ADDIS ABABA UNIVERSITY

ADDIS ABABA INSTITUTE OF TECHNOLOGY

SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

Study on Construction Cost Accounting System of State Owned Road Contractor: A Case Study on Ethiopian Construction Works Corporations – Transport Infrastructure Sector

by

Tigist Tsegaye Molla | GSR/4447/10

A thesis submitted to the School of Graduate Studies of Addis Ababa University in partial fulfillment of the requirements of the Degree of Master of Science in Civil Engineering in Construction Technology and Management

Advisor:

ABRAHAM ASSEFA TSEHAYAE (PhD)

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Abraham Assefa Tsehayae (PhD)	_____	_____
ADVISOR	SIGNATURE	DATE
Asregedew Kassa (PhD)	_____	_____
INTERNAL EXAMINER	SIGNATURE	DATE
Eng. Yibeltal Zewdu	_____	_____
EXTERNAL EXAMINER	SIGNATURE	DATE
_____	_____	_____
COMMITTEE CHAIRPERSON	SIGNATURE	DATE

DECLARATION

I certify that this research work titled "*Study on Construction Cost Accounting System of State Owned Road Contractors: A Case Study on Ethiopian Construction Works Corporations – Transport Infrastructure Sector*" is my own work. The work has not been presented elsewhere for assessment. Where material has been used from other sources, it has been properly acknowledged /referred.

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TIGIST TSEGAYE MOLLA | GSR/4447/10

DATE:

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ABSTRACT

This research investigated the cost accounting system of state-owned road contractor by taking Ethiopian Construction Works Cooperation's transport infrastructure sector as a case study. The construction industry consumes different resources such as, material, manpower and equipment which have to be managed properly to ascertain the profit. The research is based on the problem of ascertaining the cost of each cost object in order to evaluate the project status and helps the decision makers to make corrective measure on time. The proper implementation of costing system is necessary to determine the profitability of each cost object whereby management can identify whether the cost object is contributing profit or loss. Both primary and secondary data collection were used in this research. The primary data were obtained from the company using a questionnaire and secondary data were obtained from company cost records, reports, and cost accounting implementation manuals. Desk studies by randomly selecting three ongoing projects were done for detail study on current system. Based on the collected data, the detailed analysis has been conducted to find answers for the research question and modified costing system was proposed.

The study found out that the organization does not have a structured and typical cost accounting system. The respondents revealed that the company's current system is weak when evaluating based on different requirements of the costing system. According to the research, the ability of the current system in providing relevant information to decision-makers for future planning and decision making is poor. Lack of training on updated cost accounting techniques, difficulties in data collecting and gathering, and lack of adequate information on cost data are the mostly occurred problem during implementing costing system in the organization. It is recommended that the company should use the proposed system of cost accounting to overcome the shortcoming of the current system based on the data findings. The proposed costing system is expected to improve responsibility center identification, cost determination, indirect cost allocation, variance analysis at activity and resource level and data presenting format.

Key words: Activity based costing system; Costing system

ABBREVIATION

ECWC : Ethiopian construction works corporation

TICS : Transport infrastructure construction sector

ABC : Activity based costing

TC : Traditional costing

IGPG : International Good Practice Guidance

IFAC : International Federation of Accountants

PVA : Process Value Analysis

ICAI : The Institutes of cost accountants of India

PAVIC : Productivity Analysis with Video and Computer

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1 Background

The construction industry is one of the foremost industries of today that has a great impact on the economy of any nation. The industry has a huge contribution to sustainable economic development by satisfying some of the basic objectives of development including output generation, employment creation, and income generation and re-distribution (Serdar & Syuhaida, 2012). It has also a significant role in satisfying basic physical and social needs, including the production of shelter, infrastructure, and consumer goods.

The industry is a complex business sector where the need for accurate costing systems is more vital than any other since competitive bidding is deeply rooted in its tradition whereby the lowest bidder wins the contract (Lehtonen, 2001). If a contractor wants to involve in a competitive bid, maintaining proper costing systems is needed with sound mechanisms for accurate cost allocation, apportionment and performance measurement. Lehtonen,(2001) also argues that to produce performance information, a cost build-up for each project must be done, after which the profitability of each project can be accurately determined and management can identify which projects are contributing profits and which are making losses.

Construction costs are classified based on traceability to cost objects as a direct and indirect cost. These costs have to be allocated to each activity to obtain the total cost of each cost object. Evanse,(2015) indicate that direct costs are those costs that can be linked or traced to the final product or service offered, whereas indirect costs are representing the consumption of company resources that are shared by its products. These costs can be allocated to cost objects either by using a traditional costing system or activity-based costing system.

In order to ascertain the profit and give relevant information to the managers cost accounting system is very essential. Cost accounting aims to give management the basis for decision making, improved efficiency and how to enhance the performance of organization. From a managerial point-of-view, the effort to develop, implement and

operate a cost system is justifiable only when the cost information provides effective support for decision making (Evanse, 2015). Cost accounting measures, analyzes, and reports financial and non-financial information relating to the costs of acquiring or using resources in an organization (Charles, Srikant, & Madhav, 2015). It classifies, records, allocates and appropriation expenses for the determination of cost of products or service and the presentation of suitably arranged data for control and guidance of management (Horngern, 1978).

This research aims to give some relevant understanding about the Ethiopian Construction Works Corporation Transport Infrastructure Construction Sector (ECWC TICS) current practice of cost accounting system, encountered problems during the implementation and finally proposes a modified costing system. The proposed system is prepared to overcome the shortcoming of the current system based on the data findings.

1.2 Problem statement

Completion of a construction project within the intended budget is a major criterion of project success by clients, contractors, consultants and related stakeholders (Zewdu & Getachew, 2015). There are usually several problems that prevent the project from executing based on the planned budget. According to Jouni, (2009), the main problems in construction projects are related to cost accounting and cost control. One of the most problematic issues is that cost accounting and controlling methods are not operating in real-time. A study made on project management maturity in the Ethiopian construction industry by Abadir, (2011) found out that 44% and 50% of the contractors cost management process maturity is either incomplete or perform informally. Whereas the cost management practices maturity is 58% apply no practice, or are incomplete. This indicates that there is poor construction cost management practice in the country.

In a construction company, an unsuitable costing system may result in management failing to measure the project's performance accurately. This might, in turn, lead to strategic decisions being made on the basis of inaccurate project costs. Ali and Kamaruzzaman (2010), put proper project costing and financing as the first measure to be taken to control construction costs. According to Gulham (2013), the lack of proper cost accounting leads to inefficient use of materials, overstocking and inefficient decisions

leading to project cost overruns. This research will study on the overall system, method and problems encountered in the actual implementation of cost accounting in ECWC TICS and propose a modified costing system in order to fill the gap in the current system.

1.3 Aim and Objective

The aim of the research is to study the cost accounting system of state-owned road contractors in Ethiopia. The study considers Ethiopian Road Construction Corporation Transport Infrastructure Sector cost accounting system as a case study. To achieve the study aim, the following specific objectives have been established as below:

- Explore the cost accounting system of an Ethiopian construction industry,
- Investigate and evaluate the cost accounting system in Ethiopian construction industry,
- Determine the problem area and difficulties in implementing the system of cost accounting using a case study company, and
- Modify existing system of cost accounting using a case study.

1.4 Research question

The study sought to answer the following specific questions

- What is the knowledge of the company staffs about cost accounting?
- What type of costing system does the company use to determine the cost?
- How do they implement the costing system?
- What are the problems encountered in implementing the costing system?
- Does the costing system provide relevant information to management for future planning and decision making?

1.5 Significance of the study

The outcome of this study will benefit the organization to improve the costing system by enhancing awareness of the materiality of cost accounting in an organization, investigating the current practice of the cost accounting system, identifying the problem encountered during the implementation and proposing a modified costing system. Also, this study is significant to other contractors in familiarizing with the concept, importance and different methods of cost accounting and providing some insights into the

prerequisites of a successful cost accounting procedure and the importance of such cost control practices and processes.

1.6 Scope and limitation of the study

The research scope is limited to cost accounting system of state-owned road contractor. Due to the absence of cost accounting system and required data the study is limited to a case study on Ethiopian Construction Works Corporation Transport Infrastructure Sector (ECWC TICS).

1.7 Structure of the research

This research consists of five chapters. Chapter 1 is an introduction to the research and includes seven sections that present the background, problem statement, objectives and research questions, significance of the research, scope of the study, structure of the thesis and research methodology. Chapter 2 discusses the literature review for the study. Chapter 3 presents how the study will conduct and also discusses how the data is collected. Chapter 4 focuses on research findings and data analysis. Chapter 5 summarizes the findings and outlines the recommendations of the study. The chapter also highlights the contributions of the research and concludes with suggestions for further studies.

2. LITERATURE REVIEW

2.1 Definition of cost

The term cost can be defined as the monetary measurement of expenditure incurred on or attributable to achieve a specific objective, such as acquiring goods or services (Drury, 2012). It can also be described as the resources that have been sacrificed or forgone to attain a particular objective.

The terms ‘Cost’ and ‘Expenditure’ are used interchangeably to mention the same thing in the field of business. Costs that are incurred for the production of a product or service have to be determined, the techniques and process of ascertaining costs are known as costing. Costing includes classifying, recording, allocation and appropriation of expense to determine the cost of product or service and for the presentation of arranged data for control and guidance of management (ICAI, Cost and managment accounting, 2012).

Terminology

A cost object is any activity, product, service or job order for which the cost is assigned. Drury (2012) defines cost objects as any activities for which a separate measurement of cost is desired. Carefully identifying the cost object is very crucial for a sound costing system.

A cost pool is assembling the cost in a meaningful group in an organized manner. A cost pool is defined by CIMA (2005), as a grouping of costs relating to a particular activity in an activity-based costing system. In the case of a manufacturing organization, as regards stores, cost of classification, cost of issue of store requisitions, inspection costs, etc. can be pooled under the heading ‘stores’ (ICAI, Cost and managment accounting, 2012). In another word, it is the sum of the total cost assigned to an activity. (Charles, Srikant, & Madhav, 2015)

Cost drivers are any factors that have the effect of changing the level of total cost. Chales, Srikant, & Madhav, (2015) defines cost drivers as a variable, such as the level of activity or volume that causally affects costs over a given period.

Cost accumulation is a process of collecting cost data in some organized way (Charles, Srikant, & Madhav, 2015). The accumulated cost is then assigned to designate the cost object.

Cost assignment is a general term that encompasses both tracing direct costs to a cost object and allocating indirect costs to a cost object. . Chales, Srikant, & Madhav, (2015) defines cost assignment as gathering a cost in a cost pool and assigning it to a specific cost object.

Cost allocation is the process of assigning costs when a direct measure does not exist for the quantity of resources consumed by a particular cost object (Drury, 2012). It is a form of cost assignment of indirect cost to a cost pool and cost object through the use of cost drivers.

Cost sheet is a statement that shows various components of the total cost or per unit cost in a systematic manner (ICAI, Cost and managment accounting, 2012). It is important for ascertaining cost, fixing of selling price, cost control and facilitating managerial decisions. The cost sheet can be prepared based on historical and estimated costs. In historical cost basis, the cost sheet is prepared after the actual cost is incurred. Whereas the estimated costs sheet is prepared before the commencement of production.

2.2 Classification of cost

In performing an activity there may be different costs incurred. Cost classification is a process of identification of each item and systematic placement of like items together according to their common features. As per cost accounting standard by ICAI,(2012) cost can be classified regarding the nature of the expense, its traceability to a cost object, its relation to functions/activities, its behavior and its relationship to the production process. Based on this cost can be classified as follows: -

I. Classification based on traceability to a cost object

Depending upon the traceability of expenditure to cost object, cost can be classified into the direct and indirect cost. Direct costs are an expense that is related to a particular cost object and can be traced to it in a cost-effective (economically feasible) manner (ICAI, Cost accounting, 2018). Otherwise, the cost component can be termed as an indirect cost. For example, the costs of rock material in rock fill activity in construction considered as

direct cost because it can be easily traced or identified with the rock fill activity. Whereas the cost of the store, safety facility, workshops, offices, parking facilities can be considered as an indirect cost because these costs are not particularly done for the rock fill activity rather it is required to support the working crew all activity.

II. Classification based on the nature of the expense

Costs should be gathered together in their natural groupings such as material, labor, equipment and other expense. Material costs are any cost of material which are used for the production of a product or provide a service. Labor cost indicates the payment made to the permanent or temporary employees for a production of a product or rendering of service. Equipment cost means the cost of machinery or any other equipment which are used for the production of a product. For example, in construction firms activities use different types of machinery and equipment, it is important to accurately estimate the equipment cost as part of the total cost of the construction project. Expenses are other than material, labor and equipment which are involved in an activity.

III. Classification based on function

A company performs several functions like manufacturing, selling, research, etc. In this case, costs may be required to be determined for each of these functions. For example, functional cost for a manufacturing sector can be classified as production and manufacturing cost, administration cost, selling and distribution cost, research and development cost.

IV. Classification based on the nature of the behavior

Based on the behavior in response to the change in the activity levels costs can be classified as a fixed cost, variable cost, and semi-variable cost. Identifying these costs provides valuable information for making management decisions and evaluating the performance. Fixed cost is an expense that a company is obligated to pay which doesn't vary with the change in the volume of activity. These costs are not affected by temporary fluctuation in the activity of an enterprise and it is usually time-related. For example, rent, depreciation, etc. Variable cost is an expense that changes or directly varies with the total activity or volume of output produced. For example, direct material, piece-rate

labor, etc. Semi-variable costs contain fixed and variable elements they are partly affected by the fluctuations in the level of activities. Maintenance and supervision are a good example.

V. Classification based on the nature of production or process

To identify costs in manufacturing it is important to classify the costs based on the production process of the industry. For example, a type of cost based on a production can includes

1. **Batch cost** is total cost related to a cost unit which consists of a group of similar courses which maintain its identity through one or more stage of production (ICAI, Cost accounting, 2018).
2. **Process cost**

Some products are produced from a sequence of the continuous or repetitive process the cost incurred during a period is considered as a process cost. This type of costing is applied in industries where continuous manufacturing is carried out and the unit costs are identified by dividing the process cost by the number of units produced during the period (ICAI, Cost accounting, 2018).

VI. Classification based on costs for management decision making

The main purpose of ascertaining the cost is to provide relevant data for management to make the decision-making process reasonable. For managerial decision making, cost data can be analyzed keeping in view the following cost concepts:

Marginal costing is variable costs which indicate the rate at which the total cost of a product increases or decreases due to the production increase by one unit (ICAI, Cost accounting, 2018). Since fixed costs don't change with the change in the volume of product the marginal cost is only influenced by the change in the variable cost.

Differential cost also known as incremental cost, is the difference between the total costs because of the selection of one alternative to the other (Drury, 2012). It has a similar principle with the marginal cost but the main difference is that the marginal costing represents the increasing or decreasing of cost due to adding one extra unit of output,

whereas incremental cost represents the additional cost/revenue resulting from a group of additional units of outputs.

Opportunity cost is the cost that measures the revenue forgone or sacrificed because of not making the best alternatives or choosing one option over the other (Charles, Srikant, & Madhav, 2015). It refers to the return expected from an investment other than the present one.

Replacement cost is the expense of an asset in the current market for the purpose of replacement (ICAI, Cost accounting, 2018). It is useful in determining the optimum time of replacement of an asset.

Relevant cost is costs which are relevant for a specific purpose and pertinent for making a decision. Those costs can be changed by a decision whereas the other cost which is not affected by the decision is irrelevant.

Imputed cost also known as 'implicit cost' are a hypothetical cost that a firm forgoes by taking one action or strategy over another. According to Drury (2012), this type of costs isn't involving cash outlay computed only for the purpose of decision making. It is a type of opportunity cost that cannot be recorded in the books of account but significant for making a decision.

A sunk cost is the costs that have been incurred before where the decision will be unaffected. These costs are irrelevant made in the past can't be changed by any decision that will be made in the future (Drury, 2012).

Normal/Abnormal cost normal costs are the expenses that are usually incurred or expected to incur at a given level of output (CIMA, 2005). Unusual or unexpected costs occur due to abnormal situation of production is called abnormal cost.

Avoidable/unavoidable cost

Avoidable costs are those cost which can be kept by under a given performance efficiency or by not adopting a given alternative, whereas unavoidable costs can't be saved. Unavoidable costs are fixed cost which can't be eliminated or escape because they are essential to be incurred to acquire the product.

VII. Classification by time

Historical costs are the actual costs of product or service which are determined after the event. Those costs are ascertained after they have been incurred and they represent the cost of actual operational performance.

Predetermined costs are computed based on the specification of all factors affecting the cost and cost data which can be standard or estimated.

Standard cost is planned unit cost of a product, component or service (CIMA, 2005). The predetermined calculation of the amount of cost from an assessment of the value of cost elements correlates technical specifications and the quantification of materials, labor and other costs, that will occur under the specified working condition. It is useful in providing bases for controlling costs and efficiency.

Estimated cost is forecasting a cost based on the past performance which focuses on the level of costs not to be exceeded. It is also used in price fixation and tendering.

2.3 Accounting

Accounting is a tool that transfers economical information to people who have an interest in an organization such as the managers, shareholders, investors, and even for the government (Drury, 2012). It is an art that focused on keeping records of receipts and payments as well as income and expenditure (ICAI, Cost and managment accounting, 2012). Many kinds of literature named it as a "language for financial decision". In any business after gaining a sound knowledge on different types of cost which can occur in the business, it is also crucial to have the proper format of recording the costs for the future and present decisions. For accounting information to be appropriate for decision making, the accountant who process the data must be conscious about for what is the purpose the information be used and by whom (Sharma B. , 2007). There are many groups of users of this information and each of these groups will have different needs for accounting information (Atrill, 2009). According to ICAI (2012), it can be broadly divided into 3 categories namely:

- Financial Accounting,

- Management Accounting, and
- Cost Accounting,

2.3.1 Financial accounting

Financial accounting can be defined as a branch of accounting that keeps track of a company's financial transaction by classifying, analyzing and recording in a systematic manner to prepare a summary at the end of the year to and out the results of the concerned accounting year (ICAI, Cost and managment accounting, 2012). Basically, financial accounting desire at looking at the outcome of an accounting period in part of profits or losses and assets and liabilities. Financial accounting is mainly concerned with the provision of information to external parties outside the organization (Drury, 2012).

2.3.2 Management accounting

According to Drury (2012), management accounting is concerned with the provision of information to people within the organization to help them make better decisions and improve the efficiency and effectiveness of existing operations. Management accounting is primarily concerned with management by which it helps in making rational decisions for the accomplishment of these objectives. Management accounting is an accounting system that will help the management to improve its efficiency. The main thrust of management accounting is towards determining policy and formulating plans to achieve the desired objectives of management (ICAI, Cost and managment accounting, 2012).

2.3.3 Cost accounting

Cost accounting measures, analyzes and reports financial and non-financial information relating to the costs of acquiring or using resources in an organization (Charles, Srikant, & Madhav, 2015). It refers to the process of recording all incomes and expenditures and ends with the preparation of statements and reports for ascertaining and controlling the costs of a product. Cost Accounting is classifying, recording and appropriate allocation of expenditure for the determination of the costs of products or services, and the presentation of suitably arranged data for control and guidance of management (ICAI, Cost accounting, 2018). Cost accounting accounts for the cost of products, service or an operation. According to the Institute of cost accountants of India (2018), cost accounting

is defined as a quantitative method that collects, classifies, summarizes and interprets information for product costing, operation planning, and control and decision making.

It is conspicuous from an exploration of different literature that the separation between cost accounting and management accounting is highly ambiguous some writers citing to the decision making facet in terms of cost accounting and other writers using the term management accounting; the two terms are often used synonymously (Drury, 2012).

Cost accounting differs from other types of accounting in such a way that it focuses on the computation of cost on a scientific basis and thereafter controlling and reduction of cost. One of the main objectives of cost accounting is to collect records and measure numbers that describe economic activity such as amounts, prices, values, and other quantities. Another main task of cost accounting is to create and use reports and calculations based on these numbers for decision-making, to reduce the company's costs and to improve profitability.

2.4 Difference between cost accounting and financial accounting

There is a misunderstanding about the meaning of cost accounting and financial accounting. Both types of accounting have their aims and purpose. The major difference between these two branches of accounting as per Charles, Srikant & Madhav, (2015) and ICAI, (2012) are:

Table 1: The Difference between Financial Accounting and Cost Accounting (ICAI, (2012))

Cost accounting	Financial accounting
Provides essential information to the management staff for proper planning, operation, control, and decision making.	It provides information to different parties involved in business internally and externally.
It helps to ascertain the cost of goods produced.	It helps to know the operational results and financial position of a business.
It classifies the costs into the material, labor, fixed overhead, and variable overhead.	Transactions are divided into debit and credit terms.
It provides a detailed system of control for materials, labor and overhead cost with the help of standard costing and budgetary control	It emphasizes the recording aspect without attaching any importance to control.
Variance analysis is to identify the favorable and adverse difference between standard cost and actual cost.	It records only actual transactions occurring in the course of business operations
Provides valuable information on the efficiency of employees, plant, and machinery	Don't provide information on efficiency
Facilitates the presentation of cost information at regular intervals.	Financial statements are annually presented.
Profit or loss is estimated on a specific product, branch, department or job.	It presents the operational results of the entire business.

2.5 Objectives of Cost Accounting

As per ICAI, (2012) the objectives of cost accounting can be summarized as under:

- **Ascertainment of cost:** the primary objective of cost accounting is to ascertain the costs of a product or cost object on per unit basis or total cost, for example, cost per kg, cost per meter, cost per liter, cost per ton, etc.
- **Fixing of the selling (unit) price** once the unit basis or total costs of a product or cost objects is known then the selling price or the service price of the product or service can be determined by adding a reasonable amount of profit.

