the most common methods for analyzing raw data, which are collected through questionnaire. Also, for answering this research questions, using the data collected, using descriptive analysis and Relative Importance Index (RII) was very important. According to Yamane (1967), RII value was calculated with the following formula:

$$RII = \frac{\sum_{i=1}^5 w_i x_i}{A \times N}$$

where: W= weighting given to each factor by respondents and it ranges from 1 to 5 as per the Likert scale

x = frequency of ith response given for each cause

A = highest weight (i.e. 5 in this case)

N = total number of participants (41 in this research as the sample size or respondents are 41 chosen contractors)

The steps taken to do the analysis of this research can be summarized as follows:

- Data collected from questionnaires are entered into Excel.
- Summary of each data is generated from the data collected.
- Charts and bar graphs that show the positioning of the tools and techniques used by the contractors to control their construction project are developed.

- Relative importance index is calculated for each project control technique.
- The ranking is done for each of the project controlling technique by using the RII in descending order.
- The data were summarized based on the ranks of the techniques used.

CHAPTER FOUR

RESEARCH ANALYSIS AND FINDINGS

4.1. Introduction

As discussed in chapter one , the analysis of this research is mainly done to find an answer to the research question raised and to discuss the objective stated in previous sections. For this research, the analysis type which is used is chosen to be descriptive analysis. By using descriptive analysis, the needed objectives are clearly elaborated and this will be covered in the upcoming sections.

4.2. Data Analysis and Finding

The collected questionnaires from the 41 contractors were coded in MS-Excel, by using this, the percentage of each technique was found. In order to rank the construction project control system practiced by the contractors RII method was used. Using this method helps to assess the practice used to control time, cost and quality management methods and order the methods as per the use by the contractors. The same approach has been used by various researchers to analyze the data collected from the questionnaire survey as indicated in the literature review of this research.

The following major findings are the outputs found from the data gathered from the questionnaires, interviews and the conducted analysis:

- The time, cost and quality management control practices of BCI and GCI in Addis Ababa.
- The time cost and quality management control practices of BCI and GCI in Addis Ababa that experience delay, cost overrun and quality problem in the completion of their construction projects.
- The construction control recovery techniques used by BCI and GCI.
- The responsible entity of construction controlling in BCI and GCI firms.
- The perception of the professionals in BCI and GCI about their company's construction management control system.

As described in chapter one of this research, finding the response of the research questions were the major target of the researcher and the above results as described in the below sections clarify the findings.

4.2.1. RQ 1-Which type of time, cost and quality controlling tools and techniques do BC1 and GC1 use the most?

4.2.1.1. Which type of time controlling tools and techniques do BC1 and GC1 use the most?

Construction time controlling methods stated in the PMBOK are practiced in different contractors in Addis Ababa based on their knowledge of the tools and techniques, organizational structure and availability of manual and work methodology to conduct the techniques. As stated in PMBOK there are different tools and techniques that are used to control the time (schedule) of the project. In this research one of the research questions is to find the frequently used time controlling tools by the contractors. In order to do so, these tools and techniques were listed and the contractors were informed to rate the tools and techniques by their firm using 5-point Likert scale questions. In order to rank the techniques RII is used and the results help to rank the techniques in their order of usage by the contractors.

From the filled questionnaires by BCI and GCI and the frequency analysis done it is found that use of Project management software (RII=0.834) to control the time of Building construction projects weights than other techniques used to control time of projects, as per the collected data more than 25 % of the respondents always use and around 68 % of the respondents very often use this tool. Also, from the interviews held with purposively chosen contractors, it is found that most of the contractors find the use of software's easy to control the time of construction projects. As per the finding 1/5 of the respondents always use trend analysis (RII=0.712). Crashing with RII=0.639 is the third used time controlling technique by Grade one building and general contractors of Addis Ababa. The three-time controlling methods (Network Diagram, CPM, and PERT), Resource optimization techniques and EVM techniques have 4 to 6 ranking with (RII= 0.60, RII=0.59 and RII=0.429) respectively based on the usage by the contractors.

Table 4.1: Time Controlling Tools and Techniques by BCI and GCI

Time Controlling Tools & Techniques	Never		Rarely		Sometimes		Very often		Always	
	No	%	No	%	No	%	No	%	No	%
Trend Analysis	4	9.76%	3	7.32%	8	19.51%	18	43.90%	8	19.51%
Network Diagram, CPM, PERT	3	7.32%	17	41.45%	2	4.88%	15	36.59%	4	9.76%
EVM	22	53.66%	3	7.32%	8	19.50%	4	9.76%	4	9.76%
Software	0	0	0	0	3	7%	28	68%	10	25%
Resource Optimization	5	12%	24	58%	2	5%	4	10%	6	15%
Schedule Compression	1	2.44%	16	39.02%	4	9.76%	14	34.15%	6	14.63%

Apart from this, the finding of the literature on researches conducted in Malaysia, India, Gaza Strip and Ethiopian construction industry showed that the most practiced time controlling techniques are CPM and PERT.

Furthermore, as per the result almost all contractors do not use EVM technique to control construction projects and during the interview with the chosen contractors this fact is elaborated, most of the contractors find EVM calculations time taking to use and the know-how of most of the professional in the construction firm regarding this technique is minimal because of this they prefer to use simpler method that does not need further calculations such as using MS -Project software and trend analysis. This is also identified in the research conducted by Zewdu (2016), which studies about the case of Ethiopian contractors' practice that only a few techniques and software packages are being used for planning and time control. The study of Yimam (2011), found that on average one third (1/3) of Ethiopian contractors performed only three out of four PMBOK time management processes.