- **Controlling and reduction of cost**: - cost accounting helps to preserve the cost of a product at optimum level without affecting the proper quality. Costs can be controlled by comparing the Standard and actual costs of a product. Cost reduction implies the retention of essential characteristics and quality of products and genuine saving of expense by the elimination of wasteful and inessential elements.
- **Assisting the management for planning and decision making** it provides relevant data in a systematic manner and actual information about the cost to the management for the evaluating, future planning and decision making. Cost accounting helps in the presentation of relevant data to the management which helps in decision making. Decision making is one of the important functions of Management and it requires the presentation of relevant data. Cost accounting enables the presentation of relevant data systematically so that decision making becomes possible.
- **Forecasting the future cost** by using the past records of cost accounting the product future cost of an activity can be done so that the budget can be allocated.
- **Control efficiency** also helps in locating wastages, inefficiencies and other loopholes in the production processes/services offered.
- **Ascertainment of profit** by using the cost accounting techniques division wise, activity-wise and unit wise profitability can be ascertained. Also with the help of cost accounting data the management can increase the level of output and profit.
- **Effective information of the system** it enables us to ascertain the cost at every level of the production process and activity level.

2.6 Importance of cost accounting

An effective and organized system of costing may have the following importance:

- Providing information to different bodies with respect to production, cost, materials, labor, stores, plant capacity, etc. which assist out planning,

- Identifying profitable and unprofitable activities that help the management to reduce or eliminate wastages and inefficiencies such as underutilization, idle time, spoilage of material, etc.
- Managing the cost in a systematic way which will lead to effective product pricing.
- Supporting continuous inventory system, this ensures preparation of interim profit and loss account.
- Assisting in the formulation of policies related to the product, price, etc.
- Comparison of cost between different periods, products, departments or firms.
- Revealing idle capacity, would help the management to deal with bottlenecks.
- Ascertainment of cost and profit more frequently and examination of their causes in detail.
- Taking decisions based on facts and formulation of suitable policies for various matters.

2.7 Method of costing

ICAI (2018), defines costing as a technique and process of ascertaining the cost. Costing is classifying, recording, allocation and appropriation of expense for the determination of cost of products or service and the presentation of suitably arranged data for the purpose of control and guidance of management (Charles, Srikant, & Madhav, 2015). The primary aim of cost accounting is to ascertain the cost of the product offered or the services provided. To do the same, it is necessary to follow a particular method of ascertaining the cost. To ascertain the cost of products or services offered different methods of costing are applied in various businesses. According to ICAI, (2012) there are two principal methods of costing:

1. Job Costing
2. Process Costing

2.7.1 Job Costing

This method of costing is the category of basic costing methods applicable where the production is as per the requirement of the customer. In this method, a cost object is a

unit or multiple units of a distinct product or service called a job (Charles, Srikant, & Madhav, 2015). For industries, when the production is not on a continuous basis, rather it is only when order from customers is received as per the specifications and with a different product in such type of business, organizations use Job Costing or Job Order Costing. This creates the need for the cost of each unit to be calculated separately (Drury, 2012). A job may be a product, unit, batch, sales order, project, contract, service, specific program or any other cost objective that is distinguishable clearly and unique in terms of materials and other services used (ICAI, Cost and managment accounting, 2012). The cost of a completed job will be the materials used for the job, the direct labor employed for the same and the production overheads and other overheads if any charged to the job. Job costing includes batch costing and contract costing

- **Batch Costing:** is the extension of the job costing, used where units of a product are manufactured in batches and used in the assembly of the final product. Thus components of products like television, radio sets, air conditioners, and other consumer goods are manufactured in batches to maintain uniformity in all respects (ICAI, Cost and managment accounting, 2012). The cost per unit is determined by dividing the costs of the batch by the number of units produced in a batch.
- **Contract Costing:** is a method used when the job is big and spread over a long period (ICAI, Cost and managment accounting, 2012). Contract costing is used by concerns like construction firms, civil engineering contractors, and engineering firms.

2.7.2 Process Costing

This type of costing is used in those industries where the production is in a continuous process, i.e. the output of one process becomes the input of the subsequent process and so on (ICAI, Cost and managment accounting, 2012). Examples of such industries are paint works, chemical plants, food manufacturing, oil refining, paper mill, textile mills, sugar factories, fruit canning, dairy and so on. In such industries, the input is put in the first process and the output of each process becomes the input of the subsequent process until the final product emerges from the last process. (McCaffer, Thorpe, & James, 1990)

2.8 Process of cost accounting

To achieve the objectives of cost accounting the system should correctly follow each process of cost accounting. NCC, (1979) classified the process of cost accounting into four phases namely; performance data recording, data processing, performance evaluation and corrective decision making.

2.8.1 Performance data recording

According to National Computing Centre, N.C.C. (1979), data recording refers to the process of "accumulating, regularly, the necessary information so that progress on a project can be measured, both as regards time and cost utilization, and also the completion status of current activities". The data recording method can be manual or computerized. In manual recording the cost data are maintained by hand while in a computerized system the cost data are maintained by using computers. Many researchers like Rasdorf, (1991) discouraged manual data capture because the system is subject to human errors during filling out forms by hand, summarizing the paper forms onto others and keying information into computer work stations. Also McCaffer, Thorpe & James, (1990) criticized manual data capture via the use of forms or cards for being inaccurate, laborious and containing only limited details to enable effective monitoring and control of projects. To overcome the problems, many researchers proposed a computerized data capture system using portable laptop computers such as Charles Gregory in association with Loughborough University of Technology quoted in Abubakhar, (1992), developed a program the Site Manager System (SMS). The SMS software was designed to be used on portable (laptop) type computers. The design philosophy was that the user could take his/her data wherever he/she went. The site machines were coordinated by a central PC at the head office. This machine ensured that all sites were kept up to date with the latest software and data. Communication between site and head office was achieved via the exchange of floppy disks, usually on a weekly basis (Abubakhar, 1992).

As mentioned in Abubakhar, (1992) PAVIC system (Productivity Analysis with Video and Computer) was also developed at the Department of Construction Engineering and Management of Chalmers, University of Technology in Sweden. The PAVIC system

entailed video recording of work operations and analyzing the film by connecting it to a specially coded computer which was programmed to imprint time marks on the sound track of the videotape and transform the recorded information into statistics such as means, maxima, minima and standard deviation for each operation studied. Abubakhar (1992), states three methods of performance data capturing that appear to be particularly for construction projects are card recording system, computer-generated turn around the system and graphical method.

1. **Card recording system**

In this system all items of expenditure on-site should be captured systematically and progressively such as; labor operational time and cost, materials consumption and wastage, equipment utilization, breakdown and idle time, overhead expenses, and costs of subcontractors, subcontractor's . Depending on the activities to be carried out, a foreman collects the relevant forms for labor, materials, plant, and attendance before starting time each day and enters the relevant data through the day as the operations proceed (Abubakhar, 1992). At the end of the day, he signs and drops the completed forms at the site office where all the forms for that day will be processed. Clough, Searse, & Koki (2008), have identified designed forms or cards as the most popular means of capturing data on construction sites. Such forms include time sheets for labor, plant and subcontractors, site diary, equipment utilization register, work quantity summaries, and stores forms.

2. **Computer-generated Turnaround Document**

As the name indicates it is a communication tool of primary significance for conveying information between the office environment and the job site. The turnaround document is not much different from the card system. Each foreman picks up an exception printout of his expected activities for the day from the (site) computer room and returns the completed document at closing time for feeding into the computer. Strictly speaking, the turnaround document is simply a case of the card system linked to the computerized database and with automated processing and evaluation

3. **Graphical method**

This method of data capturing can be applied into generally small projects with very simple schedules, repetitive projects and on management contracts where a main

contractor schedules and monitors the activities of subcontractors. The foreman gets a copy of the project schedule in bar charts or networks and shades the progress of his operations on a daily, weekly or monthly basis and reports regularly to the management. As Abubakhar, (1992) states this method is not effective in monitoring actual costs even though it provides a good focus on the project schedule.

2.8.2 Data processing

As per Abubakhar, (1992) data processing is a process of accumulation, classification and recording of received information into some recognized and meaningful manner to facilitate identification of significant deviations from plans and or standards. The raw data provided from the data capturing stage uses to answer most of the questions that form the aim and objective of performance measurement. To measure and interpret the raw data some computational and or analytical routine is needed to present the data to the management and supervisors.

2.8.3 Evaluating the performance

A periodic performance evaluation is done to measure the degree of deviation between completed activities and plans. As per the institute of cost accountants of India, (2012) the main aspect of performance measurement is a comparison between the targets and actual. There are several tools and techniques like budgets and budgetary control, standard costing and marginal costing, which are used in measuring the actual performance against the target performance. This will facilitate introspection and corrective action can be taken for further improving the performance.

It is a means by which unnecessary causes of waste can be identified so that the organization knows where to focus its effort. As per Tunji-Olayeni, (2016) the purpose of performance measurement is to provide timely and accurate feedback on the efficiency and effectiveness of operations and to focus attention on continuous improvement. Takim, R., Akintoye, A. and Kelly, J. (2003) state in a construction project context, it is regarded as a systematic way of judging project performance by evaluating the inputs, outputs and final project outcomes (Takim, Akintoye , & Kelly, 2003). In different literature there are different methods for evaluating the performance Abubakhar, (1992) tries to list out two methods that are suitable for construction.

1. Performance ratio

Performance ratio provides a more pragmatic approach to the evaluation of performance data and involves direct matching of data on an activity by activity basis to provide a basis for corrective decision-making (Abubakhar, 1992) . The formula for calculating performance ratios is:

$$\text{Performance Ratio (PR)} = \frac{\text{Actual performance (AP)}}{\text{Planned Performance (PP)}} \times 100\%$$

If PR> 1, something has gone wrong to warrant corrective action; or that as long as PR < 1, there is nothing wrong with the project, and that conditions are all favorable.

2. Variance analysis

Constriction project works are usually planned to ensure that work is carried out according to the budget, to the desired quality and in the allowed time. Mostly divergences from plans occur. Nevertheless, such divergences are expected because of the nature of the work and uncertainties associated with it. So the progress of the project is required to be monitored and compared as the work proceeds to be able to identify and measure cost and time variances. Variance analysis helps to monitor the project at every level of an organization. Kabiru and Abuh, (2013) states the basic concept of variance is simply the difference between actual costs incurred and standard or budgeted costs applied to an activity or service process in a period. When practical or realistic standards of performance are put in place, taking into consideration wastage and other losses, and the actual performance deviates positively or negatively from the predetermined level of performance, then there will be a question of why cost variance has occurred.

Kabiru I. and Abuh A,(2013) states that when the variance occurs first, the management should recognize that the variances are only a starting point, a clue for investigation and secondly, from the viewpoint of control, these variances should be measured as soon as possible. The longer the delay, the staler would be the data and the fewer the opportunities for corrections (Horngern, 1978).

The analysis of variance will be based on the various elements of costs in a process, usually into material, labor, equipment, and overheads. It is the analysis and comparison

of the variables that had caused the variation between the standards and actual performance to highlight and prevent wastes in whatever form. Dandago K.I and Tijjani B, (2005), states material variance could arise from the instability of prices, a supply of material and management lapses such as inefficient purchasing policy, the uncertainty of required materials and mistakes, reversal of specification and inadequate resources. Labor variances are said to be caused mainly by management lapses like the improper determination of internal rate, provision for labor turnover and idle time, quality of labor and poor conditions of the machine. And variances from overheads are due to changes in production volume, labor disputes, poor production scheduling, poor production quality and major shifts in demand for products. Abubakhar, (1992) state the general formula for calculating variance as;

$$\mathbf{V = (A\text{-}P)\ R}$$

Where: V = variance of the resource being measured

A = actual amount of resource used

P = planned amount of resource to be used

R = planned rate/price for the resource

Abubakhar, (1992), states different types of variances that have to be computed but not limited for construction for each cost code or center. Such as:

1. LRV = labour rate (price) variance
2. LEV = labour efficiency variance
3. MPV = materials price variance
4. MUV = materials utilization variance
5. MYV = materials yield variance
6. EEV = equipment efficiency variance
7. ERV = equipment rate variance
8. OHV = overhead variance
9. TCV = total cost variance

2.8.4 Corrective decision making

After analyzing and evaluating the performance a corrective decision have to be taken. In this level, the managements are concerned about what must be done immediately to restore performance to the desired level or correct standards and the basic causes of deviation. According to Abubakhar (1985) cited in Abubakhar, (1992), the decision-making process has the following steps:

1. Analyzing reported performance data to determine the cause(s) of any identified loss of performance.
2. Making rational decisions as to what action to take to correct the deficiency and to attempt to return performance to the desired level.
3. Communicating the corrective decisions to the right level and at the right time, (usually as soon as possible), for implementation.
4. Implementing the corrective decisions by instructing staff and management of the new approach.

Abubakhar, (1992), list out the following as a corrective decision option for management in the case of construction

1. Change the resource mixes of adverse activities
2. Review/change the plan, schedule, and budget of the project.
3. Review/change site organizational structure and/or project information system.
4. Review the activities of vendors, subcontractors, consultants, and clients.
5. Re-evaluate local market for labour, materials, equipment, subcontractors etc..
6. Employ alternative methods and or procedures for site operations and management.
7. Review contract conditions in relation to claim generating clauses.

2.9 Overheads

As discussed earlier, based on the nature costs are classified as a direct and indirect cost. Direct costs are those which are identifiable and traceable to the cost object while indirect costs are not traceable to the cost object. If the company manufactures or produce only

one product all cost is direct and easily traceable to the product but if more than one product is offered by the firm the indirect costs are not traceable with a particular product. This indirect or supplementary cost which cannot be wholly debited to a particular job is called Overhead cost (ICAI, Cost and managment accounting, 2012). As per CIMA,(2005) overheads comprise costs of indirect materials, indirect employees and indirect expenses which are not directly identifiable or allocable to a cost object in an economically feasible manner. Thus all indirect material, indirect labor and indirect expense are called overheads. For example, rent, tax, depreciation, maintenance repairs, supervision, etc.

2.9.1 Overhead distribution

The ultimate aim of knowing overhead is to absorb the cost in product unit produced by the firm. Absorption of overhead means charging of each unit of a product based on the appropriate portion of its share of overhead expense (ICAI, Cost and managment accounting, 2012). A lot of care has to be taken in the absorption of overheads as accurate absorption will help in arriving at an accurate cost of production. The steps in overhead distribution are discussed below.

1. **Collection and classification of Overheads**

The collection of overhead is very important. It is a process of recording each item of cost in the records maintained for the ascertainment of cost of each cost center (ICAI, Cost and managment accounting, 2012). The documents can be collected from different sources like store issues, payroll sheets, subsidiary records, and other reports.

After the overhead costs have been collected it is advisable to classify them according to their category. Classification is defined by CIMA (2015) as, 'the arrangement of items in logical groups having regard together nature (subjective classification) or the purpose to be fulfilled (Objective classification. Classification of cost in an accurate manner is a prerequisite to any form of cost analysis and control system. It can be made according to the following basis:

I. **Classification according to Nature: -** based on the nature overheads are classified as follows

Indirect material: can be defined as the costs of materials that cannot be directly attributed to a particular product unit (ICAI, Cost accounting, 2018). For example, lubricants used in a machine are indirect material.

Indirect Labour: These are indirect employee cost which cannot be directly attributed to a particular cost object. Wages and salaries paid to indirect workers, i.e. workers who are not directly engaged in the production are examples of indirect wages (ICAI, Cost and managment accounting, 2012).

Indirect Expenses: are expenses, which cannot be directly attributed to a particular cost object. For example, expenses such as rent and taxes, printing and stationery, power, insurance, electricity, marketing and selling expenses, etc.

II. **Classification according to function** depending on their function overheads can be classified as follows:

Manufacturing overhead has a different name such as factory overheads, production overheads and works overhead. The indirect expense which is incurred for production or manufacturing process, but cannot be identified with the product unit are called manufacturing overheads (ICAI, Cost and managment accounting, 2012). For example, factory rent insurance, repair, and maintenance of plant and machineries, salaries of foreman and supervisor, lubricant oil, stationery, etc.

Administrative overhead these are costs that are incurred for running the general management and administration of the organization (ICAI, Cost and managment accounting, 2012). The expense may be for policy formulation, directing the organization and controlling the operation of the organization. These costs are incurred for the benefit of the organization as a whole.

Selling and distribution overheads are all indirect expenses related to sales management for the organization. An expense incurred for getting an order from the consumers is called selling expense whereas costs incurred for the execution and handling of order from the time it is ready for dispatch until it reaches the consumers are called distribution expense (ICAI, Cost and managment accounting, 2012). This overhead

in the total cost would depend on many factors such as the nature of the product, type of customers, spread of market, statutory restrictions, etc.

III. Classification based on behavior or variability

Fixed overheads also known as period cost are constant expenditures incurred during a period without regard to the volume of production during that period (Maharshi Dayanand university, 2004). These costs are not affected by the outputs of production only when the change in output is not substantial. If the change in the output is substantial these will increase and remain constant.

Variable overheads are costs that fluctuate in the same ratio to the volume of output. For example, power, and selling commission.

Semi- variable overheads these are costs which are partly fixed and partly variable. For example telephone costs. There are two types of semi-variable overhead, the expense which changes with the change in the volume of output and the cost which remains constant with a certain range of output, then jump up and remain constant for another range and so on (Maharshi Dayanand university, 2004).

2. Departmentalization of overhead

The term departmentalization of overheads refers to creating the department in the firm so that the overhead expense can be easily allocated and apportioned to the departments like fabrication, assembling, maintenance, test room, etc (ICAI, Cost and managment accounting, 2012). The process helps in the ascertainment of cost of each department and control of expense. This involves the following stages:

a. Allocation is a process of charging a full amount of overhead cost from a particular cost object (Maharshi Dayanand university, 2004). According to CIMA, (2005) cost allocation is defined as, the charging of discrete, identifiable items of cost to cost centers or cost units. For example, electricity charges can be allocated to various departments, depreciation of machinery can be allocated to various departments, and the salary of the store clerk can be allocated to the stores department. Therefore, the allocation is a direct process of identifying overheads to cost units or cost centers. The term allocation indicates ration of the whole item of cost to a particular cost center or cost object without any division (ICAI, Cost and managment accounting, 2012).

b. **Apportionment** there is a situation where the allocation of overheads to a specific cost center is not possible; in this case, the overhead costs have to be apportioned to different departments based on suitable bases. This process is known as 'apportionment of overheads'. Apportionment is a process of allotment or splitting up the overhead costs and charging it to the cost centers on an equitable basis (Maharshi Dayanand university, 2004). For example rent of the factory, general manager's salaries, etc. The bases for the apportionment have to be studied and decided carefully. For example, for rent, the basis for apportionment can be floor area occupied by each department, for general lighting numbers of light points for each department, for material handling value of materials used are the bases. This apportionment of overheads is called the primary distribution of overheads (ICAI, Cost and managment accounting, 2012).

c. **Reapportionment of overheads** as we have seen earlier before starting allocation of overheads the firm has to be classified to a different department to ascertain and identify the cost incurred in each department. The firm can be broadly classified as production department and service department. Production departments are departments where the actual production process takes place. Whereas service departments are the department that gives service to the production departments (ICAI, Cost and managment accounting, 2012). For example, human resource department, maintenance department, general service department, store department, etc. The apportionment of the service department to the production department is known as the reapportionment of overheads (Maharshi Dayanand university, 2004). This reapportionment of service overheads to the production overheads is called a secondary distribution summary of overheads (ICAI, Cost and managment accounting, 2012).

3. Absorption of overheads

Absorption refers to charging of overheads of cost centers to different cost units in such a way that each cost unit bears an appropriate portion of its share of overheads (Maharshi Dayanand university, 2004). This is done by means of overhead rates. An overhead rate refers to the rate at which the overheads are to be charged to different cost units. It can be in the form of a rate per unit or percentage (Maharshi Dayanand university, 2004). ICAI,

(2012) indicates several methods in determining the overhead rates such as actual, predetermined overhead, blanket, and multiple rates.

Actual overhead rate is obtained by dividing the overhead expenses incurred during the accounting period by actual quantum on the base selected (ICAI, Cost and managment accounting, 2012). Assuming that the rates are worked out on a monthly basis the formula is:-

$$Overhead\ Rate = \frac{Actual\ overhead\ during\ the\ month}{Value/Quantitiy\ of\ the\ base\ during\ the\ month}$$

Predetermined overheads rates it is computed by dividing budgeted overhead expense for the accounting periods by the budgeted bases (quantity, hours, etc.) (ICAI, Cost and managment accounting, 2012).

$$Overhead\ Rate = \frac{Budgeted\ overhead\ expense\ for\ the\ period}{Budgeted\ bases\ for\ the\ period}$$

Blanket overhead rates this may be absorbed either based on one single rate (known as a blanket rate) computed for the factory or based on separate rates for each individual department or cost center (ICAI, Cost and managment accounting, 2012). It is applied where one product is manufactured or where work performed in different departments is more or less on a uniform pattern.

$$Blanket\ Rate = \frac{Overhead\ cost\ for\ the\ factory}{Total\ quantum\ of\ the\ base}$$

Multiple overhead rates this method is most commonly used to determine the multiple overhead rates, i.e. separate rates: for each producing department, for each service department, for each cost center and for each product line (ICAI, Cost and managment accounting, 2012). The multiple rates are worked out according to the below formula:

$$Overhead\ Rate = \frac{Overhead\ cost\ allocated\ \&\ apportioned\ to\ each\ product, dept.}{Corresponding\ Base}$$

Under-absorption and Over-absorption of Overhead

Overhead costs that are absorbed in the costs unit is the total sum of the overhead costs allotted to individual cost units by application of the overhead rate. If the amount absorbed is less than the amount incurred, which may due to actual expenses exceeding the estimate and / or the output or the hours worked may be less than the estimate, the difference denotes under-absorption (ICAI, Cost and managment accounting, 2012). On the other hand, if the amount absorbed is more than the expenditure incurred, which may be due to the expense being less than the estimate and / or the output or hours worked may be exceeding the estimate, this would indicate over-absorption, which goes to inflate the costs (ICAI, Cost and managment accounting, 2012).

2.10 Cost Assignment

As we have seen earlier based on their nature costs are classified as a direct and indirect cost. These two costs have to be assigned to a cost object to know the cost of each product or service. The direct cost can be assigned accurately to cost objects because they can be specifically and exclusively traced to a particular cost. This direct assignment of direct cost to cost object is termed as direct cost tracing. In contrast, the indirect cost cannot be traced directly to cost objects because these costs are common for several cost objects (Drury, 2012). So that indirect costs are assigned to the cost objects by allocating the cost. Cost allocation is the process of assigning the cost when the quantity of resources consumed by a particular cost object can't be directly measured (Drury, 2012). Allocation of the cost can be based on a different basis for example machinery hour, a quantity of material used, direct labor hour, etc. The bases which are used to allocate the indirect cost called allocation bases or cost drivers. Drury, (2012) states that when allocation basis is significant determinants of the cost it is known as the cause – and – effect allocation whereas where the cost allocation base is used that is not a significant determinant of its cost, the term arbitrary allocation is used.

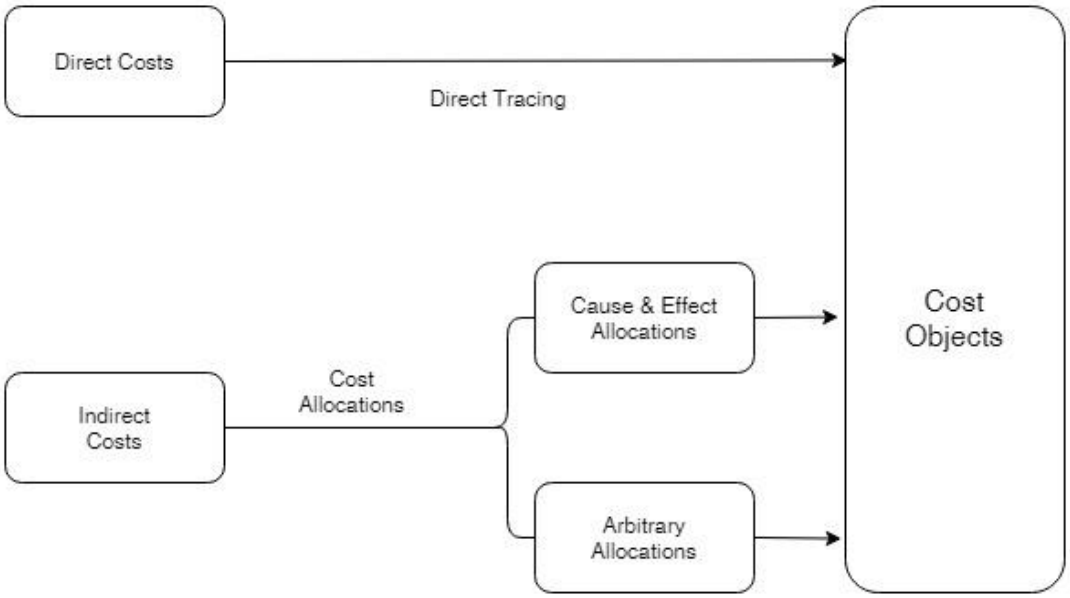

Figure 1: Cost Assignment Method (Drury, 2012)

2.11 Costing systems

The main objective of any costing system is to determine scientifically the cost of a product or service. For facilitating the calculation, costs are divided into direct and indirect. Direct costs are the costs which are traceable to the products/ services offered. On the other hand, indirect costs which are also called 'overheads' are not traceable to the particular products/services. Based on the assignment of cost to the cost object there are two types of costing system named as direct and absorption costing system (Drury, 2012). A direct costing system also known as a marginal or variable costing system assigns an only direct cost to the cost object whereas the absorption costing system assigns both direct and indirect cost to cost object (Drury, 2012). Charging of direct cost of a product is comparatively a simple procedure and can be done with better accuracy. There are problems in charging the indirect costs of a product and there is a possibility of distortion of costs. Distortion in a cost results into incorrect cost calculation may lead to wrong decisions such as errors in fixing selling price, missing profitable activities, ignoring customer orientation, etc. (Drury, 2012). Depending on the allocation of

overhead, absorption costing system, it can be divided into divided into traditional costing system and activity-based costing system.

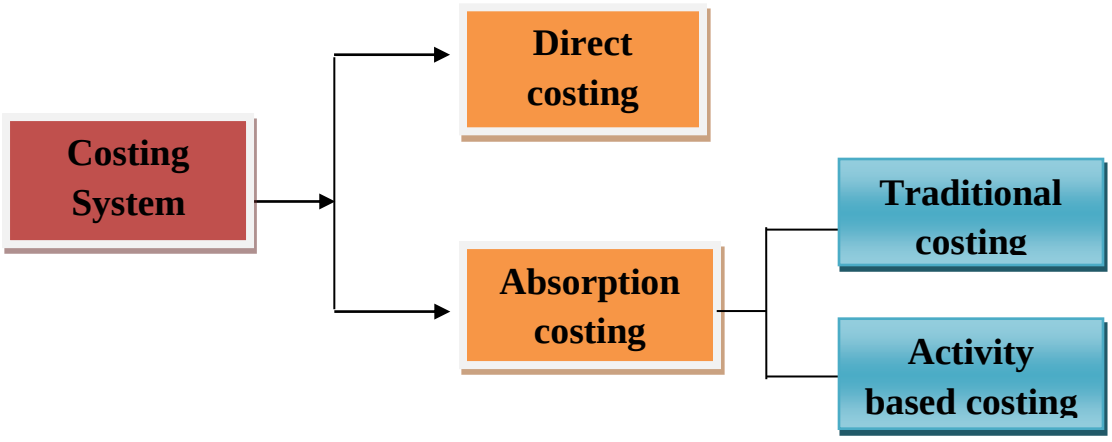

Figure 2: Costing System Classification

2.11.1 Traditional costing system

The traditional costing system of cost accounting refers to the allocation of manufacturing overhead costs to the products manufactured. The system also known as the conventional method was developed in the early 1900s. It uses arbitrary cost allocation and assigns or allocates the company's indirect costs to the items manufactured based on volume such as the number of units produced, the direct labor hours, or the production machine hours (Drury, 2012).

Limitation of the traditional costing system

- In a traditional costing system, overheads are allocated, apportioned and finally absorbed in the cost units. There can be distortion in computing costs due to the basis selected for absorption (ICAI, Cost and managment accounting, 2012).
- The division between fixed and variable may not be realistic as there are many complications due to the complexity of the modern business (Majid & Sulaiman, 2008).

- There should be a linkage between the activities and the costs. Similarly, the information should be available simultaneously which means that information should be made available while the activities are going on. The information available after the activity is over will not be of much use (Charles, Srikant, & Madhav, 2015).

2.11.2 Activity-based costing

Activity-Based Costing (ABC) is a costing system that tries to charge the indirect costs to the products and services fairly accurately. According to Akyol, Tuncel, and Bayhan, (2005) an activity-based costing system defined as a methodology that measures the cost and performance of activities and cost objects. Also Reeve W. and Duchan, (2012) define the activity-based costing system as an accounting framework that is based on relating the cost of activities to final cost objects, such as products or customers. According to Drury, (2012) the ABC system was promoted in the 1980s as a mechanism for more accurately assigned the indirect cost to the cost object. ABC system differs from the traditional costing system by the level of sophistication. The traditional costing system is simplistic whereas ABC is sophisticated. Simplistic systems are inexpensive to operate, but they are likely to result in inaccurate cost assignment and reporting of inaccurate cost, which can cause managers to make a dangerous mistake. The end result may be high cost of error. Conversely, sophisticated systems are more expensive to operate but they minimize the cost of errors.

Figure 3: Cost systems – Levels of sophistication (Drury, (2012))

CIMA, (2005) defines activity based costing as cost attribution to cost units based on benefit received from indirect activities e.g. ordering, setting up, and assuring quality. Activity-Based Costing has been introduced to overcome the limitations of traditional costing systems.

Objectives of Activity-based costing

- To bring more accurate result in the computation of the cost of a product or service by removing the distortions as seen in the traditional costing system
- To help the management in decision making by accurately computing the costs of products and services.
- To allocate overheads based on activities.
- To identify value-adding activities and eliminate non-value-adding activities.
- To detect the opportunities for improvement and reduction of costs.

As per the institute of cost accountants of India,(2012) the following steps have to be followed to install a cost accounting system in an organization. The stage of activity based costing is explained below.

- **Understanding and analyzing manufacturing process**: -to install any costing system, the study of the manufacturing process is essential. For activity based costing system also, it is necessary to study the manufacturing process and ascertain various stages involved in the same so that 'activities' involved in the same can be identified (ICAI, Cost and managment accounting, 2012).
- **Study of the Activities involved**: -The next step is to study the activities involved in the manufacturing process. This step is very crucial as the entire Activity Based Costing is based on the identification of activities. In this step, the activities involved in a process are identified.
- **Activity Cost Pool:** - Cost pool is defined by CIMA, (2005) as, 'the point of focus for the costs relating to a particular activity in an activity-based costing system. In the case of a manufacturing organization, as regards stores, cost of classification, cost of issue of store requisitions, inspection costs, etc. can be pooled under the heading 'stores'. Thus cost pool concept is similar to the

concept of a cost center. The cost pool is the point of focus or in other words, it is the total cost assigned to an activity. It is the sum of all the cost elements assigned to an activity.

- **Cost Drivers**: - is any factor which causes a change in the cost of an activity. (CIMA, 2005). Thus a cost driver is an activity that generates cost. Activity-based costing is based on the belief that activities cause costs and therefore a link should be established between activities and products. The cost drivers thus are the link between the activities and the cost (ICAI, Cost and managment accounting, 2012).
- **Identification of costs with the products**: - The final stage in Activity based costing is to identify the cost with the final products which can also be called as cost objects. Cost objects include products, services, customers, projects and contracts. As mentioned earlier, direct costs can be identified easily with the products but the indirect costs can be linked with the products by identifying activities and cost drivers. Thus Activity Based Costing is the process of tracing costs first from resources to activities and then from activities to specific products (ICAI, Cost accounting, 2018)

For effective implementation of an activity-based costing system, there is a need for involvement of the staff and their training on a continuous basis (Maharshi Dayanand university, 2004). Similarly, there is a need to review the working of the system at periodic intervals and keep a follow up of the feedback received. These actions will ensure the effective implementation of the system. Support of top management is also required for the effective implementation of this system. Activity based costing system is definitely a better system but much depends on the implementation of the same (ICAI, Cost and managment accounting, 2012). Traditional cost systems tend to report less accurate costs because they use cost drivers where no cause-and-effect relationships exist to assign support costs to cost objects (Drury, 2012).

2.12 Evaluating and improving costing in organizations

Every organization whether it is private, public or voluntary sector consumes economic resources to operate every action or function. Those resources of the organization have to

be measured, accumulated and assigned to various processes and outputs to allow the structure and operation of the organization to explained, understood and improved. Costing, the accounting term that embraces these processes and expresses them using money as a common language lies at the heart of managerial accountancy and, exercised intelligently. Costing contributes to an understanding of how profits and value are created, and how efficiently and effectively operational processes transform input into output (IFAC, 2009). The information available in costing can be used to provide feedback on past performance and motivate to change the future performance. IFAC, (2009) states that costing for decision support is valuable for performance improvement, value creation, "what if" analysis, and the effective and efficient application of an enterprise's resources and processes.

2.12.1 Key Principles of Evaluating and Improving Costing in Organizations

International Federation of Cost Accountants (IFAC), (2009) states that using costing effectively for decision making requires understanding clear, timely cause-and-effect relationships between an output and the inputs required to produce it. Conflicts can arise when managers use the wrong cost information to support decision making.

The IFAC, (2009) establishes six fundamental costing principles that will help organizations to evaluate and improve their approach to providing relevant and reliable managerial information. According to IFAC,(2009) these principles are designed to apply in all organizations and provided as a benchmark to evaluate the good practice in applying costing systems and methods and using costing information, for managerial decisions. It will enable the decision-makers by providing a descriptive and historical view of costs and a predictive forward-looking view that together provide the basis for analysis, evaluation, planning, and decision support. The key principles underlying widely accepted as good practice by IFAC, (2009) are:

A. **The importance of costing to good financial management**:-The ability to identify, measure, interpret, and present costs as they relate to an organization's economic flow of goods and services, both historically and in a forward-looking context, is necessary for an informed understanding of the organizational drivers of profit and value.

B. **Fitness for purpose:** -Cost information should be prepared in a manner appropriate to the specific context and purpose of its use, of which there are three principal applications:
   • External reporting – historical and descriptive
   • Performance evaluation and analysis – interpretative and diagnostic
   • Planning and decision support – analytical and predictive

C. **Business model/reality-driven: -** Cost models should be designed and maintained to reflect the cause-and-effect interrelationships and the behavioral dynamics of the way the organization functions. The information needs of decision-makers at all levels of an organization should be taken into account, by incorporating an organization's business and operational models, strategy, structure, and competitive environment.

D. **Materiality/cost-effectiveness: -** The design, implementation, and continuous improvement of costing methods, data collection, and systems should reflect a balance between the required level of accuracy and the cost of measurement (i.e., cost benefit tradeoff), based on the competitive situation of the organization.

E. **Comparability over time and consistency: -** Cost information should be collected and analyzed systematically and in such a way as to ensure comparability over time, whether in a routine information system or for a specific application and/or purpose.

F. **Transparency and auditability: -** Definitions and sources of cost data, the operational and other non-financial data underpinning them, and the methods of calculating costs, should be transparent to users and recorded and capable of review, risk analysis, and assurance.

2.13 Problems in the implementation of costing system

According to Abedalqader A. (1992), the main problems encountered in the implementation of costing are lack of top management support, difficulties of choosing cost drivers and difficulty in identifying activities. Based on the literature review Nangan, (2012) tries to list out and state the common problems which can be occurred in the

implementation of costing system as tabulated in Table 2 and defines some of the problems as follows:

1. **Lack of top management support**

The lack of top management support in the implementation of costing is one of the common problems encountered in the implementation of the costing system. Wessels S.and Shotter M(2000: 222) states that the intensity of the lack of management support increases especially when the top management is more concentrated or focused on other priorities in the firm, as being more important than the costing initiative or when costing initiative is not aligned with the company strategy. Also, a key-related problem cited by Wessels and Shotter,(2000) is that the implementation of costing is too time-consuming for operational managers.

2. **Technical or resource constraints**

Marivic, (2004) quoted in Nangan, (2012), states that the difficulties in implementing costing are technical and complex since the steps involved need detailed records of the costs associated with producing products and services. Marivic, (2004), also observes that employees lack of basic knowledge and skill of costing techniques. Sartorius, (2007) states that other technical or resource obstacles include a difficult definition of cost centers and cost drivers, a lack of adequate information or technology system, a difficult accumulation of data needed for costing and a difficult integration of costing data with another system. Also, Majid and Sulaiman, (2008) argue that the high cost of the implementation, especially the cost of IT (purchasing and updating specific software) are one of the resource constraints encountered by companies during the implementation of a costing system. A study by Wessels and Shotter (2000), indicates that the lack of adequate employee resources is also one of the resource constraints.

3. **Misconceptions about costing**

According to Nangan, (2012), most companies face employee resistance while implementing costing. In this regard, Majid and Sulaiman, (2008) state that lower-level employees are skeptical of the new system, primarily because they do not know what costing is all about. According to Sartorius, (2007) the misconceptions about costing

leads to inadequate marketing of costing and negative publicity within companies. Marivic (2004) quoted in Nangan 2012 states that cost would be adopted more readily by various companies if costing were marketed better by the accountants themselves.

4. **Lack of coherence with the organization's goal and culture**

According to Wessels and Shotter, (2000) the problems relating to a lack of coherence with the organization's goal and culture are the incompatibility of costing with company strategy, and inadequate training of managers, and inadequate training of implementers, inadequate training of users and resistance to change in organizational culture.

Table 2: Common problems in implementing costing, (Nangan 2012)

Main obstacles in implementing a costing system
Top management support
Lack of top management support
Management resistance; seeing costing as just a passing "fad"
Management gives more emphasis to other priorities in the firm
Too time-consuming for operational managers
Absence of project sponsor
Technical or resource constraints
Complex and require detailed records and more effort
Employees lack basic knowledge and skill of costing techniques
Difficulty in identifying and defining cost centers and suitable cost drivers
Lack of adequate systems and IT
Difficulty with data collecting and gathering
Difficulty in integrating cost data with other systems
The high cost of implementation - especially the cost of IT

Too time-consuming for accounting personnel
High turnover of costing project team individuals
Only accounting personnel on the project team
Misconceptions about costing
Inadequate marketing of costing - especially by accountants themselves
Negative publicity about costing
Employees' resistance because they do not exactly know costing
Negative perception about costing
Satisfaction with the current system
Lack of coherence with the organization's goal and culture
Incompatible with company strategy
Inadequate training of managers
Inadequate training of implementers
Inadequate training of users
Resistance to change in organizational culture

2.14 Construction theories and cost accounting system

Any costing techniques which are used in construction need to be aligned with construction production theory and should not conflict with theories that have been developed to achieve efficiency in the industry. According to Evanse (2015), there is a close similarity between principles of the TC and ABC systems and some construction production theories. Lean construction theory is one of the most important theories related to construction production. As per Womack & Jones, 1996 cited in Evanse (2015), lean thinking was first established by Womack, Jones, and Ross in 1991. Khataie & Bulgak, (2013) define a lean concept as "a management philosophy combined with a

set of processes and methodologies which can eradicate and minimize the waste from the production process".

The concept of lean construction is the application of lean concepts to the construction industry. According to Kramer, Henrich, Koskela, and Kagiolou (2002) quoted in Evanse, (2015) lean construction tries to manage and improve construction processes at low cost and with maximum value through a consideration of customer value. Similarly, ABC aims to add value and reduce wastage by eliminating non-value adding activities (Evanse, 2015). Both lean construction theory and ABC systems emphasize customer value additions and product quality.

According to Khataie and Bulgak (2013), lean manufacturing is focused on approaches that can help an organization to reduce the waste factors in its processes. Similarly, Garrison (2011) state, one of the first steps in developing an ABC system is Process Value Analysis (PVA), which helps the manager to eliminate non-value added activities in the company and to improve quality.

2.15 Applications of Cost accounting in construction

The construction industries, like other industries, have been experiencing deep changes involving both the business environment and internal organization. In this context, new cost management information that provides a better understanding and helps to manage increasingly turbulent and complex production processes is needed (Johnson & Kaplan, 1987). In the construction industry, the inadequacy of cost accounting systems has resulted in the dissociation between cost management and the production planning and control processes (Marchesan & Formoso). In general, construction cost control consists basically of monitoring actual performance against cost estimates and identifying variances.

Using the traditional cost account information has become mostly irrelevant and even dangerous for managerial purposes (Kaplan & Cooper , 1997). According to Johnson & Kaplan (1987) cited in Evanse, (2015), states that traditional management accounting information tends to be too late, too aggregated and too distorted to be relevant for production planning and control. According to Marchesan, and Formoso, (2013) the

failings of the traditional management accounting systems have three important consequences. Firstly, the system cannot provide accurate product costs. Costs are distributed to products simplistically and arbitrarily that usually does not represent the real demand imposed by each product on the company's resources. Secondly, traditional management accounting systems fail to stimulate decisions that can affect the overall production result. Finally, the cost management information provided by the traditional systems is of little help to managers in their effort to improve production performance.

According to Marchesan, and Formoso, (2013) some alternatives for traditional cost accounting systems have been developed, aiming to regain the managerial relevance of cost information. One of these alternatives is the activity-based costing (ABC) method, which has been suggested as the leading contender to replace traditional cost accounting methods due to its capability to make the processes and activities performed in an organization transparent and observable. The information produced by ABC cost systems can increase process transparency, guiding to identify non-value adding activities and take the necessary corrective actions (Kaplan & Cooper , 1997).

According to Kim & Ballard, (2002), traditionally construction companies use resource-based costing (RBC) and volume-based allocation to deal with the problem of allocating indirect costs to cost objects. The system of allocating overheads directly to cost objects by the resource is known as resource-based costing, whereas volume-based allocation refers to a system of cost allocation in which costs are assigned to products or services using direct labor hours consumed or contract value. The difficulty with the current system is that companies do not obtain accurate project costs because they fail to allocate overhead costs, or they use a uniform cost driver to assign overhead costs to work divisions (Kim & Ballard, 2002).

This makes it difficult to find where the money is being made or lost because progress payments for each work division contain overhead costs (Kim & Ballard, 2002). Therefore, using the current system of overhead allocation, contractors may be unable to reduce or influence profitability since the system does not pinpoint how much the contractor has spent on each section of the project (Evanse, 2015). ABC was chosen as

the conceptual basis of the proposed system for its capability to provide a better understanding of the processes and the activities performed, as well as for its affinity with the new operations management ideas.

Donizetti, (2015) classifies the cost accounting system for manufacturing industry into three main parts chart of account, responsibility center, and allocations system. A chart of account is related to the acquirement of resources. This resource has to be classified based on destination to the responsibility centers; each center contains costs related to activities done in that center. Responsibility centers are classified as a support center and product center. Support centers are a department or a section that is not directly involved in performing the activity but it gives support to the production department or unit. Whereas product centers are a subdivision of cost objects which has a direct relationship with the final product or service. Finally, the costs which are classified as a support center and product center have to be allocated to the product or cost objects.

2.16 Research Gap

There is limited research made on study about the cost accounting system of construction companies. The measurement of project performance is essential as it enables important management decisions to be reached on time and also helps in identifying areas requiring improvement. Jouni (2009), states that the main problem in the construction industry is related to cost accounting and cost control. The most problematic issue is that cost accounting and controlling methods are not operating in real time. Due to the use of unsuitable costing system the managements might fail to measure the project performance accurately. Moreover, the lack of proper costing system leads to inefficient uses of material, overstocking and inefficient decision leading to project cost overruns. Therefore, need for research to investigate the overall costing system of an organization is essential to evaluate the cost ascertainment system and identify the problem encountered in implementing the system.

3. RESEARCH METHODOLOGY

3.1 Introduction

Kothari (2004), defines research as the systematic method consisting of enunciating the problem, formulating the hypothesis, collecting the facts or data, analyzing the facts and reaching certain conclusions either in the form of the solution toward the concerned problem or in a certain generalization for some theoretical formulation. Singh (2006), stated that research is simply the process of arriving as a dependable solution to a problem through a planned and systematic collection, analysis and interpretation of data.