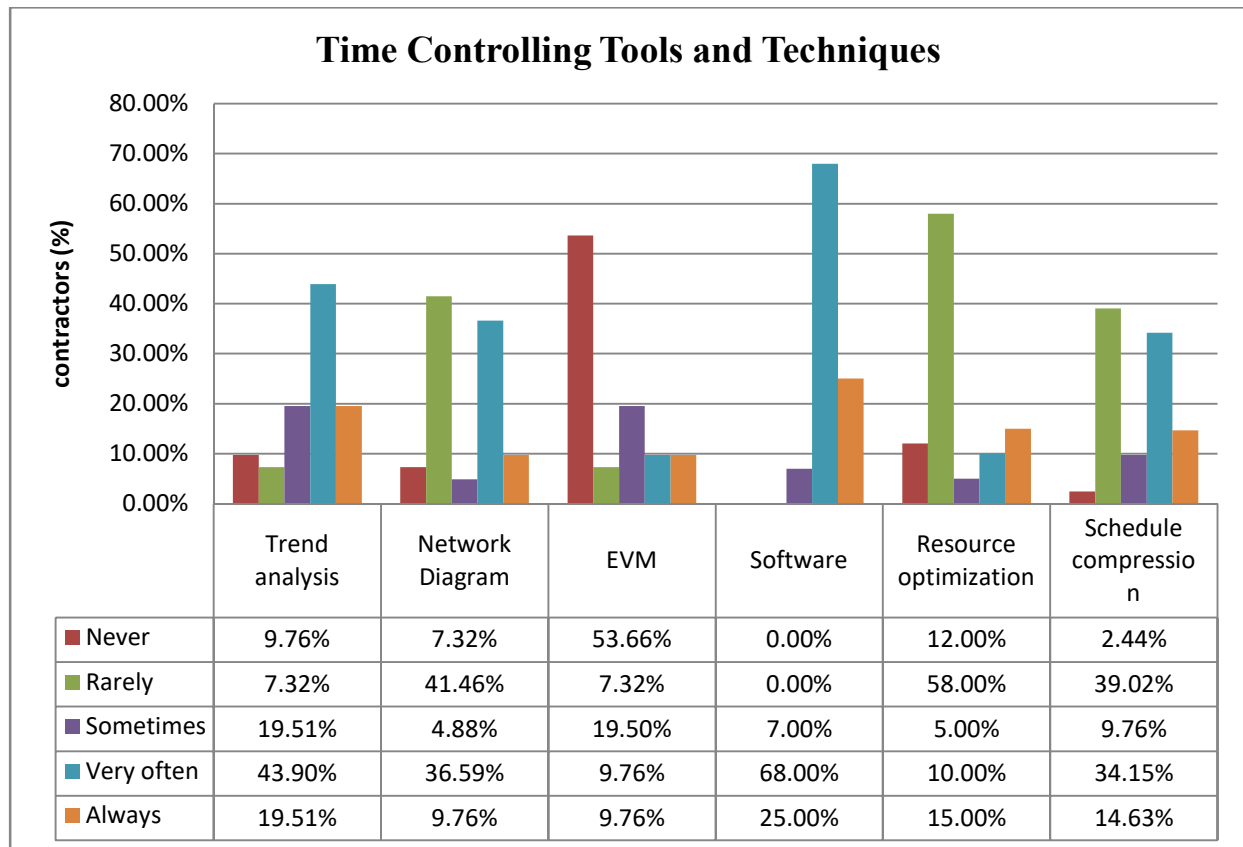


Figure 4.1: Time Controlling Tools and Techniques

4.2.1.2. Which type of cost controlling tools and techniques do BC1 and GC1 use the most?

Cost controlling techniques that are stated in the PMBOK include forecasting, calculation of TCPI, EVM, using project management software, performance reviews, and reserve analysis. These controlling tools were studied among the contractors under research. Based on the finding project management software (RII=0.761), is used mainly as a cost management technique by the contractors. Around 17.07 % of contractors always use software to control the cost management of their projects. Next to software is performance reviews (RII=0.741) and Forecasting (RII=0.717). The least used techniques by the contractors are Reserve analysis, EVM and TCPI having RII of 0.537, 0.512 and 0.507 respectively. As per the interview held with the contractors the usage of software and other simple forecasting methods are usually used because the emphasis is not given to the detailed calculation of cost controlling techniques such as EVM, TCPI and reserve analysis as per the finding of this research around 1/4 of the contractors Never used this technique.

Table 4.2:Cost Controlling Tools and Techniques by BCI and GCI

Cost Controlling Tools & Techniques	Never		Rarely		Sometimes		Very often		Always	
	No	%	No	%	No	%	No	%	No	%
Forecasting	0	0%	7	17.07%	8	19.51%	21	51.22%	5	12.2%
TCPI	10	24.39%	19	46.34%	6	14.63%	5	12.2%	1	2.44%
EVM	11	26.83 %	20	48.78 %	4	9.76%	2	4.88%	4	9.76%
Software	3	7.32%	2	4.88%	2	4.88%	27	65.85%	7	17.07%
Performance Review	2	4.88%	4	9.76%	4	9.76%	25	60.98%	6	14.63%
Reserve Analysis	7	17.07%	6	14.63%	24	58.54%	1	2.44%	3	7.32%

This is also further described in the reviewed literature, Study conducted in India by N & Baskar (2016) showed that Forecasting (RII =0.817) is most practiced by the contractors. Research conducted by Yimam, (2011) indicated that only 1/3 of grade one contractors (GC1, BC1, RC1) in Ethiopia use computer tools for cost estimate preparation and about 60% of the contractors performing on average 3 out of 4 practices expected to be carried out in cost management. This shows that most of the cost controlling mechanisms that need detail calculations and project status checks are not practiced by the contractors in AddisAbaba.

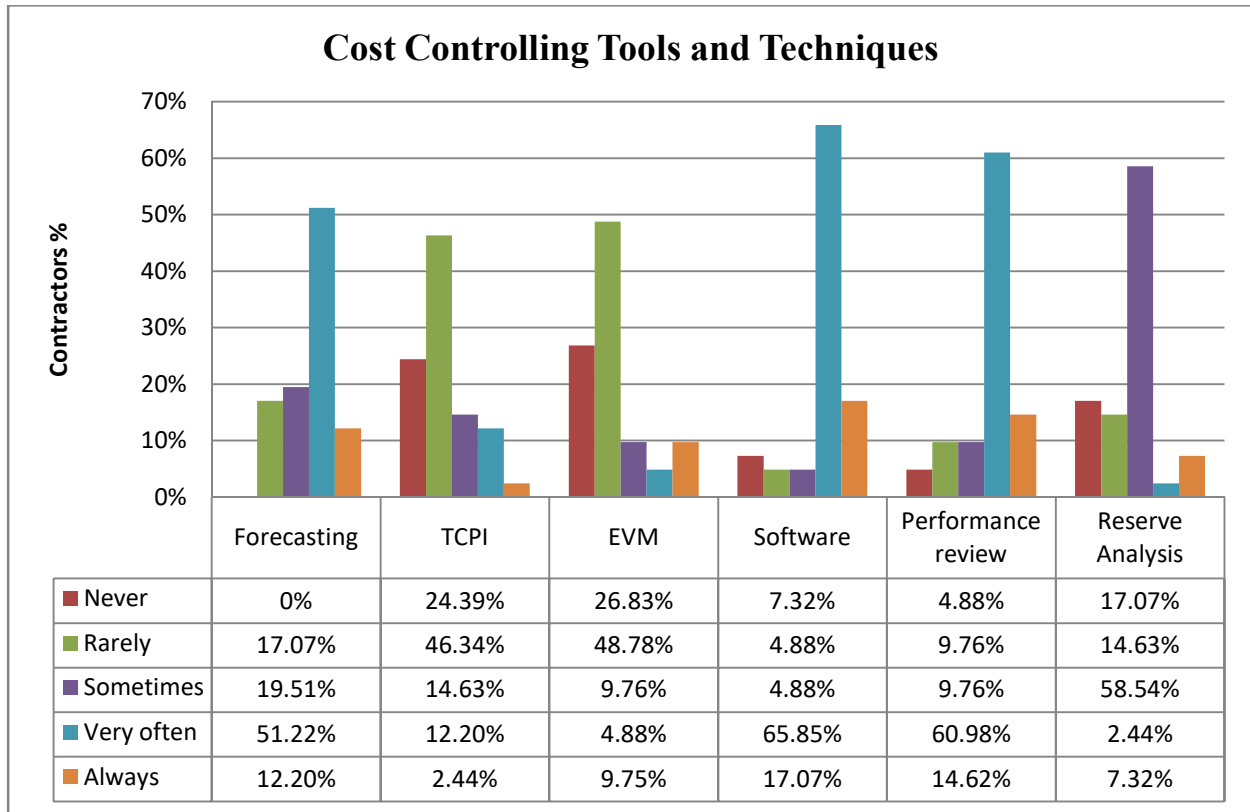


Figure 4.2: Cost Controlling Tools and Techniques

4.2.1.3. Which type of quality controlling tools and techniques do BC1 and GC1 use the most?

Quality controlling which is a vital work in the construction process is practiced in Addis Ababa GC1 and BC1 contractors majorly by using the inspection method (RII=0.732). Around 24% of the contractors always and 32% of the contractors often use this method to check the work quality and control if the construction work is progressing to the needed quality. Next to inspection is the approved change request in which the contractors use has RII of 0.698. Cause and effect diagrams, flowcharts, check sheets and histograms are also used by these contractors. However, these methods are ranked 3rd by usage with RII of 0.527. From the listed techniques the statistical sampling is the list practiced technique (RII=0.502). Around 46% of the contractors never used this technique as project quality control tools and technique.