3.1.2 Types of research

There are different types of research. Kothari (2004), tries to classify different types of research as Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, and Conceptual vs. Empirical. Descriptive research includes surveys and fact-finding enquires of different kinds. The major purpose of descriptive research is a description of the state of affairs as it exists at present. In analytical research, on the other hand, the researcher has to use facts or information already available and analyze these to make a critical evaluation of the material. Applied research aims at finding a solution to an immediate problem facing a society or an industrial/business organization, whereas fundamental research is mainly concerned with generalizations and with the formulation of a theory. Quantitative research is based on the measurement of quantity or amount. It is applicable to phenomena that can be expressed in terms of quantity. Qualitative research, on the other hand, is concerned with a qualitative phenomenon, i.e, phenomena relating to or involving quality or kind. Conceptual research is related to some abstract idea(s) or theory. It is generally used by philosophers and thinkers to develop new concepts or to reinterpret existing ones. On the other hand, empirical research relies on experience or observation alone, often without due regard for system and theory. It is data-based research, coming up with conclusions that are capable of being verified by observation or experiment. Kumar (1999), tries to categorize different types of research based on three perspectives application, objectives and the type of information sought.

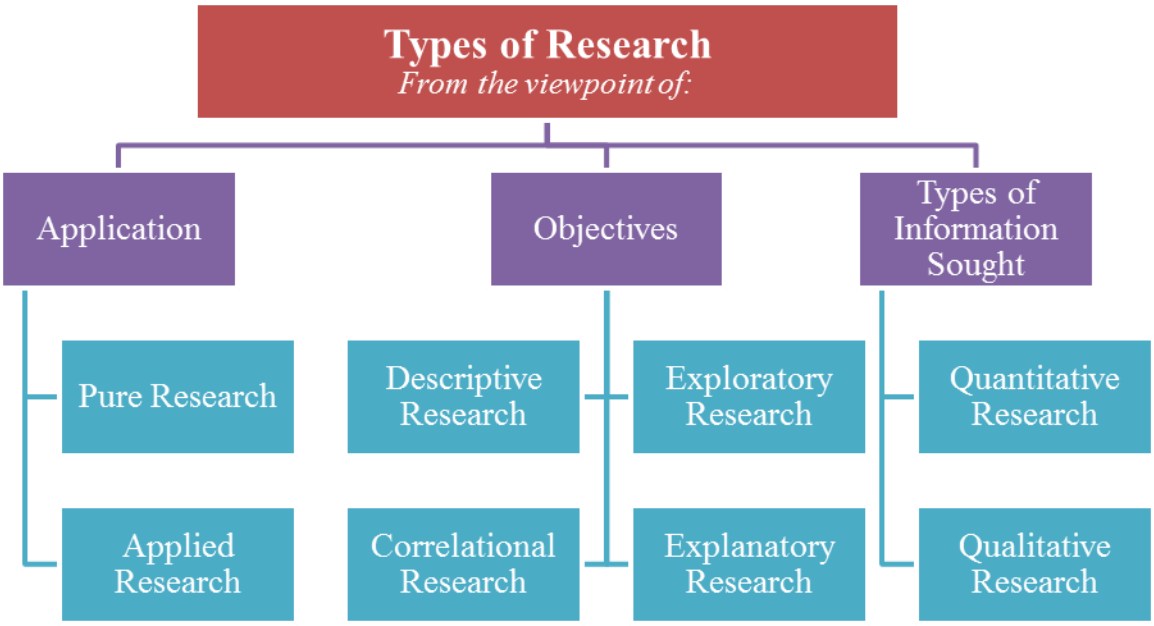

Figure 4: Types of research (Kumar, 1999)

From the above classification, this research is descriptive and analytical, applied and quantitative research. It is analytical as it uses the company's existing cost accounting reports to study the overall system; It is applied as it tries to find the solution for the problem areas in implementing the system and propose a modified cost accounting system for the company; It is descriptive as it tries to describe and find out the facts about the cost accounting system of the company; It is quantitative as it tries to quantify the response of the company employees through questionnaires.

3.2 Research process

A brief overview of the research process is essential before embarking on the details of research methodology and techniques. The research process consists of a series of actions or steps necessary to effectively carry out research and the desired sequencing of these steps (Kothari, 2004). The first step determines the nature of the last step to be undertaken. If subsequent procedures have not been taken into account in the early stages, serious difficulties may arise which may even prevent the completion of the study. By using the Kothari, (2004) flow chart as a guideline, this research follows the following research process. Firstly, research objectives are identified from the problems and the literature review will be assess from different books, journals and

previous research. The research is designed to collect data through questionnaires and desk study and then the collected data will be analyzed by using computer tools and statistics. Finally, conclusion and recommendation will be made based on the research findings.

3.3 Research Design

A research design is a procedural plan that is adopted by researcher to answer questions validly, objectively, accurately and economically (Kumar, 2011). According to Selltiz, Deutsch and Cook, (1962: 50) cited by Kumar (2011), 'A research design is the arrangement of conditions for the collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure'.

According to Kumar (2011), the research design should provide detailed information on the following aspects of the study;

- Who will constitute the study population?
- How will the study population be identified?
- Will a sample or the whole population be selected?
- If a sample is selected, how will it be contacted?
- How will consent be sought?
- What method of data collection will be used and why?
- In the case of a questionnaire, where will the responses be returned?
- How should respondents contact you if they have queries?
- In the case of interviews, where will they be conducted?
- How will ethical issues be taken care of?

Thus, depending on the above question this research has been designed as shown in the following sections.

3.3.1 Research method and strategy

Singh (2006), states that the research method is a style of conducting a research work which is determined by the nature of the problem. According to Singh (2006), research methods can be classified under three heads;

1. Theoretical problem – survey, experimental method.
2. Factual problem – Historical, case study and genetic methods.

3. Application problem – Action Research.

The survey method and case study methods are selected for this research. According to Singh (2006), the survey method of research is concerned with the present and attempts to determine the status of the phenomena under investigation. The major purpose of the survey method in research is to tell ‘‘what is”? i.e., to describe the problem or phenomenon, but many surveys go beyond a mere description of the existing situation. To answer the research question one, four and five this research use survey method by distributing three different questionnaires to organization experts, decision makers (managements staffs) and planning and marketing division.

A case study is essentially an intensive investigation of the particular unit under consideration. It is a method of study in depth rather than breadth. The case study places more emphasis on the full analysis of a limited number of events or conditions and their interrelations. The case study deals with the processes that take place and their interrelationship. According to Kumar(2011), ‘to qualify as a case study, it must be a bounded system, an entity in itself. A case study should focus on a bounded subject/unit that is either very representative or extremely atypical.’ To explore in-depth about the actual costing system case study is opted as a suitable method. Researches question two and three is checked by the randomly selecting three ongoing projects to study deeply the costing system of the company. According to Kumar (2011), the source of the case study can be a personal document, life history, related person, official records, and the subject himself. This research uses the project’s cost accounting report as a source.

3.3.2 Study focus area and Selection criteria

Due to the utilization of a large number of human, material and machinery resources, the study focuses on only state-owned road contractors. The decision to select Ethiopian Construction Works Corporations is made for three main reasons:

1. ECWC TICS undertakes most of the large and complex projects all over the country that are given to local contractors; hence, the impact of any improvement achieved will significantly contribute to the overall improvement of the contractor’s performance.

2. ECWC TICS has many types of machinery and human resources in addition to organizational and financial capability than private contractors; hence they are better suited for studying the costing system.

3. The contractor is handled by the state and constructs different governmental projects. To ensure that the public properties are used efficiently their costing system has to be studied.

3.3.3 Sampling design

Kothari (2004), states that sample design is a definite plan for obtaining a sample from a given population. It refers to the technique or the procedure the researcher would adopt in selecting items for the sample. According to Kothari(2004), depending on the two factors, representation basis and the element selection technique sampling are classified as on representation basis probability and non-probability sampling and element selection basis, the sample may be either unrestricted or restricted. Probability sampling is also known as 'random sampling' or 'chance sampling' under which every item of the universe has an equal chance of inclusion in the sample. Non-probability sampling is also known by different names such as deliberate sampling, purposive sampling, and judgment sampling. In this type of sampling, items for the sample are selected deliberately by the researcher. When each sample element is drawn individually from the population at large, then the sample so drawn is known as 'unrestricted sample', whereas all other forms of sampling are covered under the term 'restricted sampling'

By considering the above methods, this research purposively selects the Ethiopian Road Construction Corporation Transport Infrastructure Construction Sector (ECWC TICS) to study longitudinally the company's costing system. After identifying the sample size of the research, the respondents were selected purposively gather the desired information through questionnaires. Then from those ongoing road construction projects for an in-depth study of the actual system, 3 projects have been randomly selected and a detailed study has been undertaken.

3.3.4 Structure of questionnaire

In order to answer the research question, this research uses two types of questionnaires, implementers (experts) and management staffs. The questionnaire distributed for experts are to find the answer for the research question number one and four which is about the knowledge of the professionals on the cost accounting and its different techniques, and the encountered problem during the implementation. The questionnaires for management staff are prepared with the aim of answering research question number five which is on the capability and appropriateness of the costing system in providing relevant information for future planning and decision making. The respondents were asked to answer a different question by choosing from the different alternatives and rating the current costing system of the company based on the cost accounting requirement by selecting poor, satisfactory, good, very good and excellent.

3.3.5 Target population

According to Kumar, (2011) the target population refers to the entire aggregation of respondents that meet the designated set of criteria. The target population in this research includes the professionals (engineers) who are in the position of implementing cost accounting, management staff and engineering service and marketing department of the company. The cost accounting implementers are those who implement the system like data collecting, processing and analyzing the cost. The engineering service team leader and office engineer are the responsible persons for this task in the company. From the management staff, project managers, counterpart engineers, project management team leaders and marketing team engineers are included. The marketing department of the company is the responsible department for estimating the project cost and fix the unit rate price of activity for bid. Thus, they are included in the survey to know the ability of the system for forecasting and fixing the rate. Excluding the canal construction project, currently the sector has a total of 18 road construction and maintenance projects on 2020G.C. Eight of them are new road construction projects and the remaining ten are road maintenance works which are controlled by ten districts. Table 3and 4 shows a summary of the target population.

Table 3: Cost accounting implementers (experts)

Concerned Body	Respondent	Number of questionnaire to be distribute per each project	Total number of project in the organization	Total number of questionnaire to be distributed	Total number of question naire
Engineering service team	Office engineer	1	18	18	36
	Engineering service team leader	1		18	

Table 4: Management Staffs

Respondent	Number of questionnaire to be distribute per each project	Total number of project in the organization	Total number of questionnaire	Remark
Project Manager	1	18	36	One project manager & counterpart engineer for each project
Counterpart Engineer	1			
Project management Team leaders	1	4	4	For all 4 team leaders of the company
Engineering service and marketing team	1	6	6	For all 6 team members of the company

Therefore, there are a total of 82 respondents for this research, 36 from implementers and 46 from management staff.

3.3.6 Determination of sampling size

Sampling is related to the selection of a subset of individuals from within a population to estimate the characteristics of the whole population (Singh & Masuku, 2014). The advantages of sampling are faster data collection and lower cost.

As we can see from the above table there are 86 populations in this study. Yamanes, (1967) provides a simplified formula to calculate the sample size.

$$\mathbf{n = \frac{N}{1+N(e)^2}}$$

Where, n is the sample size, N is the total population size and e is the margin of error.

Therefore, by using Yamanes, (1967) formula the sample size for implementers survey, where N is 36, 95% confidence level and 5% margin of error is:

$$n = \frac{36}{1+36(0.05)^2}$$

$$= \underline{33 \text{ peoples}}$$

Using same formula the sample size for management staff survey, where N is 50, 95% confidence level and 5% margin of error is:

$$n = \frac{46}{1+46(0.05)^2}$$

$$= \underline{42 \text{ peoples}}$$

Therefore, 75 sample size shall be used in this research.

3.4 Data collection and sources

After defining the research problem and designing a research the next task is to collect the relevant data. According to Kothari (2004), depending on the source data are classified as primary and secondary. The primary data are those which are collected for

the first time and thus happen to be original. The secondary data, on the other hand, are those which have already been collected by someone else and which have already been passed through the statistical process. Kumar (2011), states that primary data are the data collected from primary sources such as observation, interview and questionnaire, and secondary data are collected from secondary sources like government publication, earlier research, census, personal records, client histories and service records.

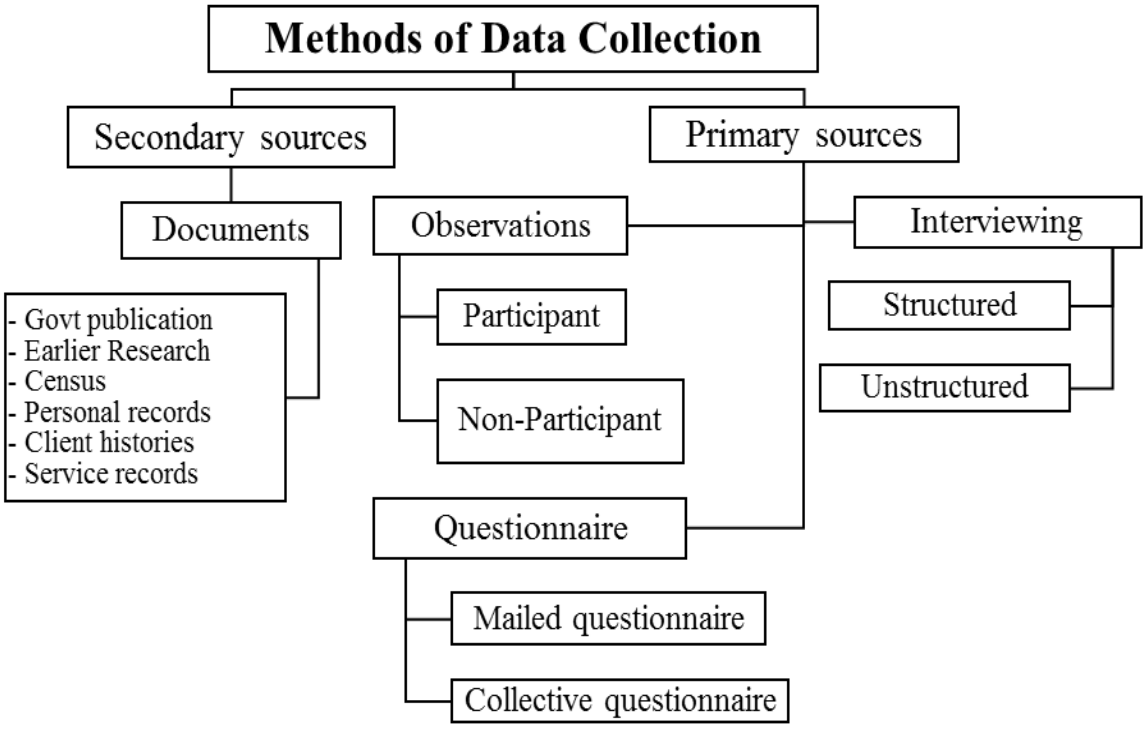

Figure 5: Method of data collection (Kumar,2011)

This research uses both primary and secondary data collection. The primary data refers to the data which was obtained from the company by using questionnaires. Both open and close-ended questionnaires were used as a primary data collection method for this research. Secondary data was obtained from the company's existing records, reports, and cost manuals. In the secondary data collection, the real information about how the companies are implementing the cost accounting system, the methods and overall practice were gathered.

Furthermore, a literature review was used as one of the secondary data collection methods to gather information about the concept, method, techniques, and practice of cost accounting in construction and other businesses. Depending on the information obtained from this review then used to evaluate the current system of costing, identify which method of costing was used and modifying the existing system from other countries experience. Thus, the study made use of several sources of literature such as relevant books, journals, related websites on the internet, and other documents that are related to the topic used under study.

3.5 Research instruments

The data was collected using questionnaires and case study of the companies' reports. The purpose of the research is to study the costing system of the contractors. The questionnaires will be designed to provide answers to the research questions. Questions were grouped into sections to answer the following:

- Whether or not the company professionals have appropriate knowledge about the costing system,
- The methods of costing the company used to determine the construction cost,
- The implementation method of costing,
- Encountered problems and difficulties in the implementation of the system,
- The proficiency of the system in providing relevant information for management for making decisions, planning, controlling and evaluating the resource.

The questionnaire is selected for its efficient method of collecting reliable data that can be quantitatively analyzed. The research will use both questionnaires containing, close and open-ended questions.

Kumar (2011), classify questionnaires open-ended and close-ended. In an open-ended questionnaire, the respondent writes down the answers in his/her words. Whereas in a close-ended questionnaire, the possible answers are set out in the questionnaire or

schedule and the respondent or the investigator ticks the category that best describes the respondent's answer. It is usually wise to provide a category 'Other/please explain' to accommodate any response not listed. In this research, the questionnaire was addressed to company experts, management staffs and marketing department.

3.6 Research validity and reliability

Validity is a very important and useful concept in all forms of research methodology which is used to evaluate the quality of the research. According to Kumar (2011), validity is the ability of an instrument to measure what it is designed to measure. Its primary purpose is to increase the accuracy and usefulness of findings by eliminating or controlling as many confounding variables as possible, which allows for greater confidence in the findings of a given study (Barry & Brooke, 2005). Reliability focuses on the ability of an instrument to produce consistent measurement. When the researcher gets the same result more than once using same instrument under similar condition, an instrument is considered to be reliable (Kumar, 2011).

According to (Kumar, 2011) there are three types of validity face and content, concurrent and predictive, and construct validity. When each question or item on the research instrument has a logical link with objective face validity will be established. Content validity assesses the extent to which the measurement covers all aspects of the concept being measured. Predictive validity is judged by the degree to which an instrument can forecast an outcome. And concurrent validity is judged by how well an instrument compares with a second assessment. Construct validity is based up on statistical procedure and is determined by ascertaining the contribution of each construct to the total variance observed in a phenomenon. In this research the face validity has been maintained.

The reliability and validity of a research results depends on creating strong research design, choosing appropriate methods and samples, and conducting the research carefully and consistently. To ensure the validity and reliability, this research use a standardized questionnaire based on established theories or findings of previous studies which is targeted to measure exactly what the research wants to find out. Also this research uses

appropriate sampling method in selecting enough participants which are representative of the population and apply the method consistently.

3.7 Data Analysis and presentation

In this study, a mixed-method of data analysis was used. Firstly, quantitative data will be analyzed by using appropriate frequency tables to represent the findings. Computers will be used to ensure accurate and speedy processing of the data. There is an inherent risk in research studies of reaching conclusions that are based on wrong responses such as coincidences; for this reason, Ms-Excel will be used to increase the accuracy of data analysis. Secondly, the qualitative data obtained from the companies records, reports, and cost manuals will be analyzed and presented in compilation sheets diagrams and tables. Then, findings will be discussed by combining questionnaires result with survey data. Finally, based on the findings, conclusions and recommendations will be made.

4. RESEARCH FINDINGS AND DATA ANALYSIS

4.1 Introduction

This chapter analyzes the data gathered through questionnaire and desk study from the cost accounting system implementers and decision-makers of the ECWC TICS. A total of 75 questionnaires were distributed to both implementers and decision-makers or management staff. The document refereed during desk study includes cost accounting reports, manual and cost data records of the company. In this chapter, the response rate, research findings from the analysis of responses and the desk study results will be discussed. The complete survey questions are presented in the Appendix B and C.

4.2 Response rate

The concept of response rate refers to the percentage of individuals who responded to a survey that was administered to them. In this regard all the cost accounting system implementers such as; office engineer and engineering service team leader and decision-makers or management staffs like project manager, counterpart engineer, head office project management team leaders, and engineering service and marketing division engineers were considered under the survey. The detail of the questionnaire distributed to the respondent and their response rate are summarized under Table 5.

Table 5: List of Responses

Response	Number obtained
Completed questionnaires	56
Incomplete questionnaires	9
Unreturned questionnaires	10
Total	**75**

Table 5 indicates that the total questionnaires distributed in the study for both the cost accounting implementers and for management staffs 56 or 74% out of 75 questionnaires were fully completed and returned, while the remaining 9 or 12% were returned incomplete and 10 or13% unreturned. The completed questionnaires were analyzed in the

following sections in accordance with the content classification. This response was considered adequate for the purpose of the statistical analysis to be carried out.

For cost accounting implementers, a total of 33 questionnaires were distributed. There were 27 responses which represent a response rate of 82%, while the remaining 6 were sent uncompleted and unreturned.

A total of 45 questionnaires were distributed to the management staff (decision-makers) of the company. There were 29 responses which represent a response rate of 64 and the remaining 5 were sent uncompleted and 11 were unreturned.

4.3 Research finding and data analysis: Cost accounting Implementers

4.3.1 Respondent profile

Out of the total of 27 respondents, 18 or 67% of respondents have an educational background of BS.c degree and 9 or 33% have MSc degree. Table 6 shows the educational background of the respondent.

Table 6: Educational Background of Respondents

Educational background	Number of respondents	Percentage
BS.c	18	67%
Msc	9	33%
Total	27	100%

Figure 6 indicates that out of 27 respondent 37% of the respondents have experience within zero up to 5 years, 52% have five up to ten years and 11% have above ten years of experience.