Table 4.3:Quality Controlling Tools and Techniques by BCI and GCI

Quality Controlling Tools & Techniques	Never		Rarely		Sometimes		Very often		Always	
	No	%	No	%	No	%	No	%	No	%
Diagrams	16	39.02%	5	12.2%	5	12.2%	8	19.51%	7	17.07%
Statistical Sampling	19	46.34%	2	4.88%	5	12.02%	10	24.39%	5	12.02%
Inspection	2	4.88 %	2	4.88 %	14	34.15%	13	31.71%	10	24.34%
Approved Change Request	2	4.88 %	2	4.88%	14	34.15%	13	31.71%	10	24.34%

As per the research studied by Yimam (2011), about 43% of the sampled contractors performed little or no quality management.

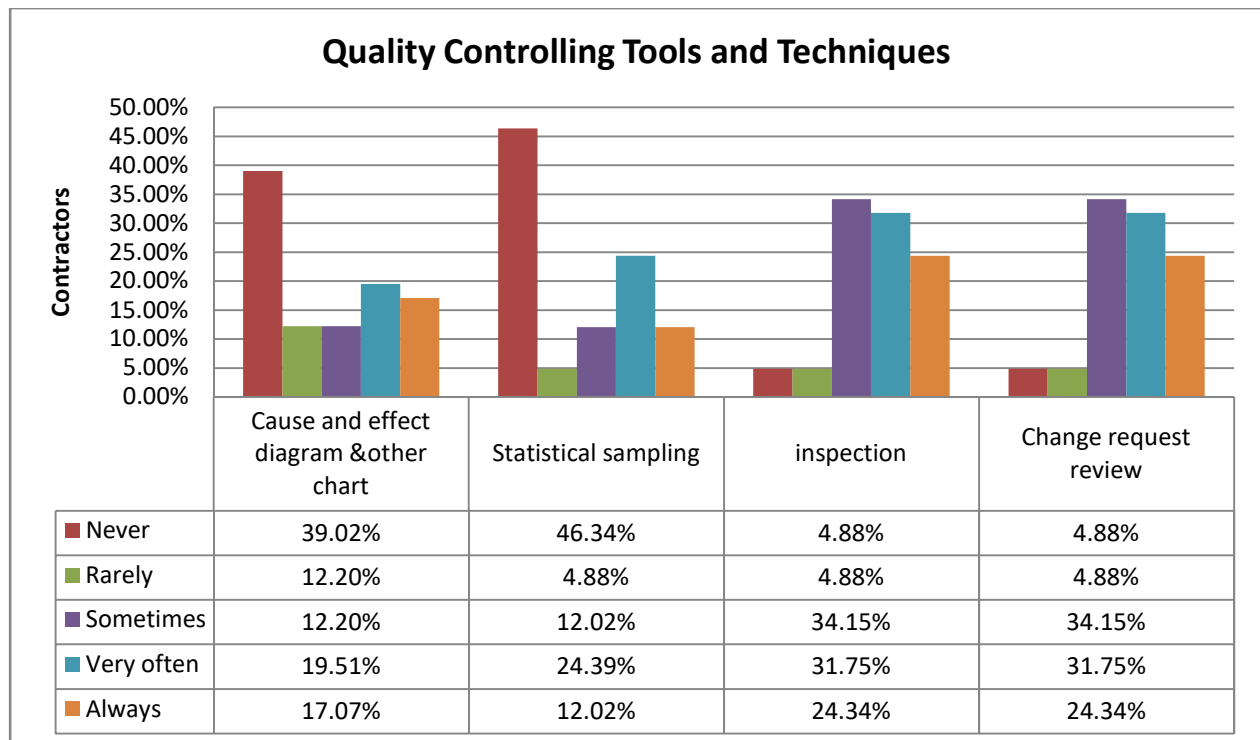


Figure 4.3: Quality Controlling Tools and Techniques

4.2.2. RQ-2 -Which type of time, cost and quality controlling tools and techniques do BC1 and GC1 having time overrun, cost overrun and quality problem use the most?

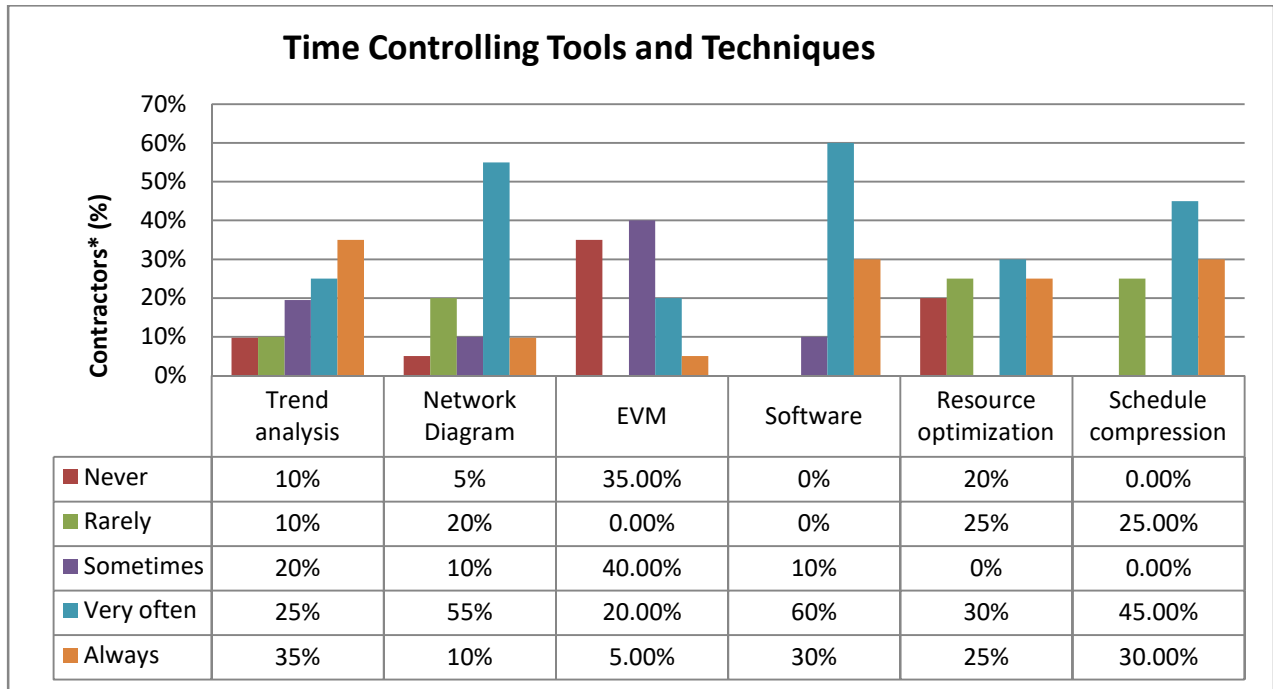
4.2.2.1. Which type of time controlling tools and techniques do BC1 and GC1 having time overrun use the most?

From the questionnaires, the contractor's executed project data were collected. Contractors were categorized based on their experience of time overrun, cost overrun and quality problem. Accordingly, contractors having the highest number of time overrun are 49% of the sampled contractors. These contractors are categorized based on a percentage of occurrence of time overrun in their executed project.