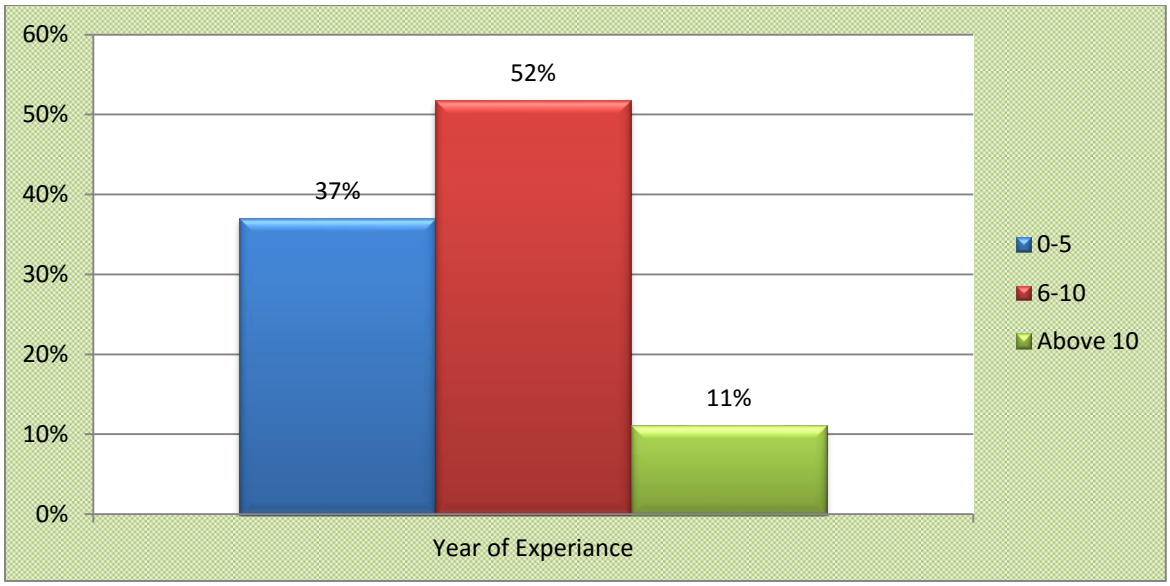

Figure 6: Respondents year of experience

The above table and figure indicate that the respondents were adequately trained, experienced and positioned to provide credible answers to the research inquiries. Furthermore, they would be capable of understanding and implementing any proposals arising out of the investigations.

4.3.2 Objectives of implementing the cost accounting

According to the literature, the researcher tries to list out the main objectives of cost accounting and the respondents are requested to answer the question about their objectives of implementing cost accounting. In this question, respondents were allowed to choose all of their objectives listed in the questionnaire by choosing more than one choice or write if there is any other which are not listed. As per the response, control and reduction of cost were chosen by most respondents, 23 or 85% of the respondent as the objective of implementing cost accounting. Measuring the performance and controlling the efficiency take 74% and 67%. Table 7 summarizes all the responses of the implementers about their objectives of implementing cost accounting.

Table 7: Objectives of implementing cost accounting

Objectives	Frequency	Percentage
To control and reduction of cost	23	85%
To measure the performance	20	74%
To control the efficiency	18	67%
To ascertain the cost of an activity	17	63%
To ascertainment of profit	14	52%
To assist the management for planning and decision making	14	52%
To forecast the future cost	13	48%
To use as an effective information system	9	33%
To fix the unit rate of an activity	8	30%
other	2	7%

Seventeen of 27 respondents (63%) choose to ascertain the cost of an activity as an objective of implementing cost accounting. Also, 52% of respondents select ascertainment of the profit and assist the management for planning and decision making. Respondents suggested that there were other objectives of implementing cost accounting such as, to identify unprofitable activity and control the expenses to reduce the occurrence of cost overrun.

4.3.3 Costing system of the company

Depending on the nature of the work different costing systems can be applied. The respondents were asked to answer about what type of costing system they use. This survey revealed that 56% of the respondents choose the activity-based costing system.

As indicated in the Figure 7 11% of the 29 respondents revealed that the organization uses direct costing system followed by 4% traditional costing system and the remaining 30% don't know about their organization costing system. These different answers on the organization costing system indicate that there is a lack of training and knowledge on different cost accounting systems and techniques in the company. This result indicates that the company has to work more in training the staffs about cost accounting.

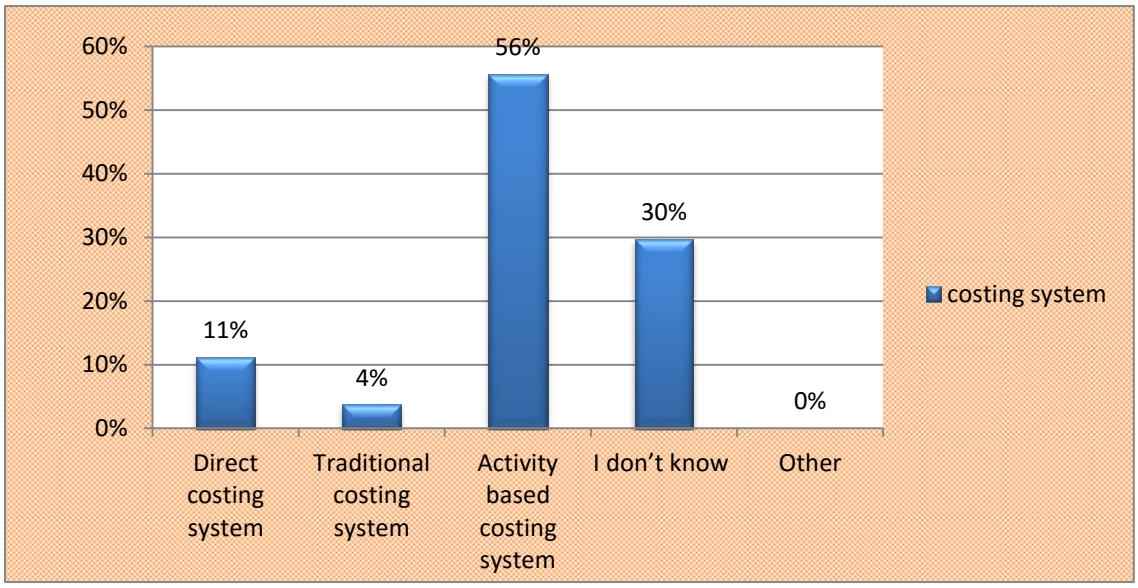

Figure 7: Costing system of the company

4.3.4 Allocation of head office overhead to the project

Respondents were asked whether or not they allocate head office overheads to the projects. The research revealed that 11(41%) of respondents allocate head office overhead and 16 (59%) don't allocate head office overhead to the project in determining the cost of each cost object. This result indicates that the company doesn't have an organized and typical cost accounting system in projects.

4.3.5 Allocation of project overhead to the work section

In the literature, it was discussed that project overheads have to be allocated to each work section by using equitable bases in order to determine the cost of each work section. Figure 8 summarized that 78% of the respondent allocate project overhead and the remaining 22% didn't allocate the project overhead cost when determining the cost of the

project cost object. This result shows that the cost data that are presented for the decision-makers are incorrect. This can lead the managers to make the wrong decision and evaluating the performance based on unreliable data which finally faces the project to unexpected cost overruns.

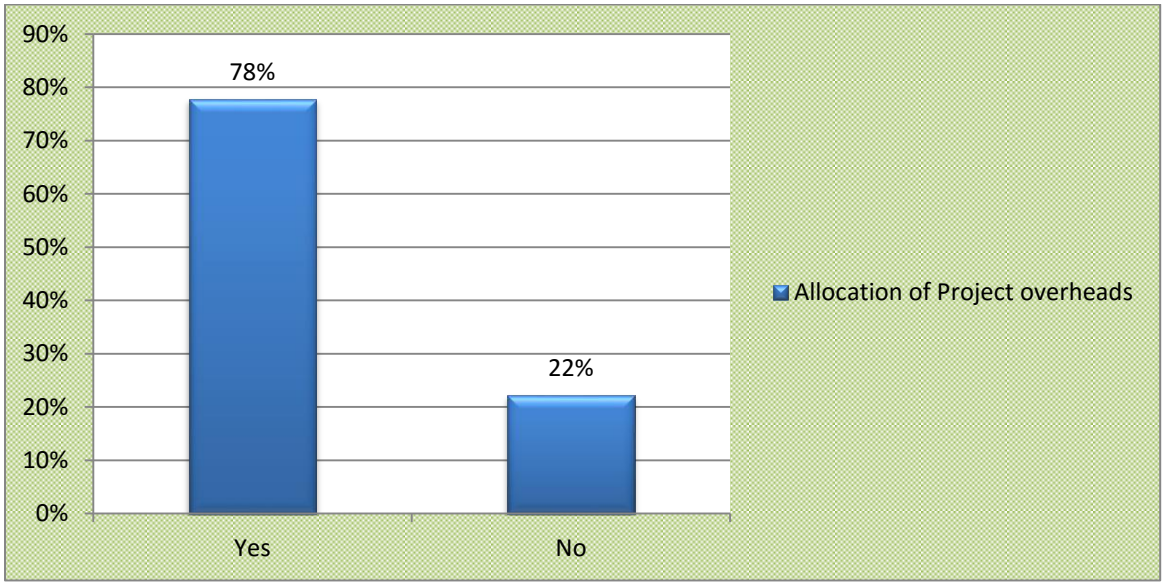

Figure 8: Allocation of project overhead

4.3.6 Cost accounting standard cost sheet

Respondents were asked about whether they use the organization's standard cost sheets in analyzing and presenting the data to the decision-makers. Out of 27 respondents, 33% revealed that they used a standard cost sheet of the organization and the rest 67% responded that they used their own cost sheet format. This different answer indicates that the organization doesn't have a typical costing system and there is a lack of training about the cost accounting system.

4.3.7 Computer software used

The respondent revealed that they use Ms- Office Excel tool as software or tool. This result indicates that the organization has not introduced any cost accounting software which can be used in the process of implementing cost accounting system. As indicated in the figure 9, 70% respondent uses computer tools in variance analysis. Also, 52% use in allocating the costs, 26% uses in recording cost data and 11% uses in presenting the relevant data.

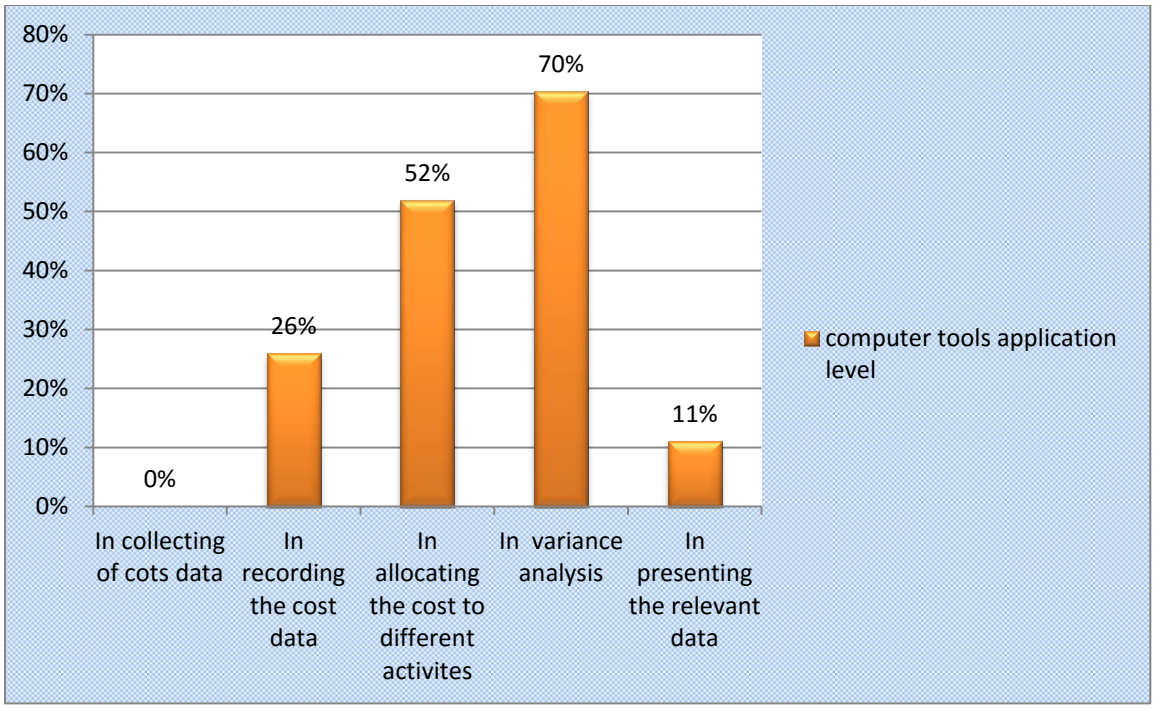

Figure 9: Level of using computer tools

4.3.8 Encountered problems during implementation

Different problems can be encountered during the application of the cost accounting system. Based on the literature the problems encountered in the costing system can be mainly categorized as top management constraint, technical constraint, and resource constraint. The respondents were asked on the problem they faced during the implementation of the system and their answers are summarized in Table8.

Table 8: Problems Encountered

Problems	Frequency	Percentage	Rank
Top management constraint			
Lack of top management support	12	44%	12
Lack of training on updated cost accounting techniques	25	93%	1
Incorrect perception about cost accounting doing it just for reporting	19	70%	5
Technical constraint			

Lack of basic knowledge and skill on cost accounting and its different techniques	18	67%	6
Lack of adequate information about the cost	10	37%	13
Difficulties in data collecting and gathering	24	89%	2
Difficulties in identifying and defining cost center and cost drivers	20	74%	4
Difficulties in identifying the actual project and head office overhead cost	16	59%	8
Inadequate knowledge about the allocation of overhead cost to each activity	14	52%	10
Difficulties in assigning and allocation of cost to each activity	12	44%	11
Using the approximate data rather than collecting the actual cost	15	56%	9
Resource constraint			
Lack of adequate number of employee resource in the cost accounting team	17	63%	7
Lack of implementation software or computer tools	21	78%	3
Other	1	4%	

The survey result revealed a lack of training on updated cost accounting techniques selected mostly by the cost accounting implementers of the company as a problem encountered during the implementation of the system. Out of 27 respondents, 93% of the respondents choose a lack of training on updated cost accounting techniques. Difficulties in data collecting and gathering selected by 89% of the respondent. The respondents also revealed that lack of implantation software and difficulties in identifying and defining cost drivers are selected as a problem by 78% and 74% respectively. Out of 27 respondents, 4% of them revealed that there is another problem encountered during the implementation of the system. The problem which is not listed in the list is the lack of raw materials for print out and present the relevant data.

4.3.9 Evaluating the current system

The respondents were asked to evaluate the company's current costing system depending on the cost accounting system requirements and principles used for evaluating the costing system of an organization. The research aimed to establish how the users are satisfied and rated their costing system. As per the literature, the respondents rated their costing system for different requirements as follows.

1. **Cost determination**

Determination of the cost of a product is one of the primary aims of the costing system. The respondents were asked to rate the effectiveness of their costing system in determining the costs of a product on per unit basis or total cost such as, cost per kg, cost per meter, cost per liter, cost per ton etc. In figure10 it is indicated that 48% of the respondent revealed the cost determination of the company costing system is good and 4% choose excellent. Out of 27 respondents, 22% rated the cost determination of the current system as poor. In this regards most of the respondents are impressed with their system in determining the costs of products per unit basis.

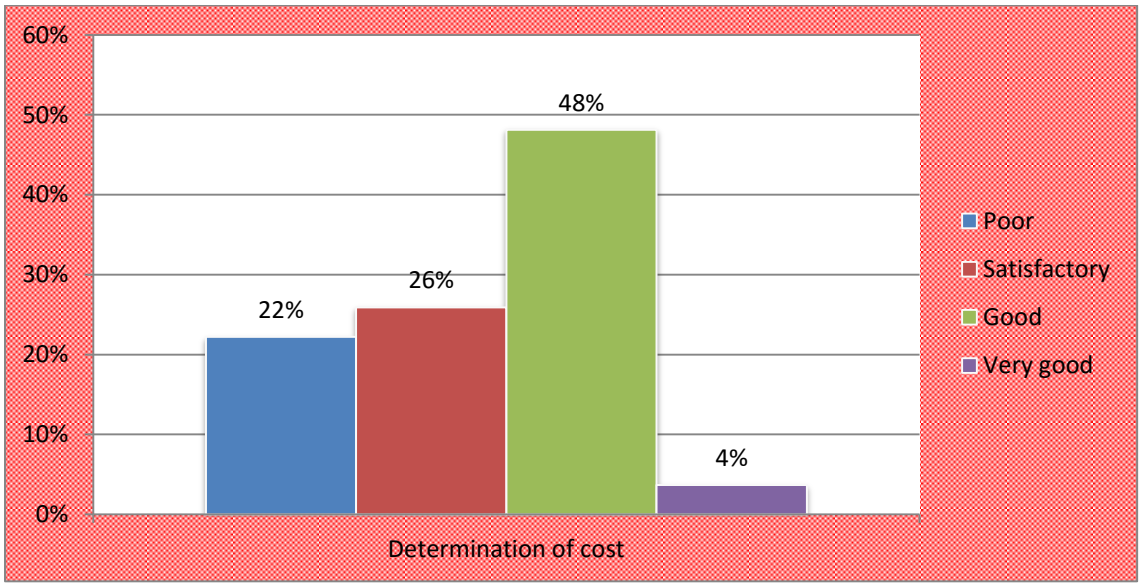

Figure 10: Determination of Cost

2. Providing relevant cost data for decision-makers

The costing system should provide cost data in a systematic manner and actual information about the cost to the management for the evaluating, future planning and decision making. Providing relevant cost data for decision-makers is one of the requirements of a costing system. As indicated in figure 11 out of 27 respondents 44% rated the current costing system as poor in assisting the management or decision-makers for planning and decision making by providing relevant cost data. Also, 30% and 19% of the respondents revealed satisfactory and good. Out of 27 respondents 4% rate the system with regarding to providing the relevant cost data for decision-makers as very good and excellent.

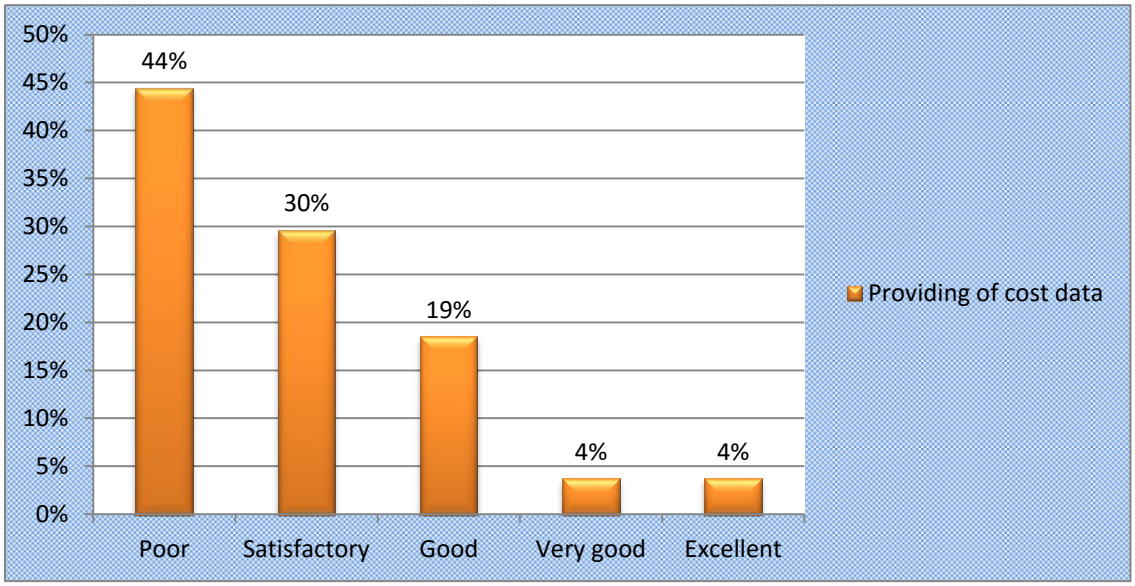

Figure 11: Providing of relevant cost data for decision-makers

3. Performance evaluation

Evaluating the performance of the project based on the standards is one of the costing system tasks. From the response, 37% of respondents revealed that the ability of their costing system in allowing to evaluating and analyzing the performance was poor. Out of 27 respondents 26% thoughts, it was satisfactory, 30% of respondents choosing it was good and the remaining 4% choose as very good and excellent. Figure 12 summarize the

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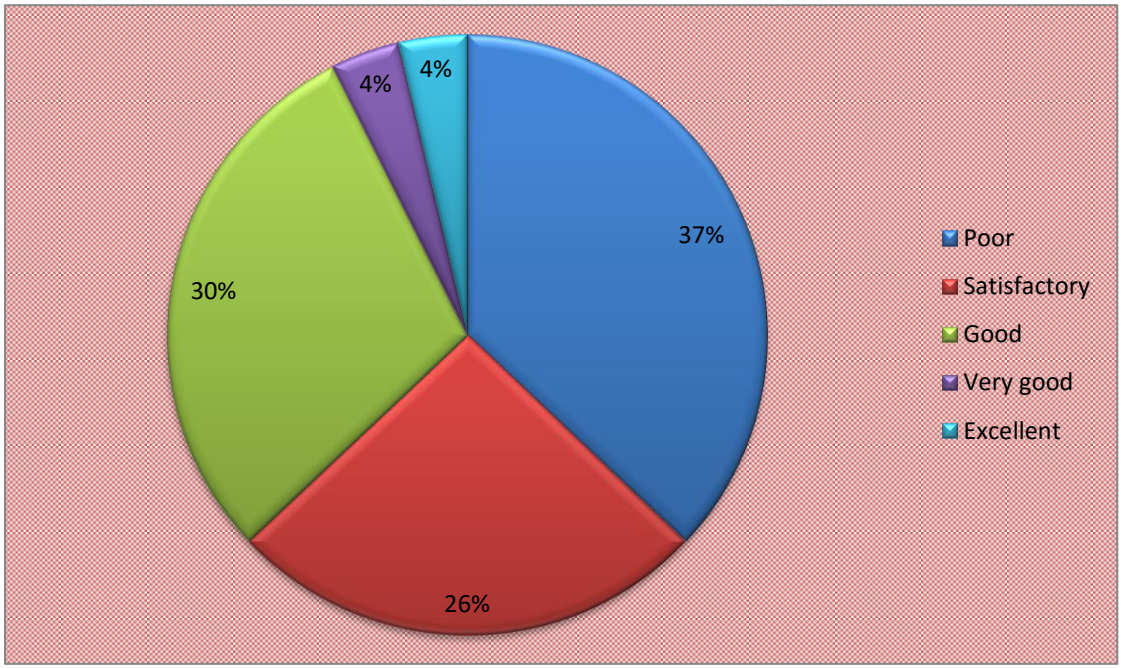

Figure 12: Performance evaluation

4. Controlling the efficiency

Different resources like labor, material, and machineries have to be used efficiently. To control the cost of products the efficiency has to be controlled by avoiding underutilization, idle time and spoilage of material. As summarized in the figure 13 37 % of the respondents rated their costing system as poor in controlling the efficiency by locating wastages, inefficiencies and other loopholes in the production processes. Secondly, 26% of them rated as satisfactory and 33% of them rated good. This indicates that the management is not impressed by the costing system of the company with regard to efficiency controlling.

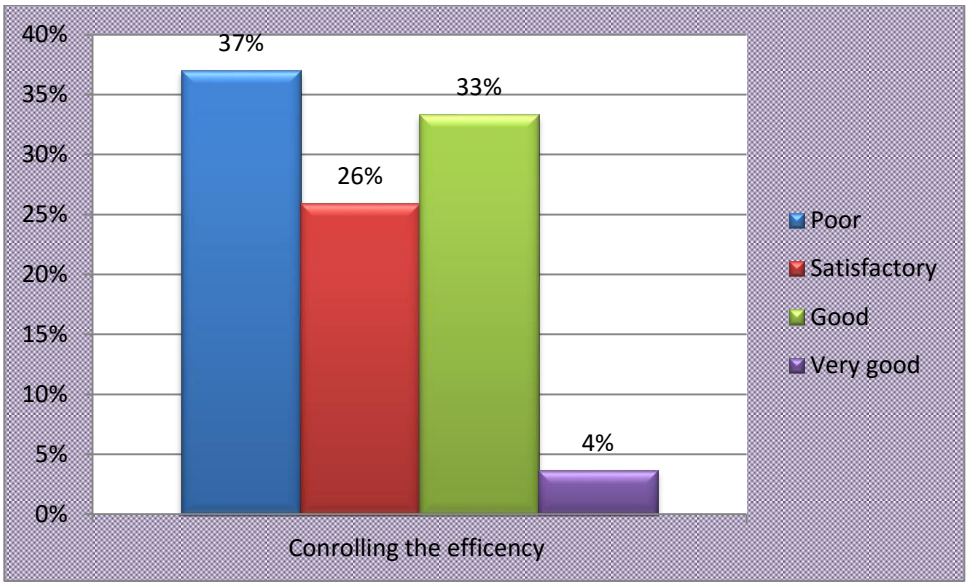

Figure 13: Efficiency controlling of the current system

5. Ascertainment of the profit

Costs of products are controlled to ascertain that the project is safe with regards of the desired profit. This profitability of activity has to be ascertained in division, activity, and unit wise. Sometimes an activity may seem profitable when seen at the level of unit wise but it may be loss when the overall costs were checked. Figure14 summarizes the rated ability of the system in ascertaining the profitability in division wise, activity-wise and unit wise. As shown in the figure 52% of the respondent rated the costing system of the company as poor in ascertaining the profitability in division wise, activity-wise and unit wise followed by 26% satisfactory, 19% good and 4% very good.

Figure 14: Ascertainment of the profit

6. **Serving as an effective information system**

Every costing system has to serve as an effective information system for ascertaining the cost at every level. Out of 27 respondents, 41% and 37% rated their company costing system as poor and 37% with regards of serving as effective information of system which enables them to ascertain the cost at every level of the production process and activity level. Figure 15 summarizes the survey results.

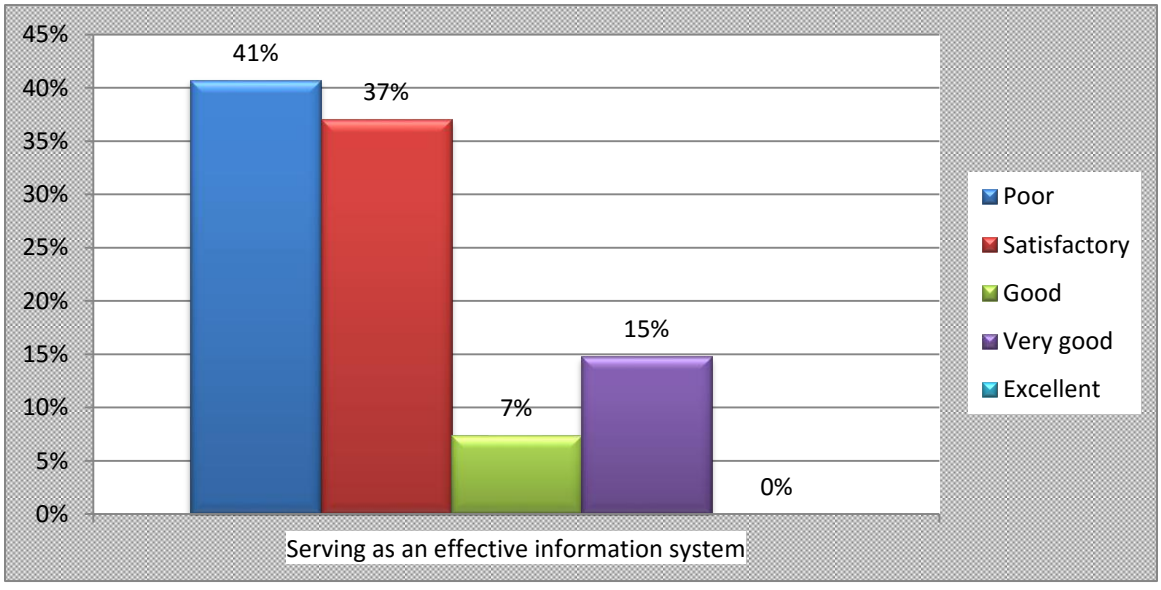

Figure 15: Serving as an effective information system

7. Identifying profitable and unprofitable activities

Identifying the profitable and unprofitable activities in the costing system assists to reduce wastage and give special consideration for an unprofitable activity. The respondent rated the company costing system for identifying profitable and unprofitable activities which help to reduce or eliminate wastages and inefficiencies such as underutilization, idle time, spoilage of material, etc. As figured below out of the total respondent 37% & 30% of the respondents rated poor and satisfactory respectively. The remainder 26% ,4% and 4% of respondents rated as good, very good and excellent.

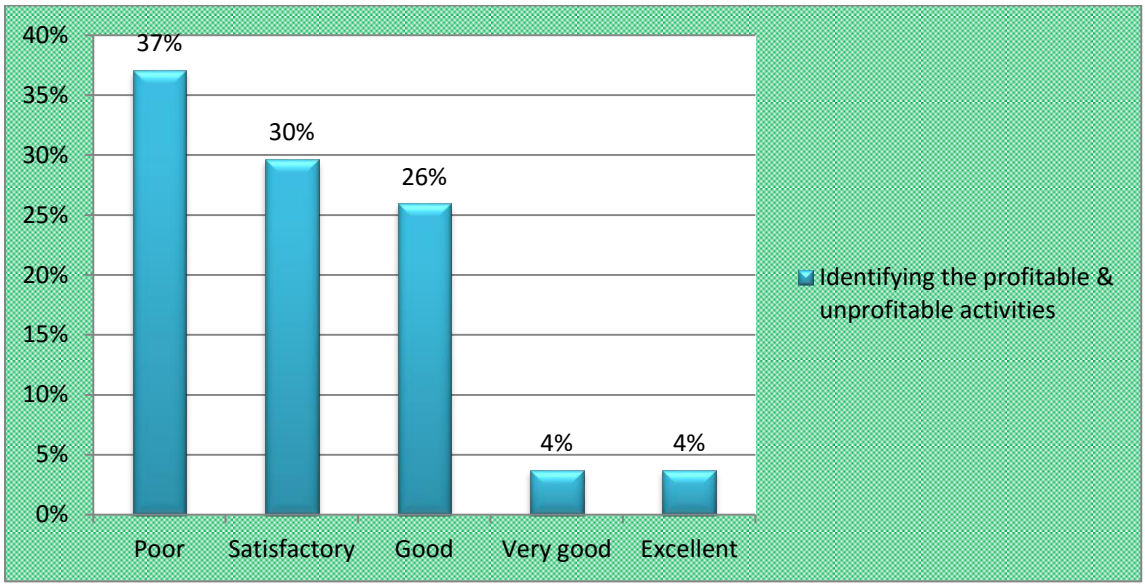

Figure 16: Identifying the profitable and unprofitable activity

8. Ability to forecast

The cause and effect relation of activities are useful for forecasting or predicting future costs. The respondents were asked to rate the ability of the current costing system to forecast from the past cause and effect relation. Out of 27 respondents, 48% of respondents revealed that the ability of their costing system to forecast the future cost of an activity was poor. The remainder 37%, 11%, and 4% were rated as satisfactory, good and very good respectively.

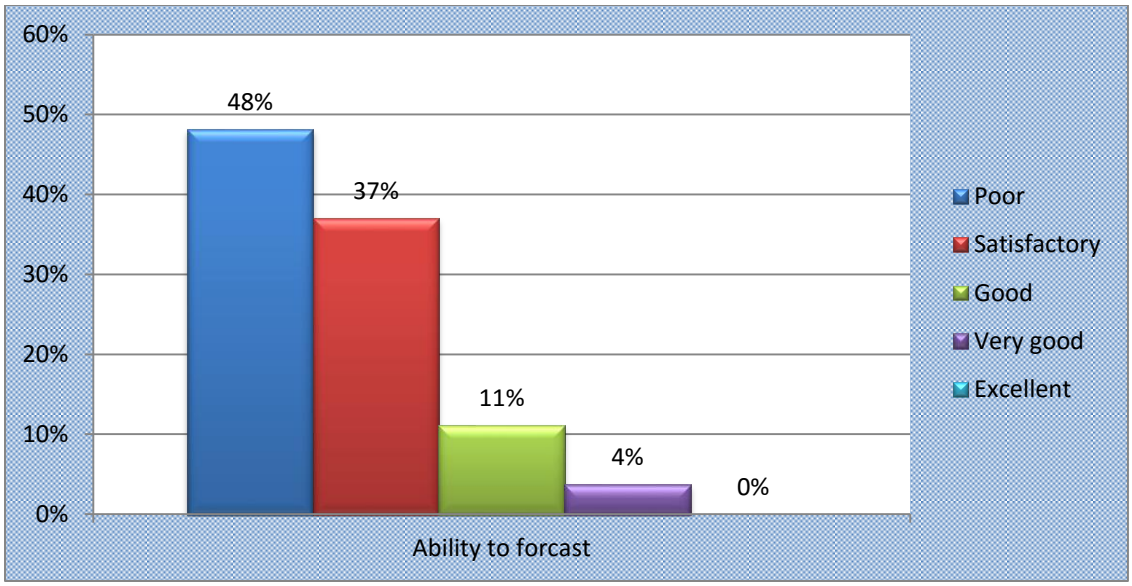

Figure 17: Ability to forecast

4.3.10 Satisfaction with the current system

After rating the costing system of their company the respondents were asked about whether they are satisfied with the current costing system of the company. The response as indicated in the figure 18 revealed that out of 27 respondent only 11% are satisfied and

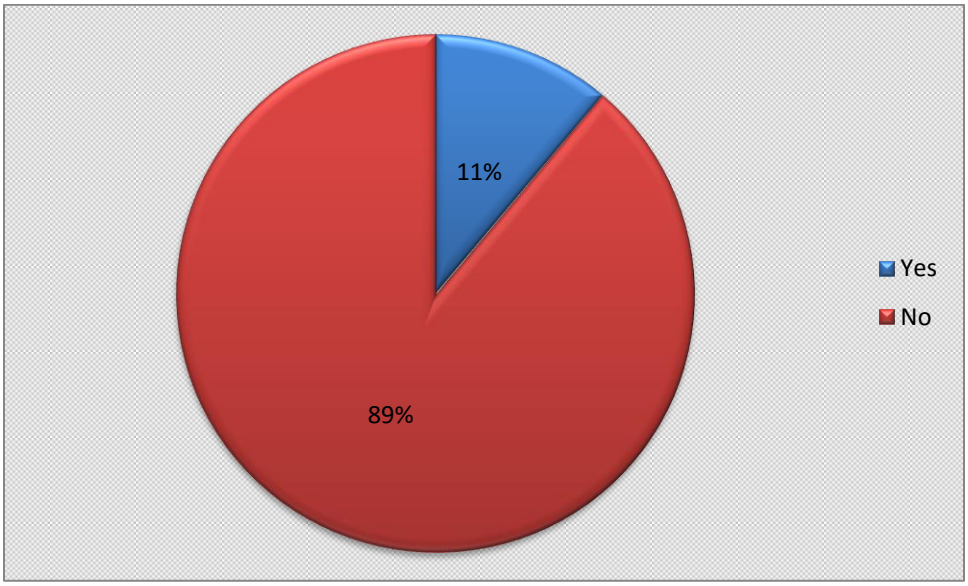

Figure 18: Satisfaction of staff with the current system

The respondent also suggests different issues that have to be amended or added in the current system which are listed as follows (Table 9).

Table 9: Respondents comment

I.N	Respondent comment
1	The company should assign well-trained data collectors in order to avoid collecting the wrong data.
2	The company should form a separated cost accounting team.
3	The company should train the staff about different costing systems and cost accounting application software.
4	The company should create a proper and uniform cost accounting system for all projects.
5	The company should take immediate decisions based on the outputs of the data.

4.4 Research finding: Management (Decision makers)

4.4.1 Respondent profile

Out of the total of 29 respondents, 24 or 83% of respondents have an educational background of BS.c degree and 5(17%) have MSc degree. Table10 shows the educational background of the respondent and their experience.

Table 10: Respondent Profile

Educational background	Number of respondents	Percentage
BS.c	24	83%
Msc	5	17%
Total	29	100%

Table11 indicates that out of 29 respondent 55% of the respondents have experience of zero up to 5 years, 34% have five up to ten years and 10% have above ten years of experience. So they would be capable of understanding and implementing any proposals arising out of the investigations.

Table 11: Respondents' Experience

Year of experience	Number of respondents	Percentage
0-5	16	55%
5-10	10	34%
Above 10	3	10%
Total	29	100%

4.4.2 Objectives of implementing the cost accounting

Depending on the literature the researcher tries to list out the main objectives of cost accounting and respondents are requested to answer the question about their objectives of implementing cost accounting. In this question, respondents were allowed to choose all of their objectives listed in the questionnaire by choosing more than one choice or write if there is any other which is not listed. Out of 29 respondents, 23 of them (79%) choose that there objective of implementing cost accounting is to measure the performance of the project. Table 12 summarizes the response about the objectives of implementing cost accounting.

Table 12: Objectives of implementing cost accounting

Objectives	Frequency	Percentage
To measure the performance	23	79%
To determine the cost of an activity	18	62%
To control and reduction of cost	18	62%
To control the efficiency	16	55%
To ascertainment of the profit	15	52%
To use as an effective information system	14	48%
Other	3	10%

Eighteen of 29 respondents (62%) choose to determine the cost of an activity and cost control and reduction as an objective of implementing cost accounting. Also, efficiency control and profit ascertainment are selected by most of the respondents as 55% and 52% respectively.

Respondents suggested that there were other objectives of implementing cost accounting such as to predict the profit and loss of the project and to capture the total cost of production by assessing the variable and fixed costs of each step of production.

4.4.3 Costing system of the company

In order to implement the costing system in an organization, there are different costing methods depending on the nature of the work. The respondents were asked to answer about the organization current costing systems. As indicated in the figure 19 below from different types of costing system stated in the literature 55% of the 29 respondents revealed that the company uses activity-based costing system followed by 17% direct costing system and 3% traditional costing system and the rest answered that they don't know about their company costing system. This different answer about the companies costing system can indicate that there is a lack of training and knowledge about different cost accounting systems and techniques in the company.

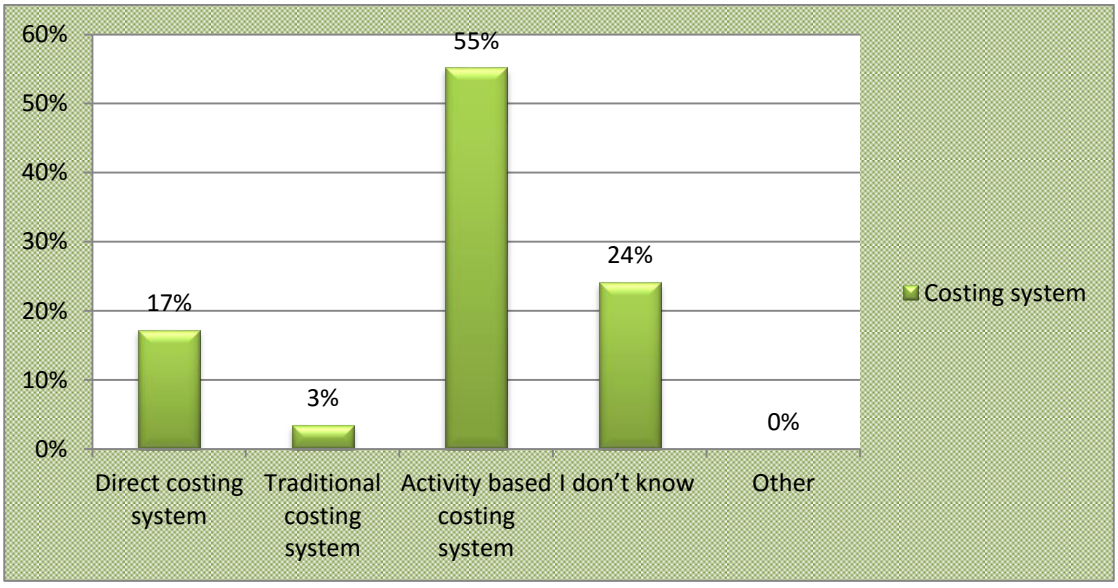

Figure 19: Costing system of the company

4.4.4 Encountered problems during implementation

The literature discusses about different problems encountered during the application of the cost accounting system. The decision-making process of a costing system is highly affected by the accuracy of the collected data. Since the system participates in different concerned bodies there are problems that lead the management to an incorrect decision.

The respondents were asked about the common problems they faced in cost accounting reports during the decision-making process and their answer are summarized as table13.

Table 13: Encountered problems during implementation

Problems	Frequency	Percentage	Rank
Top management constraint			
Lack of adequate information about the cost data	23	79%	1
Lack of training on updated decision-making techniques	15	52%	5
Incorrect perception about cost accounting doing it just for the purpose of reporting	19	66%	3
Technical constraints			
Incorrect assigning and allocation of cost to each activity	12	41%	8
Difficulties in identifying the actual project and head office overhead cost	16	55%	4
Using approximate data rather than collecting the actual cost	13	45%	6
Absence of presenting easy and understandable cost accounting reports	10	34%	9
Late reporting which makes unable to decide on a time	20	69%	2
Resource constraints			
Absence of different decision-making software or computer tools	13	42%	7
Other	3	10%	

As indicated in the survey result lack of adequate information about the cost data is the most occurred problem in the system. Out of 29 respondents, 79% choose the lack of adequate information about cost data as a problem in cost accounting reports. As

discussed in the literature cot accounting aims to ascertain and control the cost of the product. Table 13 revealed that 69% of the respondents chose late reporting of cost accounting reports as a common problem of the system. Incorrect perception about cost accounting doing it just for the purpose of reporting takes the third position, which is selected by 66% of the respondent. Respondents were suggested that there were other problems commonly faced in the decision-making stage. The problems which are not listed in the question are incorrect data collection, using incomplete cost data and lack of concern about the report.

4.4.5 Evaluating the current system

As discussed in the literature the international federation of cost accountants sets out principles for evaluating the costing system of an organization. Depending on that and different cost accounting system requirements the respondents were asked to evaluate the company's current costing system. The research aimed to establish how the users are satisfied and rated their costing system. As per the literature, the respondents rated their costing system for different requirements as follows,

1. **Determination of cost**

Ascertaining the cost of a product is the primary aim of the costing system. The respondents were asked to rate the effectiveness of their costing system in determining the costs of a product on per unit basis or total cost, for example, cost per kg, cost per meter, cost per liter, cost per ton etc. figure20 shows the response. In this regards most of the respondents are not impressed with their system in determining the costs of products on per unit basis. Only 24% of respondents indicated that the system was good in determining the product cost on per unit basis.

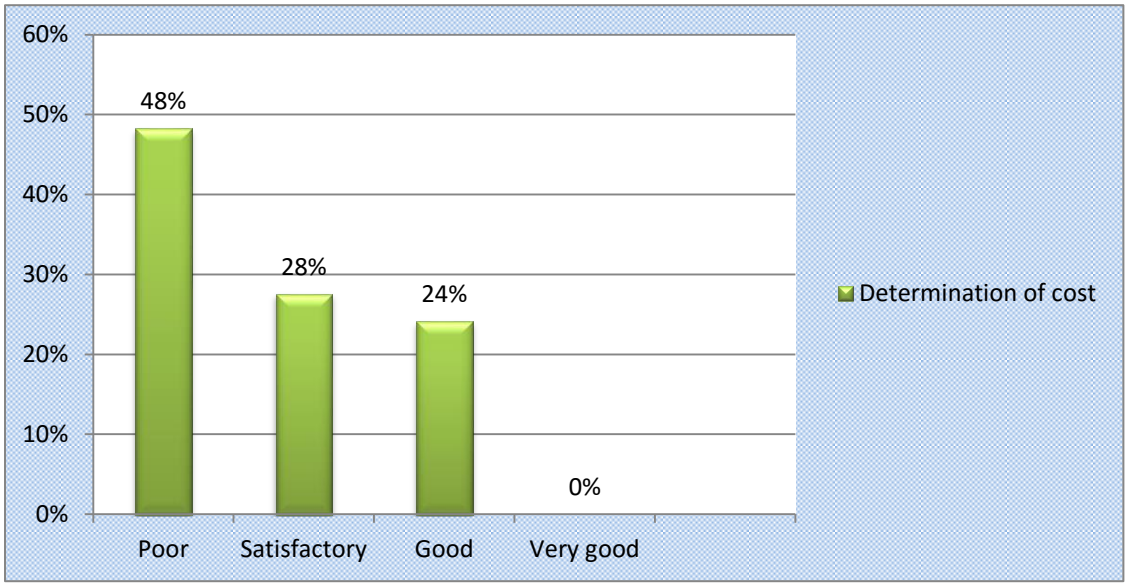

Figure 20: Determination of cost

2. Providing relevant cost data for decision-makers

Providing relevant cost data for decision-makers is one of the requirements of a costing system. The costing system should provide cost data in a systematic manner and actual information about the cost to the management for the evaluating, future planning and decision making. As indicated in figure21 out of 29 respondents 41% of them rated poor when they are asked about the ability of the system in assisting the management for planning and decision making.