Table 4.4:Contractors Experiencing Time Overrun

% of Project Delayed from Executed Projects	Contractors	
	Number	%
0-25%	7	17.07%
25%-50%	7	17.07%
50%-75%	7	17.07%
75%-100%	20	48.78%

As per the data collected from the contractors, contractors having (75-100%) projects executed having time overrun showed the time management techniques practiced by the firms. Accordingly, as per the result of RII calculation, the first ranked project time controlling tools by these contractors is Software usage (RII=0.84), second most used technique is schedule compression(Crashing) technique (RII=0.76). Also, trend analysis which was ranked second during the assessment of the contractor's practice study is found to be third-ranked (RII= time controlling tool of the contractors that face time overrun. The fourth and fifth-ranked systems are Network diagram, PERT, and CPM as a group and resource optimization with RII of 0.69 and 0.63 respectively. The least practiced technique is EVM which was also the least ranked in section 4.21.



* 75-100% of the executed project by these contractors experience delay.

Figure 4.4: Construction Control Practices and Time Overrun

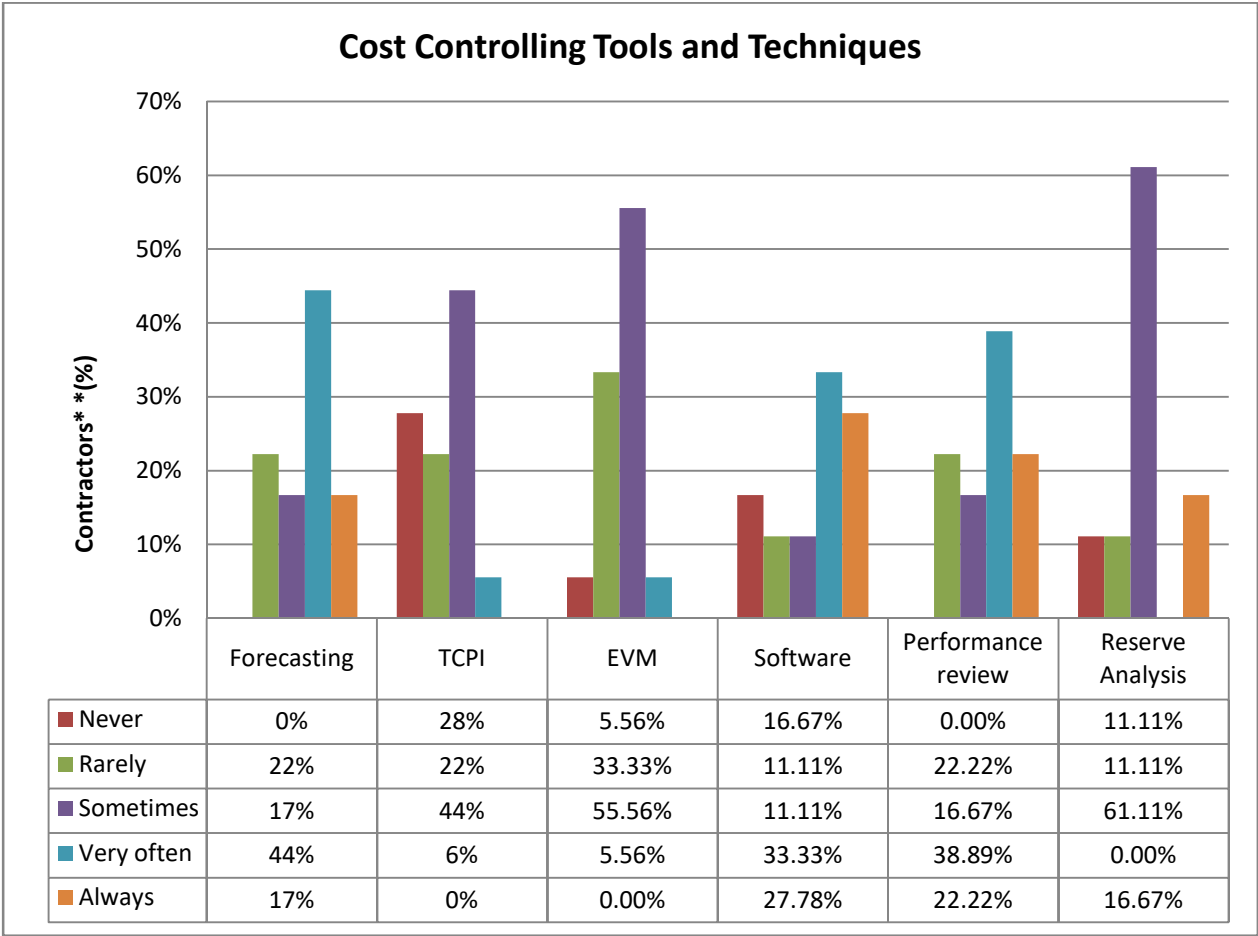
4.2.2.2. Which type of cost controlling tools and techniques do BC1 and GC1 having cost overrun use the most?

Out of the 41 sampled contractors that are selected for the questioners 18 contractors (43.9%) experience 75-100% cost overrun while executing their projects. The practiced cost management techniques by this contractors are studied.

Table 4.5: Contractors Experiencing Cost Overrun

% of Project with Cost Overrun from Executed Projects	Contractors	
	Number	%
0-25%	11	26.83%
25%-50%	8	19.51%
50%-75%	4	9.76%
75%-100%	18	43.90%

The finding showed a slight difference in the practices by the sample contractors. First practice in the rank of the cost control is a performance review (RII=0.722), the second in the rank is forecasting technique (RII=0.711). Software which was the first in the rank of the previous analysis in section 4.2.2 is ranked third with RII of 0.689. Fourth fifth and last practiced techniques are the same as the previous finding Reserve analysis, EVM and TCPI respectively.



**75-100% of the executed project by this contractor’s experience cost overrun

Figure 4.5: Cost controlling Practices and Cost Overrun

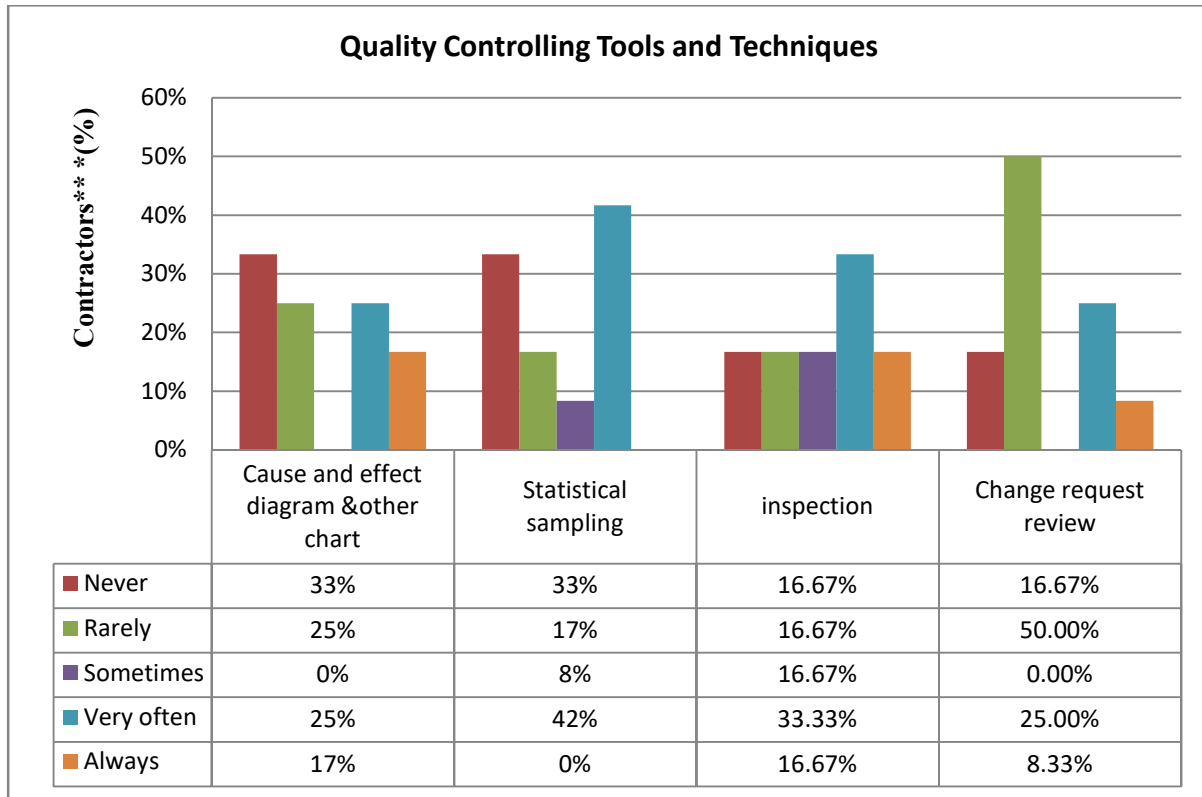
4.2.2.3. Which type of quality controlling tools and techniques do BC1 and GC1 having quality problem use the most?

From the 41 contractors that are questioned regarding the quality control practice 12 (29.23%) experience a high rate of quality problem (75-100%) quality problem.

Table 4.6:Contractors Experiencing Quality Problem

% of Project with Quality Problem from Executed Projects	Contractors	
	Number	%
0-25%	18	43.90%
25%-50%	9	21.95%
50%-75%	2	4.88%
75%-100%	12	29.27%

This contractor's first ranked quality controlling technique is the same as the total sample which is inspection with RII of 0.633. However, the second used method is a cause and effect diagram, flowchart and checks sheet with RII value of 0.533 the third-ranked quality controlling tools are statistical sampling and approved change request reviews having RII of 0.517.



***75-100% of the executed project by these contractors experiences a quality problem

Figure 4.6: Quality controlling Practices and Quality Problem

4.2.3. RQ-3- What are the construction control recovery techniques used by GC1 and BC1?

As per the collected data, different recovery techniques of cost, time and quality problem are used by the contractors. These recovery techniques as described in the PMBOK are listed and the contractors were given to choose the most up to the list technique used by their firm.

Table 4.7:Recovery Tools and Techniques by BCI and GCI

Construction Recovery Tools & Techniques	Never		Rarely		Sometimes		Very often		Always	
	No	%	No	%	No	%	No	%	No	%
Review planning Principles	0	0%	6	14.63%	23	56.1%	7	17.07%	5	12.2%
Baseline Reset	4	9.76%	9	21.95%	19	46.34%	3	7.32%	6	14.63%
Frequent Status Check	0	0%	4	9.76%	2	4.88%	13	31.71%	22	53.66%
Schedule Crashing	2	4.88%	14	34.15%	13	31.71%	7	17.07%	5	12.2%
Claim Request	2	4.88%	4	9.76%	6	14.63%	8	19.51%	21	51.22%
Variation Order	0	0%	4	9.76%	7	17.07%	8	19.51%	22	53.66%

Based on their responses, Frequent status checks ranked first on the list 53.66% of the contractors always use this technique to recover the problem encountered. Second, to this is Variation order is most practiced by the contractor with RII= 0.834, third practiced recovery technique is claim request. Around 51.22% of the contractors usually use this technique. Reviewing planning principles, schedule crashing and baseline reset are the list practiced techniques with RII of 0.654,0.595 and 0.590 respectively.

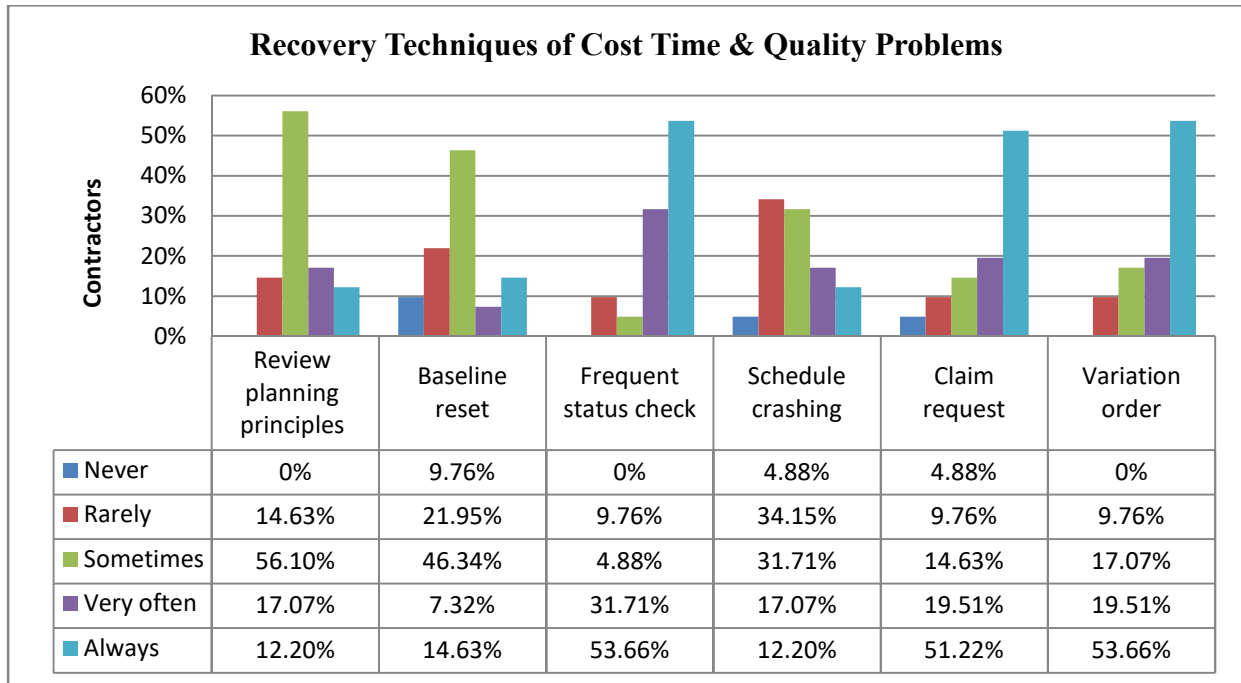


Figure 4.7: Recovery Tools and Techniques

Also recovery techniques of Cost Time and Quality Problems are ranked by using RII .The results are ranked as shown in the below table.

Table 4.8: Recovery Technique of Cost Time and Quality Problems

#	Description	RII	Rank
	Recovery Technique of Cost Time and Quality Problems		
1	Review planning principles	0.654	4
2	Baseline reset	0.590	6
3	Frequent status check	0.859	1
4	Schedule crashing	0.604	5
5	Claim request	0.805	3
6	Variation order	0.834	2

4.2.4. RQ-4-Which department is responsible for the construction controlling in the organizational structure of BCI and GCI experiencing project control problem?

As per the finding of the analysis of the research, contractors experiencing time overrun, cost overrun and the quality problem has a different organizational structure. The research classifies the construction controlling responsibility of the contractors in the different categories as per the below classification:

- 1. Contractors in which 75-100 % of executed projects by their firm experience time overrun:** As per the research 20 % of this firms control the construction management of their project by their construction team, 55% by their contract administration team, 10 % by other team and 15% do not have specific department for controlling their projects.
- 2. Contractors in which 75-100 % of executed projects by their firm experience cost overrun:** As per the research 17 % of this firms control the construction management of their project by their construction team, 55% by their contract administration team, 17 % by other team and 11% do not have specific department for controlling their projects.
- 3. Contractors in which 75-100 % of executed projects by their firm experience quality overrun:** As per the research 33 % of this firms control the construction management of their project by their construction team, 50% by their contract administration team, and 17 % by another team for controlling their projects.