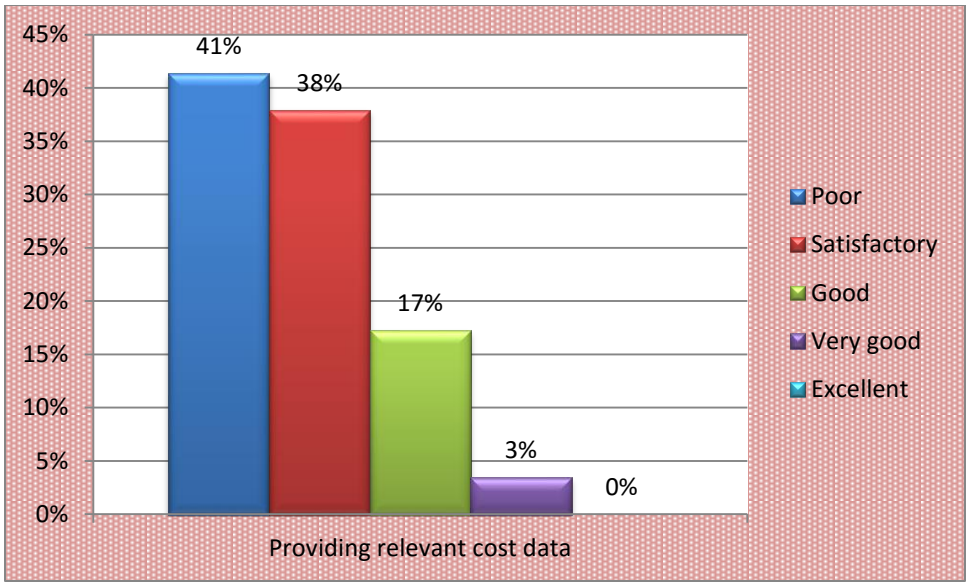

Figure 21: Providing Relevant Cost Data

3. Performance evaluation

As discussed in the literature the performance evaluation of the project based on the sited standards is an important task. From the response, 45% of respondents revealed that the ability of their costing system in allowing to evaluating and analyzing the performance was satisfactory. 28% of respondents thoughts it was poor, and 14% of respondents choose it was good. Figure 22, summarize the result.

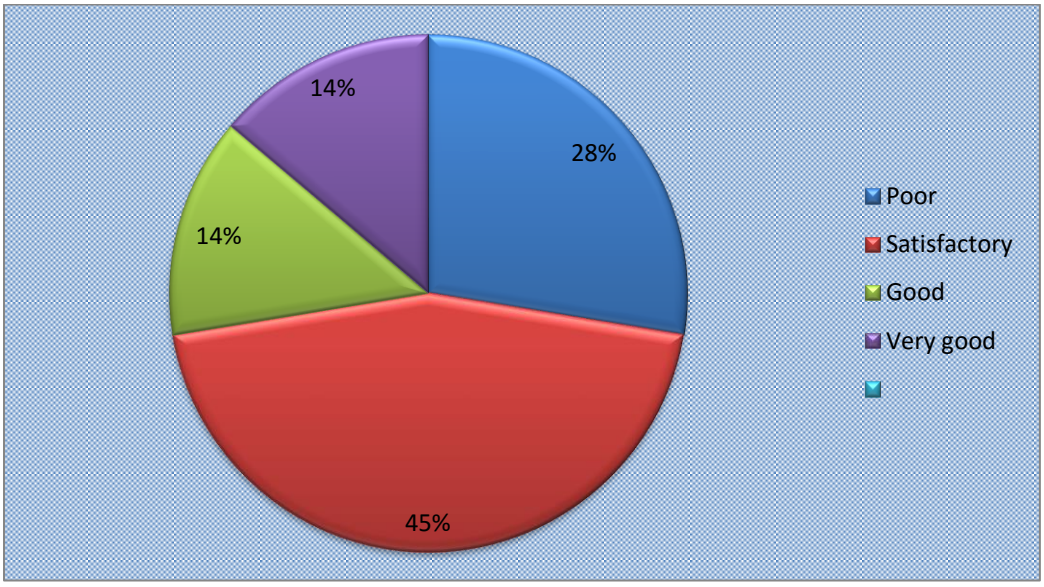

Figure 22: Performance Evaluation

4. Controlling the efficiency

The efficiency or proper usage of different resources like labor, material, and machinery is one of the main issues that the management staffs have to be highly concerned. To control the cost of products the management should control the efficiency by avoiding underutilization, idle time and spoilage of material. As summarized in the figure 23 41% of the respondents rated their costing system as poor in controlling the efficiency by locating wastages, inefficiencies and other loopholes in the production processes. Secondly, 34% of them rated satisfactory. This indicates that the management is not impressed by the costing system of the company with regards of efficiency control.

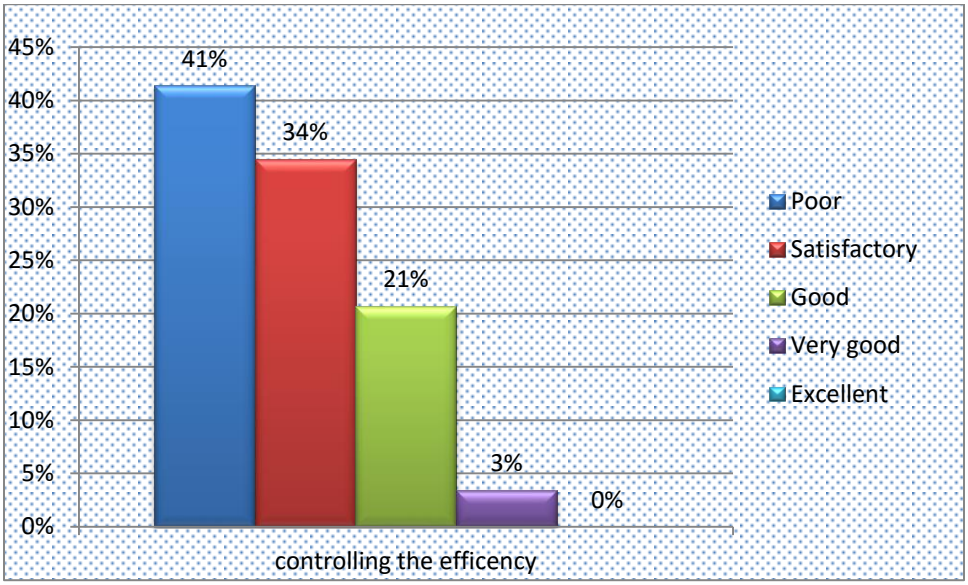

Figure 23: Efficiency controlling

5. Ascertainment of the profit

Costs of products are controlled in order to ascertain that the project is safe with regard to the desired profit. This profitability of activity has to be ascertained in division, activity, and unit wise. Sometimes an activity may seem profitable when seen at the level of unit wise but it may be loss when the overall costs were checked. Figure 24, summarizes the rated ability of the system in ascertaining the profitability in division wise, activity-wise and unit wise. As shown in the figure 24, 38% of the respondent rated the costing system

of the company as poor in ascertaining the profitability in division wise, activity-wise and unit wise.

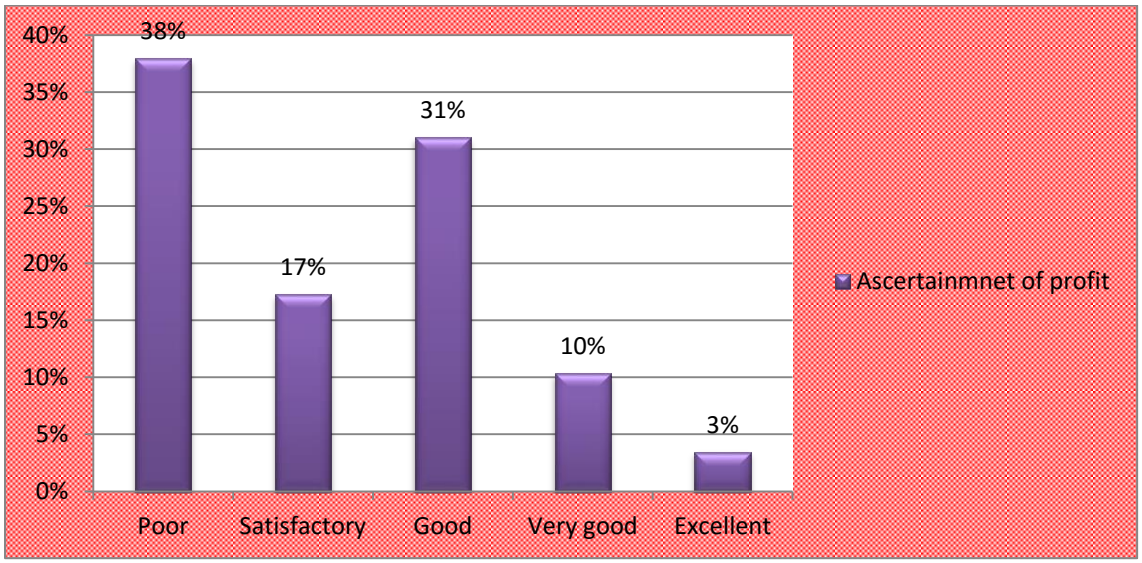

Figure 24: Ascertainment of profit

6. Serving as an effective information system

The cost information of activity has to be ascertained in every level of activity. Every costing system has to serve as an effective information system for ascertaining the cost at every level. Out of 29 respondents, 34% rated their company costing system as poor with regards to serving as effective information of system which enables to ascertain the cost at every level of the production process and activity level.

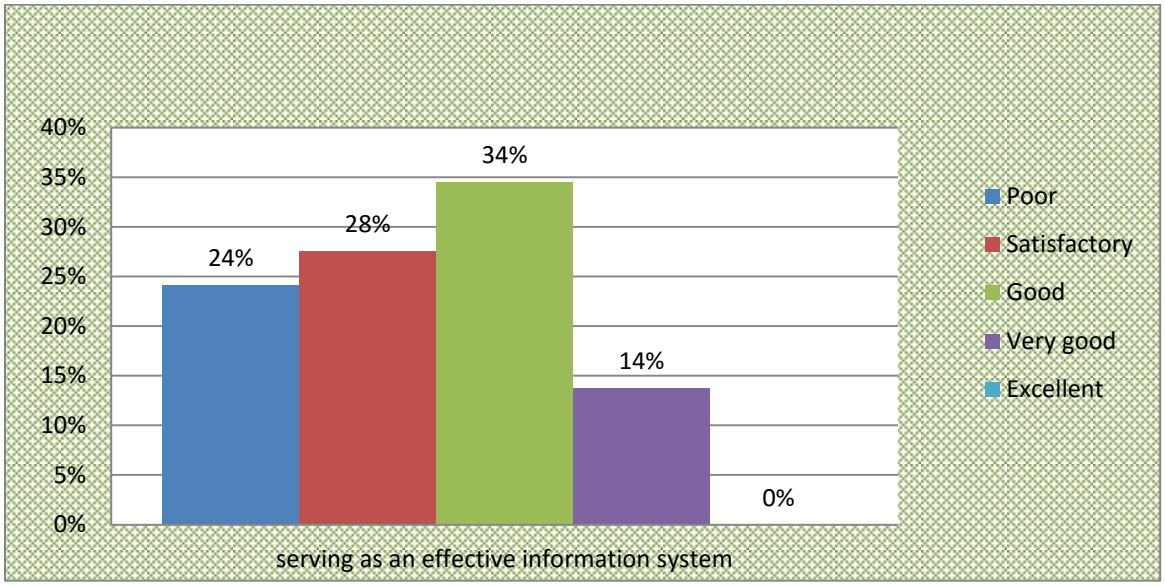

Figure 25: Serving as an effective information system

7. Identifying profitable and unprofitable activity

Proper identifying of the profitable and unprofitable activities in the costing system assists the managements to reduce wastage and give special consideration for an unprofitable activity. The respondent rated the company costing system for identifying profitable and unprofitable activities that help the management to reduce or eliminate wastages and inefficiencies such as underutilization, idle time, spoilage of material, etc as figured below. Out of the total respondent, 34% & 41% of the respondents rated poor and satisfactory respectively. The remainder 17% and 7% of respondents rated as good, very good and excellent.

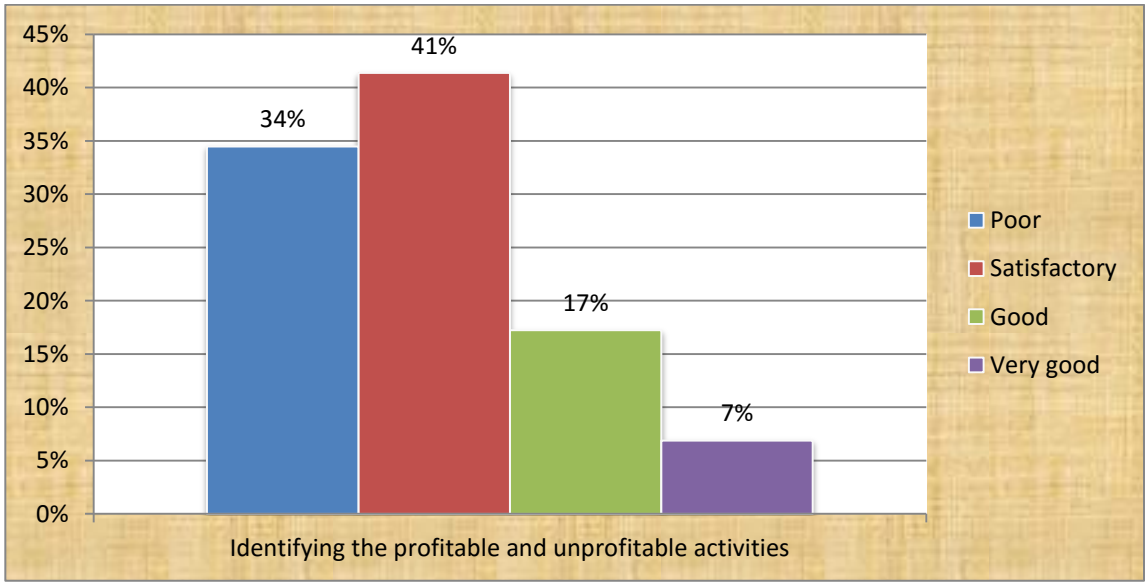

Figure 26: Identifying profitable and unprofitable activity

8. Ability to forecast

The respondents were asked to rate the ability of costing system to forecast from the past cause and effect relation. Out of 29 respondents, 45% of respondents revealed that the ability of their costing system to forecast the future cost of activity was poor. The remainder 21%, 17%, and 17% were rated as satisfactory, good and very good respectively.

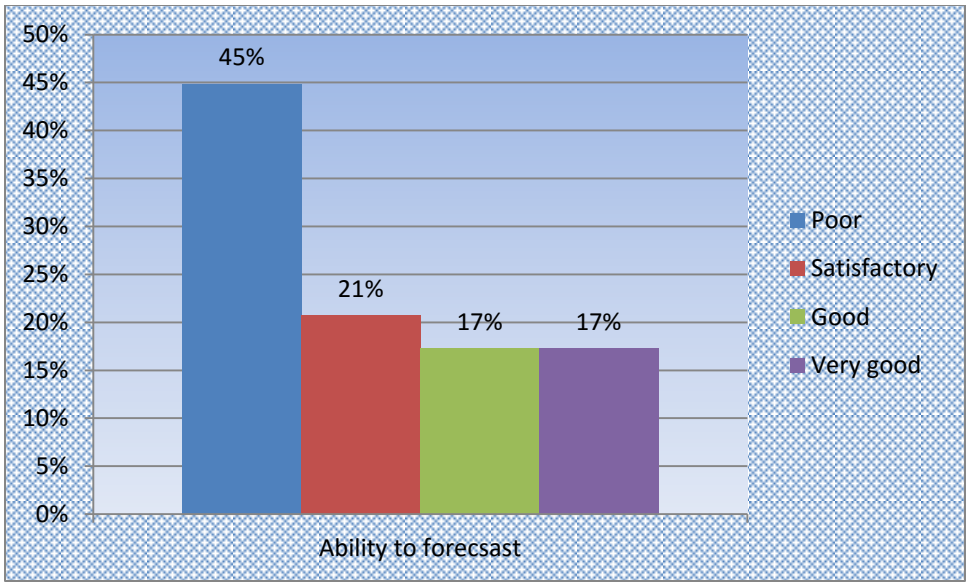

Figure 27: Ability to forecast

4.4.6 Satisfaction with the current system

After rating the costing system of their company the respondents were asked about whether they are satisfied with the current costing system of the company. The response revealed that out of 29 respondent 97% are not satisfied and the rest 3% responded that they are satisfied.

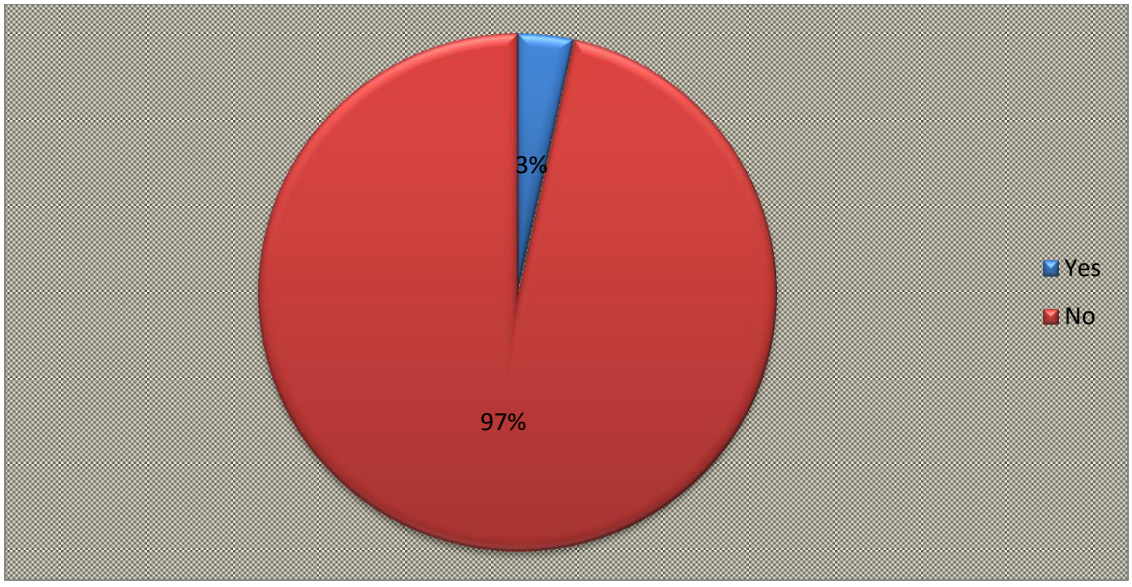

Figure 28: Satisfaction with the current system

Finally, the management was asked to suggest what they would like to add or amend in the current costing system of the company which is summarized in the Table14.

Table 14: Respondents' Suggestion

I.N	Respondent suggestion
1	The system should be automated to easily evaluate the performance of an activity.
2	The company has to give training for the project and head office staffs about data collecting in the site and to analyze variance in each activity to increase the quality of data.
3	The company should introduce different software to improve the decision-making system.
4	The feedback system should get more attention to use the cost accounting results for a better profit.
5	An independent cost accounting team should be organized at the project level.
6	On-time reporting of the cost accounting to timely amend the performance of an activity.
7	A systematic approach needs to be implemented to improve the cost accounting system.

4.5 Desk Study

4.5.1 Ethiopian Construction Works Co-corporation

Ethiopian Construction Works Corporation was established on the council of ministers Regulation No. 366/2015 on December 18/2015. It is established by merging the previous famous governmental construction companies such as Ethiopian road construction corporation (the former Awra - Godana), Ethiopian waterworks construction, Ethiopian building construction and Ethiopian dam and irrigation construction to form federal government public enterprise with the authorized capital of Birr 20,313,608,143.90(Twenty Billion Three Hundred Thirteen Million Six Hundred Eight Thousand One Hundred Forty Three and Ninety Cent). The ministry of public enterprises is the supervising authority of the corporation. The Corporation head office is found in Addis Ababa and has a branch in other parts of the country. The corporation was established to engage in domestic and overseas construction works as a contractor in construction, upgrading and maintenance of roads, bridges, works relating to dams, irrigations, hydropower generations, water supply systems, sewerage systems, drainage, deep water wells, reclamations, river diversions, construction of buildings, airfields, railways, ports and other civil works. It also engages in the assembling of construction equipment and machinery, manufacturing spare parts and provide maintenance services for construction equipment and machinery and produce construction materials and different kinds of pipes necessary for its activities and sell them as may be appropriate.

ECWC acquire, own and administer irrigation dams, deep water wells and as may be necessary water supply canals constructed and to be constructed by the federal government budget and collect charges from the beneficiaries of such dams. The Purposes for which the corporation is established are

- To engage in the rental business of construction machineries ;
- To produce qualified human resource with required discipline, number and quality for the corporation by using its own training facilities or work in co-ordination with relevant domestic or international research, education and training institutions;

- To make studies and forward proposals in line with directions given by the ministry of public enterprises to get financial, technological and modern administrative inputs (including attracting investment or to engage in investment) to be competitive and profitable in domestic and overseas works ;
- To sell and pledge bonds and to negotiate and sign loan agreements with local and international financial sources in line with the directive issued by the Ministry of Finance and Economic Co-operation and in accordance with policy direction given by the Ministry of public enterprises ;
- To undertake any other related activities necessary for the attainment of its purposes.