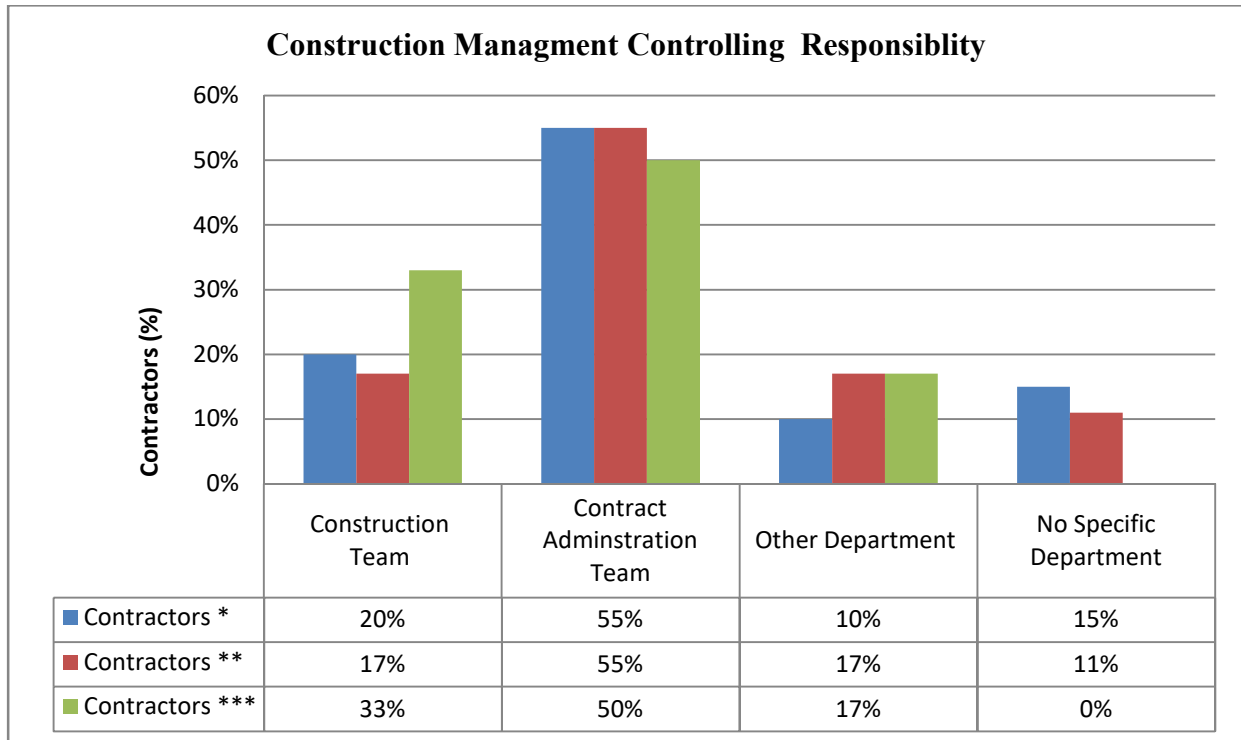


Figure 4.8: Construction Controlling Responsibility

* 75-100% of the executed project by this contractor’s experience delay,

**75-100% of the executed project by this contractor’s experience cost overrun

***75-100% of the executed project by these contractors experiences a quality problem

4.2.5. RQ-5-What is the perception of the professionals about their company's status in relation to project management controlling practice?

From the questionnaires result and the interview, the perception of the contractors regarding the status of their firm in relation to the construction control is known. As per the finding of the research, 14.63 % of the contractor's rate their companies controlling system as a poor controlling system, 12.25% as average, 53.66% as good and 19.51% as very good.

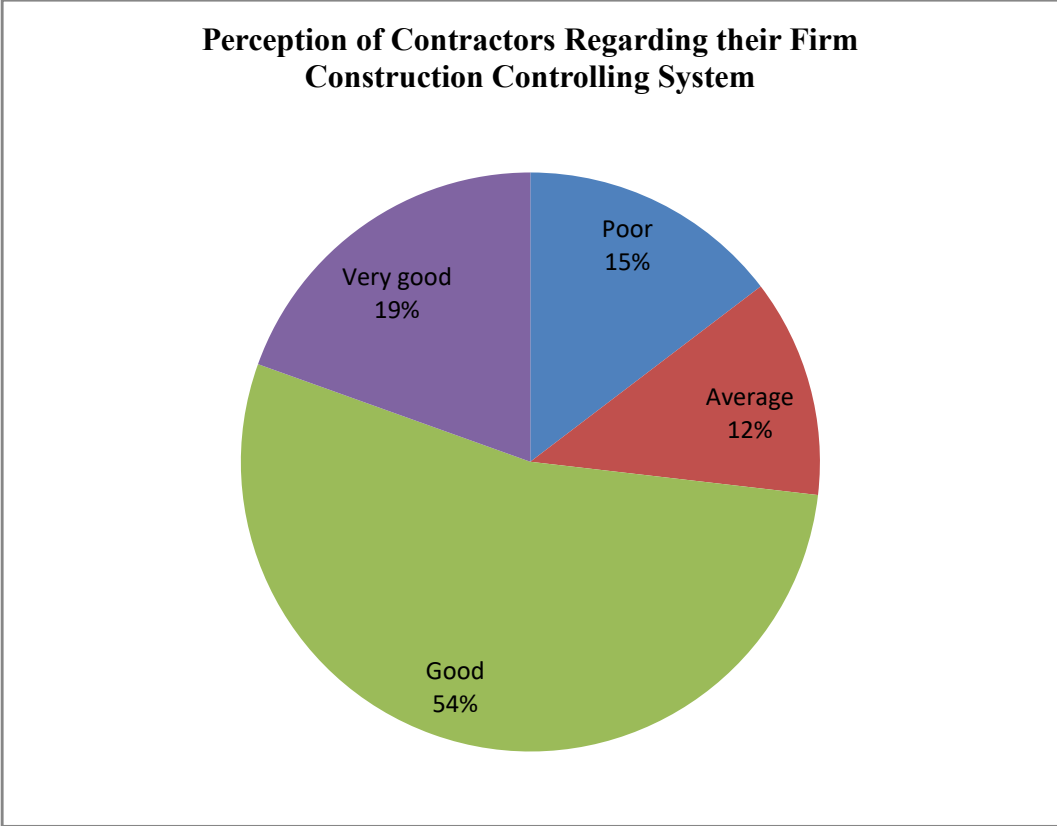


Figure 4.9: Percentages of Contractors Perception

Table 4.9: Contractors Ranked Time, Cost and Quality Control Practices

#	Description	RII	Rank	RII *	Rank
Time Management Practice					
1	Trend analysis	0.712	2	0.730	3
2	Network Diagram (CPM), PERT	0.600	4	0.690	4
3	Earned value management (SPI, CPI)	0.429	6	0.520	6
4	Project Management software (MS-project, primavera...)	0.834	1	0.840	1
5	Resource optimization technique (resource leveling /Smoothing)	0.590	5	0.630	5
6	Schedule Compression (Crashing)	0.639	3	0.760	2
Cost Management Practice					
1	Forecasting	0.717	3	0.711	2
2	To complete performance index (TCPI)	0.507	6	0.456	6
3	Earned value management (EV, BAC)	0.512	5	0.522	5
4	Project Management software (MS-project, Primavera...)	0.761	1	0.689	3
5	Performance reviews	0.741	2	0.722	1
6	Reserve analysis	0.537	4	0.600	4
Quality Management Practice					
1	Cause and effect diagram, flowchart, check sheets, histograms, control charts	0.527	3	0.533	2
2	Statistical sampling	0.502	4	0.517	3
3	Inspection	0.732	1	0.633	1
4	Approved change request reviews	0.698	2	0.517	3

*Contractors (75-100% of the executed project by this contractor's experience delay, cost overrun and quality problem)

CHAPTER FIVE

SUMMARY OF MAJOR FINDINGS, CONCLUSION, AND RECOMMENDATION

5.1. Summary of Major Findings

While studying construction control tools and techniques of BCI and GCI contractors that participate in the major building construction works in Addis Ababa, the following major findings were discovered:

- The time controlling tools and techniques by BCI and GCI contractors showed that there is limited use of different time controlling tools and techniques that are listed in the PMBOK. Majority of the contractors use project management software such as MS-project to control the time of construction projects. However detailed time controlling techniques such as EVM are not practiced on most of the construction firms.
- Contractors with time overrun problem also showed the same result that most of the firm use software to control time and resource optimization and EVM are practiced at a low level.
- The cost controlling tools and techniques by BCI and GCI showed from the tools and techniques listed in PMBOK, project management software are the most used techniques for cost control. However, the practice such as TCPI and EVM are least used by the contractors.
- Contractors facing cost overrun problem at a high rate use performance review and forecasting for controlling the cost of their construction project. But TCPI and EVM are practiced at the very low rate by these contractors.
- As per the quality control tools and techniques used by BCI and GCI contractors suffering from a high rate of quality problem, Inspection is ranked first from the list of the techniques to control the quality of projects. However statistical sampling is used in a minimum rate.
- The recovery techniques used to control the problems caused by the cost overrun, time overrun and quality problem by BCI and GCI are majorly frequent status checks and

variation orders, but techniques such as baseline reset are not practiced by these contractors as a recovery technique.

- Even though there exist delay, cost overrun and quality problems, from the studied firms, more than half of the contractors believe that the construction controlling system practiced by their firm can be categorized as a good controlling system.

5.2. Conclusion

The researches finding shows that there is a very low experience of using variety of construction controlling tools and techniques by BCI and GCI in Addis Ababa. Most of the contractors under study use simple techniques and technique that they use frequently, avoid detailed study and new techniques that show the status (the progress) of the construction projects. In addition to that, the studied contractors controlling tools and technique systems shows that there is low-level project controlling system, limited know-how of construction controlling tools and technique and lack of responsible department or division in controlling the construction projects within their company. The fact shows the professionals in the firms did not see the gap in project controlling system of their company, even though there exists delay, cost overrun and quality problem in most of BCI and GCI. The construction project delay, cost overrun and quality problem is not further studied by the contractors. There is a lack of in-depth study of the controlling system, gap and problem of the companies. The idea in relation to the gap of project controlling system of the firm is not considered as an issue in most of the studied firms.

5.3. Recommendation

5.3.1. Recommendation for Action

The below-listed points are the researcher's recommendations to the contractors to improve their controlling system:

- Providing advanced methodology and procedure of different type of project controlling tools and techniques.
- Practicing different type of cost, time and quality control techniques and selecting the best fit for their construction projects for betterment of the success of projects.

- Providing training and mentoring to the professionals to improve their project controlling practice.
- Conducting a continuous control (assessment) of the project success in relation to cost, time and quality.
- Establishing a responsible department or division that is in charge of mainly on project management control.
- Conducting evaluation of the completed project in relation to the controlling tools and techniques practiced

5.3.2. Recommendation for Further Research

Further research on the following topics can be conducted by researchers:

- Research on the relation of delay and time controlling practice of contractors.
- Research on the relation of cost overrun and cost controlling practice of contractors.
- Research on the relation of quality problem and quality controlling practice of contractors.
- Research on other parameters controlling system of contractors such as (human resource, risk,scope,safety etc.)
- Research on other stakeholders construction controlling system that contribute on the success of construction such as clients, consultants and other stakeholders
- Further study on all type of contractors (road, bridge, and dam) project controlling system.

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APPENDICES

A. Cover Letter sent to Contractors



ADDIS ABABA UNIVERSITY

School of Commerce, Department of Project Management

May 19, 2018

Dear Sir/Madam,

I am a graduate student in Project Management at Addis Ababa University, School of Commerce. I am conducting a survey on the construction control practices of Addis Ababa-based grade one building and general contractors (BC I and GC1) as part of my thesis to fulfill the requirements of Master of Arts in Project Management. The purpose of the study is to assess the construction control practices of grade one building and general contractors in Addis Ababa.

The survey will take about 15 -20 minutes of your time. Your answers will be treated anonymously and will not end up in the hands of a third party. Only processed collective results will be presented in my report. Your assistance to this research is strictly voluntary. You do not have to answer any question you wish not to.

If you have questions or concerns, please contact me through my cell phone no: (+251)-913-181-098 or email: hiwimare@yahoo.com. Thank you for your time and consideration.

Best Regards,

Hiwot Alemayehu
Graduate Student, School of Commerce Addis Ababa University

B. Questionnaire Sent to Contractors

Part I: Construction Experience Related Questions

#	Detail	Number
1	How many building construction projects that are above G + 0 did you execute in the past 5 years?	
2	How many of these projects completed on time?	
3	How many of these projects completed within the budget?	
4	How many of these projects completed to the desired quality?	

2. Who is responsible for the construction control system management execution phase of the construction?

A. The construction/ Engineering team

B. Separate individual/Department (contract administration team)

C. Another department

D. No specific Individual /Division

3. How would you rate the quality of the construction control management practice of your company?

A. Poor

B. Average

C. good

D. Very good

E. Excellent

4. How do you communicate about the construction status?

A. Regular meeting

B. Reporting

C. Progress recording

D. Other

Part II: Project Management Practice Related Questions

1. Please rate (√) in the scale of your experience of applying the time management control techniques listed below.

#	Techniques	Never	Rarely	Sometimes	Very often	Always
1	Trend analysis (examining project performance over time to determine whether performance is improving or deteriorating.)					
2	Network Diagram (CPM, PERT)					
3	Earned value management (SPI, SV, PV, CPI)					
4	Project Management software (MS project, primavera...)					
5	Resource optimization technique (Resource leveling /Smoothing)					
6	Schedule Compression (Crashing)					

2. Please rate (√) in the scale of your experience of applying the cost management control techniques listed below.

#	Techniques	Never	Rarely	Sometimes	Very often	Always
1	Forecasting (develop a forecast of completion cost)					
2	To complete performance index (TCPI) (ratio of cost of outstanding work to remaining budget)					
3	Earned value management (EV, BAC, CPI)					
4	Project Management software (MS project, Primavera...)					
5	Performance reviews (comparing cost performance over time, schedule activities or work packages)					
6	Reserve analysis (contingency or reserve need analysis)					

3. Please rate (√) in the scale of your experience of applying the quality management control techniques listed below.

#	Techniques	Never	Rarely	Sometimes	Very often	Always
1	Cause and effect diagram, flowchart, check sheets, histograms, control charts					
2	Statistical sampling (choosing the part of a population of interest for inspection)					

3	Inspection					
4	Approved change request reviews (checking if changes are implemented as approved)					

4. Please rate (√) in scale control and recovery technique that you use to control time, cost and quality of the construction projects.

#	Techniques	Never	Rarely	Sometimes	Very often	Always
1	Review planning principles					
2	Baseline reset					
3	Frequent status check					
4	Schedule crashing					
5	Claim request					
6	Variation order					

C. List of Contractors

No.	Organization Name	Con No	Category	Tel	Sub city	Wereda	House No
1	3M Engineering & Con. PLC	CON/0086	BC-1	0911 211050	Kirkos	4	393
2	Afework Gidey Berhe	CON/2584	GC-1	0911 512927	Yeka	13	-
3	Afro-Tsion Construction PLC	CON/0380	GC-1	0911 216425	Bole	4	-
4	Alliance Construction	CON/1067	BC-1	0911 208012	N/L	12	New
5	Aser Construction PLC	CON/6090	GC-1	0911 135707	Bole	-	497
6	Ashtho Engineering PLC	CON/3832	BC-1	0911 522912	Bole	7	1900
7	B Four Family Trading PLC	CON/3940	BC-1	0911 772626	N/L	1	New
8	B.G.M. Construction	CON/4873	BC-1	0911 219538	N/L	2	2013
9	Bamacon Engineering PLC	CON/2604	BC-1	0911 209024	Bole	2	1072
10	Beha Construction	CON/3944	BC-1	0911 248000	Kirkos	-	301
11	Bencon Construction	CON/5437	BC-1	0911 234504	Bole	2	5597/608/2
12	Bereka Construction	CON/0821	BC-1	0911 216141	N/S/L	2	-
13	Berhan Tobiaw Mareye	CON/0009	BC-1	0911 402558	N/L	9	-
14	Birhanu Abebe Building Contractor	CON/1840	BC-1	0911 174850	N/Silk	6	898
15	Birhanu Ashebir Construction PLC	CON/1219	BC-1	0911 231102	Yeka	8	204

16	BirukBesarAchew	CON/5073	BC-1	0911 514477	N/L	2	New
17	Bright Construction PLC	CON/0599	BC-1	0911 211161	Bole	3	2292
18	Capstone Engineering	CON/2027	BC-1	0911 512423	Yeka	1	-
19	Dawit Emiru Building Contractor	CON/1967	BC-1	0911 512552	Bole	4	411/230
20	Dawit WondimuBesha	CON/0683	BC-1	0911 212888	Kirkos	3	New
21	Desalegn Asreda Building Contractor	CON/0064	BC-1	0916 581400	Lideta	8	B008/005
22	Dugda Construction PLC	CON/5717	BC-1	0930 098564	Arada	1	595/596
23	Equator Engineering Construction PLC	CON/938	BC-1	0911 902436	Bole	6	New
24	Etete Construction	CON/4056	BC-1	0911 516970	Kirkos	3	555
25	Ethio Canadian Business Group PLC	CON/2772	GC-1	0911 233657	A/Kaliti	3	New
26	Felema Construction PLC	CON/7088	BC-1	0935 981681	Bole	07	New
27	FufaLegissa Building Contractor	CON/0646	BC-1	0911 203654	Yeka	19	631
28	GAD construction		BC-1	0114-422223	Yeka		
29	GashawMelese Building Contractor	CON/0327	BC-1	0911 207727	A/K	9	177
30	Getachew AtsbehaKidanu	CON/0635	BC-1	0911 236549	Bole	4	100

31	Gift Construction PLC	CON/10923	BC-1	0911 219557	Kirkos	02	121
32	Giga Construction PLC	CON/0659	GC-1	0911 201990	Bole	7	New
33	Grace Engineering	CON/0928	BC-1	0116 294867	Bole	14	571
34	IFH Engineering PLC	CON/1846	GC-1	0911 250321	A/K	5	-
35	Jofor Construction & Real State	CON/2914	BC-1	0911 200091	Bole	3	1192
36	Kasma Engineering P.L.C.		BC-1	0930034821			
37	Kassa& Sons Construction P.L.C.		BC-1	0911 203874			
38	Kibco Service& Investment PLC	CON/6774	BC-1	0911 201255	Bole	03	2144
39	Koracon Construction	CON/0645	BC-1	0911 214575	Arada	-	New
40	LUCI ENGINEERING P.L.C.	CON/2869	BC-1	0929 907130	Bole	9	New
41	M C G Construction PLC	CON/10490	BC-1	0929 900660	Bole	3	1/083
42	Macro General Contractor & Trading PLC	CON/0101	GC-1	0911 202814	N/L	15	New
43	Megelta Construction P.L.C.	CON/4415	BC-1	0911 678211	Lideta	8	821/50
44	Mudcon Construction PLC	CON/5630	GC-1	0911 507850	K/K	7	New
45	MuluHadgu Construction	CON/2009	BC-1	0911 513932	Bole	13	3848

46	N.K.H. Construction P.L.C.	CON/0996	GC-1	0911 204295	N/L	12	-
47	Nasew Construction P.L.C.	CON/0031	GC-1	0911 692384	N/L	7	400
48	Orbit Engineering & Construction P.L.C.	CON/0166	BC-1	0911 205031	Bole	13	1755
49	Ovid Construction PLC	CON/9679	BC-1	0911 218204	Bole	2	New
50	Powercon P.L.C.	CON/2268	GC-1	0911 637282	Yeka	3	New
51	Pyramid Construction & Trading PLC	CON/0084	GC-1	0911 202001	Arada	-	-
52	Samuel S/Mariam Endale	CON/0311	BC-1	0911 211890	Gulele	4	478
53	SATCON Construction PLC	CON/0774	GC-1	0113 727822	N/L	5	3113
54	Serja Construction and General Trade PLC	CON/5805	BC-1	0930 034906	N/Lafto	1	New
55	Sunshine Construction PLC	CON/0135	GC-1	0911 459881	Kirkos	1	653
56	Tayam Engineering & Commerce P.L.C	CON/0486	BC-1	0911 217061	Ledeta	10	115/19
57	Teklehaimanot Asgedom	CON/0515	BC-1	0911 201307	Bole	8	New
58	Tesfaye Legesse Construction	CON/6729	GC-1	0911 513237	N/L	4	1860
59	Tesfaye Tsegaye Building Contractor	CON/4111	BC-1	0916 827643	Ledeta	8	001

60	Tilahun Abebe G/Mariam	CON/4569	GC-1	0911 767528	Kirkos	2	-
61	TNT Construction & Trading	CON/2972	GC-1	0911 209811	Yeka	8	-
62	Trust Construction	CON/0853	BC-1	0911 414530	Kirkos	3	1016/2
63	Two Y Engineering	CON/2817	BC-1	0911 202629	-	4	327/1
64	Unity Engineering PLC	CON/1031	BC-1	0911 517438	-	14/15	New
65	Webcon Construction PLC	CON/6768	BC-1	0930 099304	Bole	14	206
66	Workneh GudayTeshale	CON/0692	BC-1	0911 517796	Bole	6	374/80
67	YaredEsayasMicheal	CON/5955	BC-1	0911 208484	Kirkos	6	147
68	Yohannes Haile Building Contractor	CON/3675	BC-1	0930 003850	Bole	1	-
69	YOT Construction PLC	CON/6641	BC-1	0911 206942	Bole	4	-
70	Yotek Construction PLC	CON/0799	GC-1	0911 543604	Kirkos	6	252/2
71	Yousef Kassaye Building Contractor	CON/0534	BC-1	0911 414243	A/Ketema	5	600
72	Zamra Construction PLC	CON/0620	GC-1	0911 563327	Yeka	13	New