4.5.2 Organizational structure

A framework, which enables us to bring together functions, people, and other resources for achieving objectives by providing the means for clarifying and communicating the lines of responsibility, authority, and accountability is known as the organizational structure. (Montana, P. and Charnov, B., 1993). ECWC as an organization has its own organizational structure. The organizational structures are organized for the office and the site by assigning responsibility to different bodies. Figure 29 indicates the organizational structure of the ECWC, TICS.

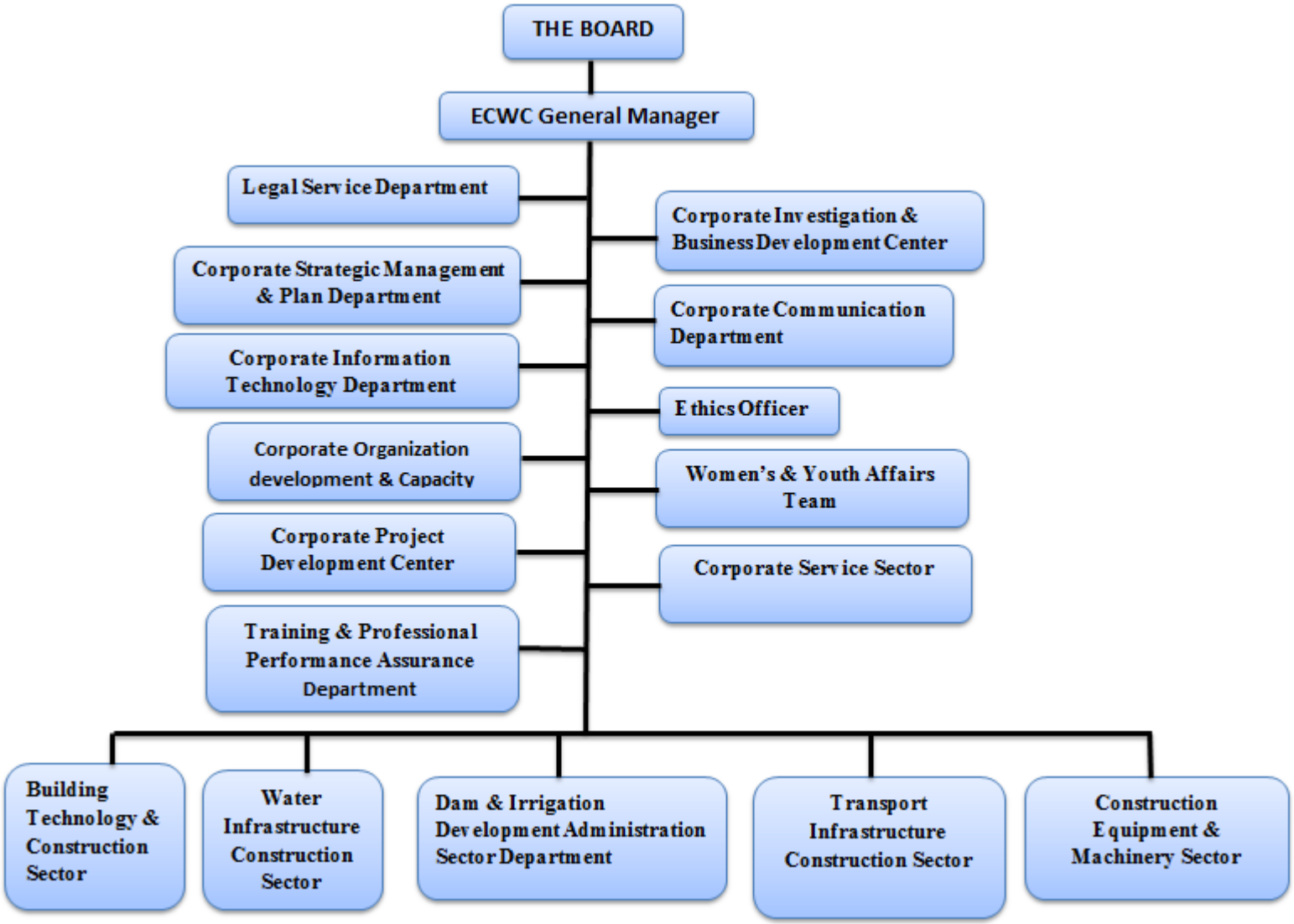

Figure 29: Corporate Structure of ECWC

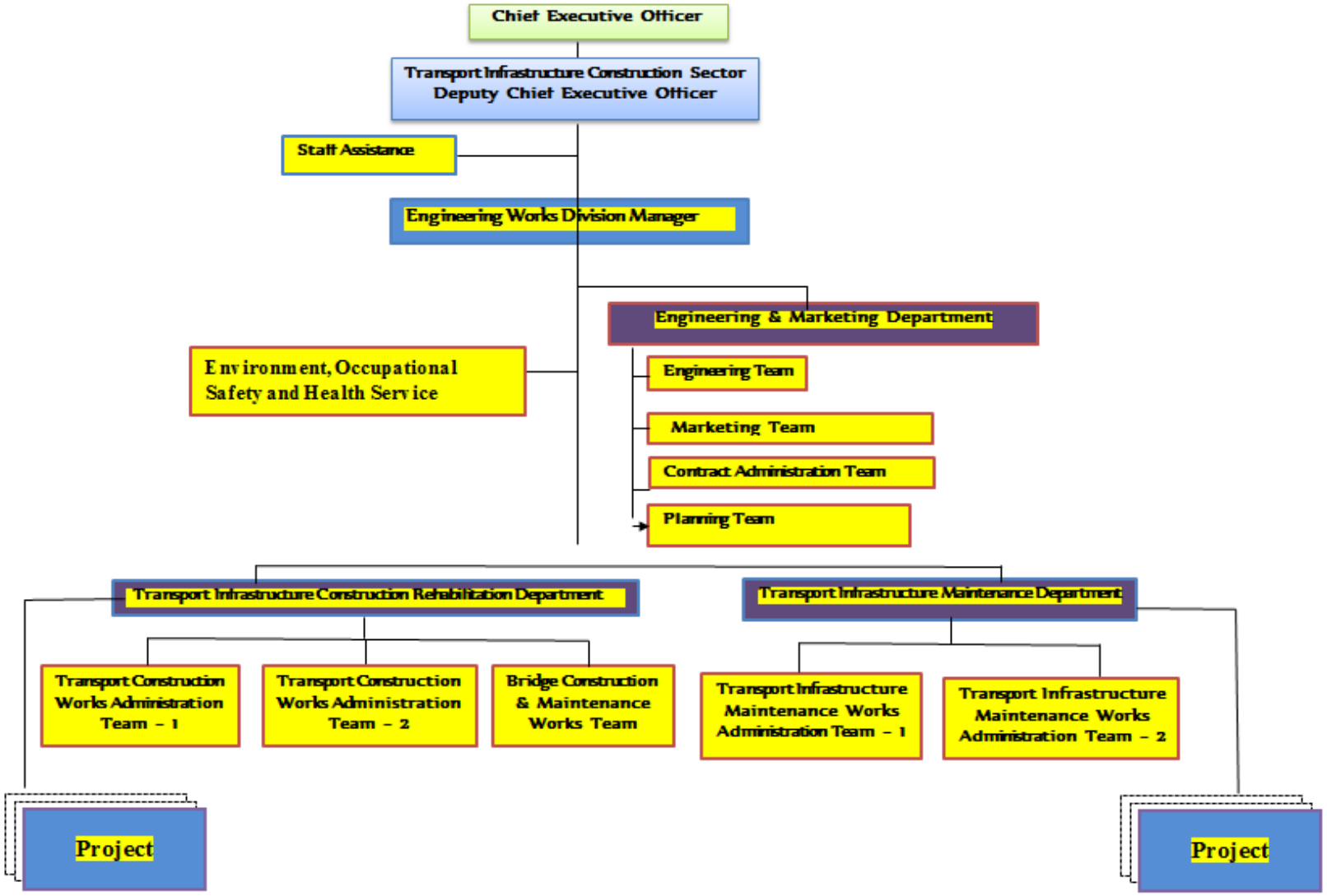

Figure 30: TICS Organizational Structure

4.5.3 Cost accounting in ECWC

As referred from the cost accounting manual of ECWC TICS, cost accounting system is implemented in the company because the company has faced critical problems of cost and progress variance when evaluating the completed projects. This late ascertainment of the cost of a project has no importance to the management to make a corrective decision on time. The cost of each activity in a project together with its variance from the standard has to be ascertained during the construction process. So, in order to overcome the cost variance problem and control cost on the progress of the project the company has introduced a system called cost accounting.

The cost accounting manual of the company stated that the implementation of the system involving different personnel ranging from the general manager, deputy general managers, division managers to road construction project manager and road maintenance project manager to initiate, plan, evaluate and monitor the implementation of cost accounting at road construction and road maintenance projects. It is facilitated by preparing a document and giving training about cost accounting procedures to give a clear image to all levels of management members about the benefits and advantages of its implementation. The cost accounting manual implementation procedure is shown in the Figure 31.

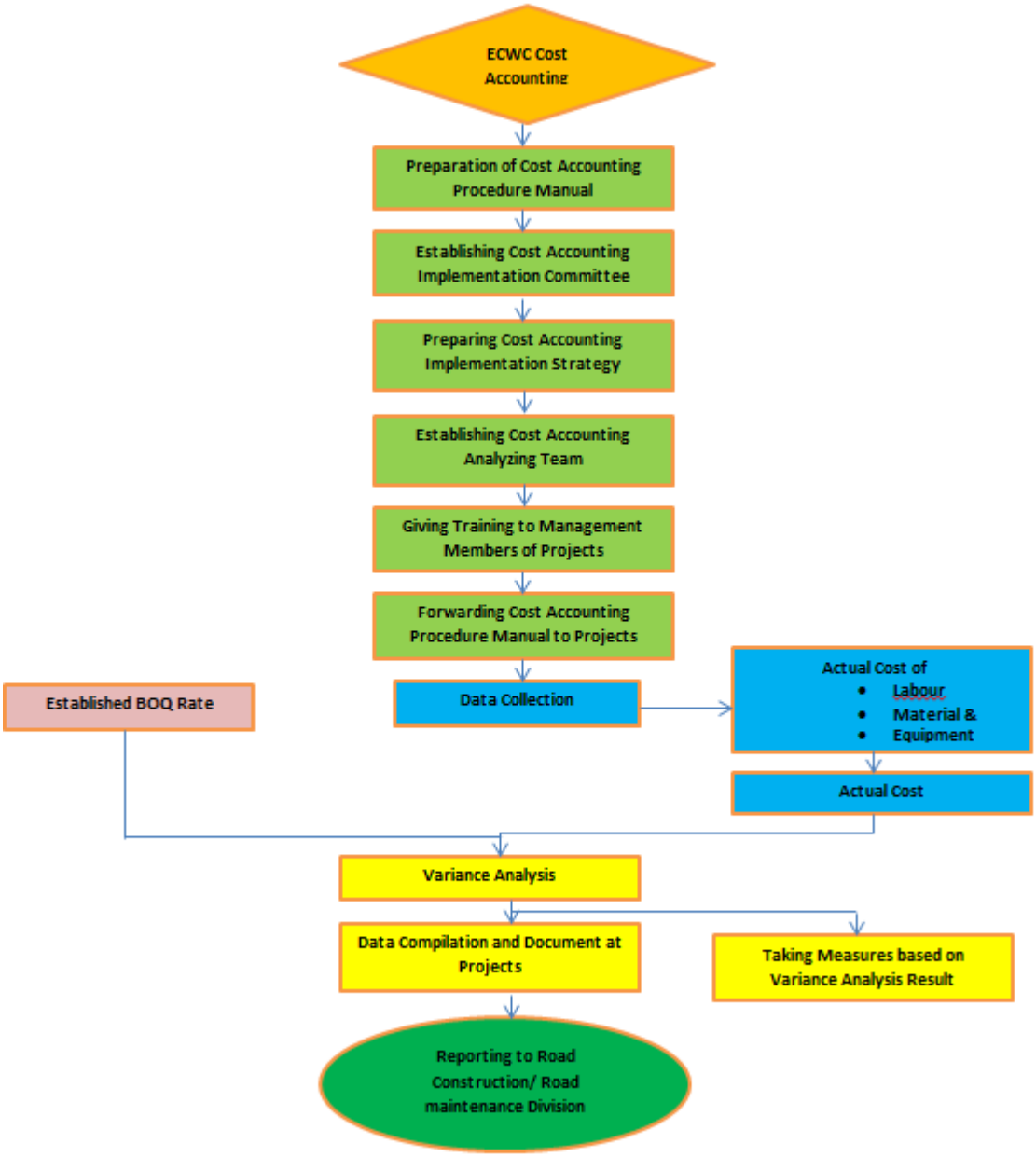

Figure 31: Cost accounting manual implementation procedure of ECWC TICS

4.5.4 Cost accounting analyzing team in ECWC TICS

The cost accounting manual of the company states that in every project there must be a cost accounting analyzing team. Cost accounting analyzing team is a unit which is established by road construction and road maintenance projects for the implementation of cost accounting manual. It is part of a cost accounting unit. The team is responsible for the analysis of project-level cost accounting with appropriate cost classification by labor, material, equipment, and overheads. Cost accounting analyzing team comprising of one

office Engineer, one accountant, one quantity surveyor and data encoder under engineering service team leader. The cost accounting analyzing team is responsible for the weekly computation of actual cost and weekly analysis of variance after properly collecting data of labor, material, equipment, and overhead for a given road construction or maintenance activity. The cost accounting analysis flow chart of the company is shown in Figure 32.

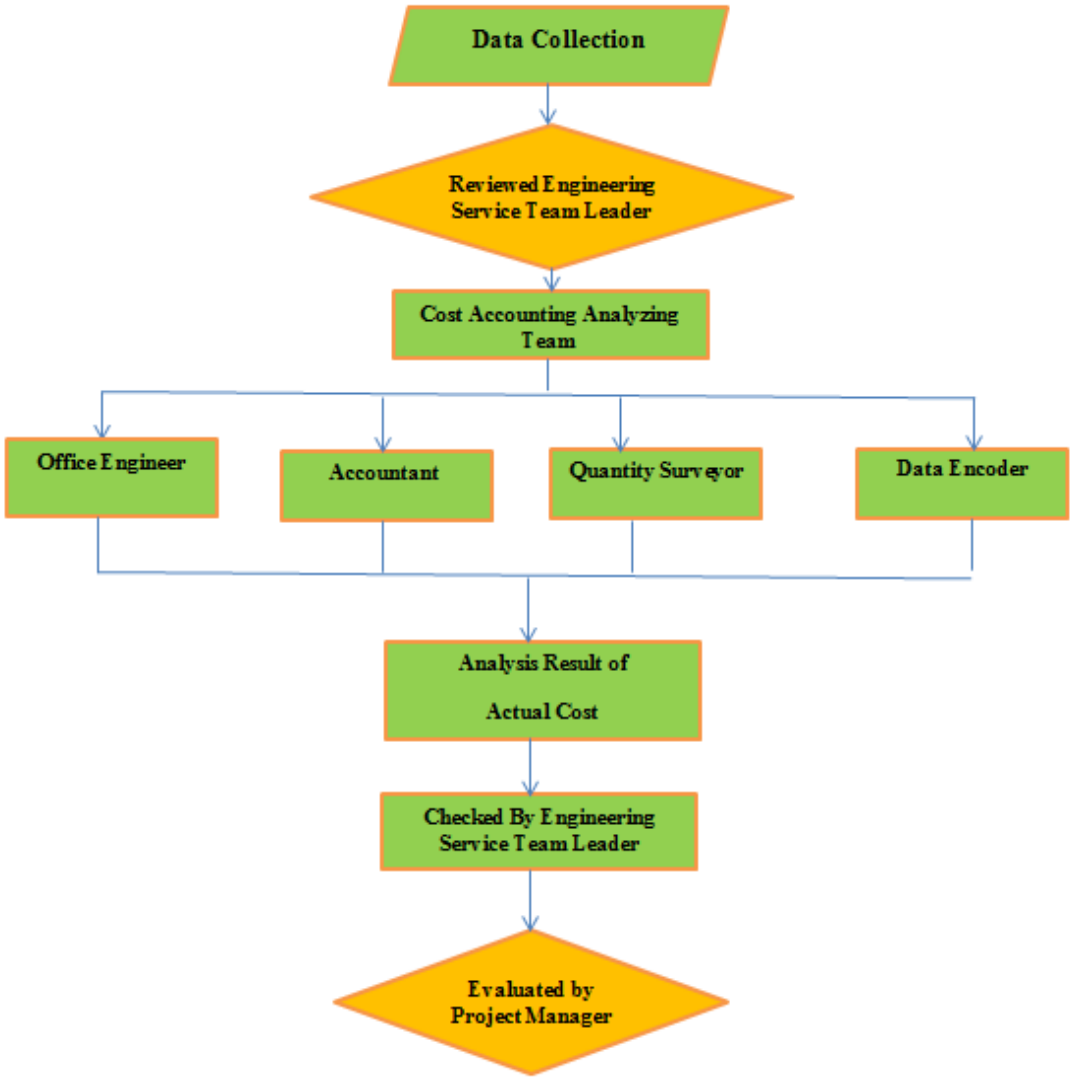

Figure 32: Cost accounting analysis flow chart

However, most projects don't have the cost accounting team as per the manual. They consist of data collectors to collect data, office engineers to analyze and engineering service team leaders to check the overall analysis process. Since the office engineer is appointed for additional tasks of the project, this could influence the office engineer's work in cost accounting reports.

4.5.5 Overhead allocation in ECWC TICS

As discussed in the literature, the indirect or supplementary cost which cannot be wholly debited to a particular job is known as Overhead cost. These costs include indirect materials, indirect employees and indirect expenses which are not directly identifiable or allocable to a cost object in an economically feasible manner. For example, rent, depreciation, maintenance repairs, supervision, etc.

In the cost accounting manual, it is stated that indirect expenses incurred from a project which are associated with the construction of road project activities are summarized as actual overhead cost of that particular project. The computation of actual overhead cost is the summation of the project actual overhead cost & head office actual overhead cost for assisting the given project. The project's head office overhead costs are being supplied by the head office finance department. The computation of actual overhead cost should be worked out at the project, based on the actual recorded data, by the cost accounting analyzing team on a monthly basis. Project actual overhead cost is different from project to project and which is highly dependent on project performance, location, topography, weather, security, and size and type.

The head office overhead cost includes three costs; the cost of the head office supporting department, cost of head office road construction and maintenance division and the cost of equipment maintenance and administration department. Costs other than road construction and road maintenance divisions are allocated to project costs depending on the level of support that the head office provided to the respective projects. Road design & construction division overhead costs are allocated to the various road construction projects and the road maintenance division overhead costs are allocated to the various road maintenance costs. The overhead costs of equipment maintenance and administration costs are allocated to various projects (construction and maintenance).

As per the manual, the computation of actual overhead cost should be worked out by the project cost accounting analyzing team on weekly basis by computing the project actual overhead costs based on the daily recorded data and estimates the actual overhead costs incurred by the head office for supporting that particular project in the week.

In ECWC TICS, mostly head office overhead costs were not considered in the computation of the actual cost and in some reports the head office overhead cost included but the allocation percentage was constant through all the time which leads to incorrect computation of cost. In order to know the actual costs of projects and profit, the actual head office overhead costs of each project have to be calculated and allocated fairly to each project. Otherwise, it is difficult to know the financial status of the project so that the managements make an incorrect decision based on false information. Head office overhead costs have to be calculated based on the accurate costs which are incurred by the head office in order to provide supports to that specific project. This cost can vary from time to time so instead of using the constant amount of cost, the company has to use the actual calculated overhead amount in order to determine the actual cost of the project.

In ECWC TICS project overhead percentage rates are calculated by summing up the total overhead cost and dividing it to the expected revenue to allocating it for each activity. Some reports indicate that they consider the same amount of cost or predetermined overhead cost but the calculated amount of overhead cost has to be used in order to get correct cost information.

4.5.6 Costing system in ECWC TICS

As discussed in the literature based on the assignment of cost to the cost object, there are two types of costing systems named as direct and absorption costing system. A direct costing system also known as a marginal or variable costing system assign only the direct cost to the cost object whereas the absorption costing system assigns both direct and indirect cost to cost object. Depending on the allocation of overheads absorption costing system also divided into the traditional costing system and activity-based costing system. The traditional costing system uses arbitrary cost allocation and assigns or allocates the company’s indirect costs to the items manufactured based on volumes such as the number of units produced, the direct labor hours, or the production machine hours. Whereas

activity-based costing is cost attribution to cost units based on benefit received from indirect activities e.g. ordering, setting up, and assuring quality. As a researcher can observe ECWC TICS uses the ABC system. The overheads are charged to each cost object or activity fairly accurately based on the benefit received from the indirect activities.

4.5.7 Data capturing in ECWC TICS

Data recording is an important task that has to be implemented in order to provide timely and accurate data for planning and control of construction projects. The entire implementation of cost accounting and the benefits of analysis depend on the accuracy of data collected. In the literature, it was cited that there is a different method of performance data capturing that appears to be particularly for construction projects as a card recording system, computer-generated turn around system and graphical method. In this system all items of expenditure on-site should be captured systematically and progressively such as; Labour operational time and cost, Materials consumption and wastage, Equipment utilization, breakdown and idle time, Overhead expenses, Attendance costs on subcontractors, and Subcontractor's performances. In the literature it was discussed that depending on the activities to be carried out, a foreman collects the relevant forms for labor, materials, plant, and attendance before starting time each day and enters the relevant data through the day as the operations proceed. At the end of the day, he signs and drops the completed forms at the site office where all the forms for that day will be processed.

ECWC TICS cost accounting manual states that the data collection for actual cost accounting is accomplished by the work execution team leader. And this team is responsible for assigning data collectors for each road activity and establish a network for proper flow of recorded daily resource utilization data for labor, equipment, manpower, and overhead data to cost accounting analyzing team during executing a given road activity. Project site data collection activities involve personnel of data collectors, foremen, site engineers, work execution team leader, and engineering service team leader.

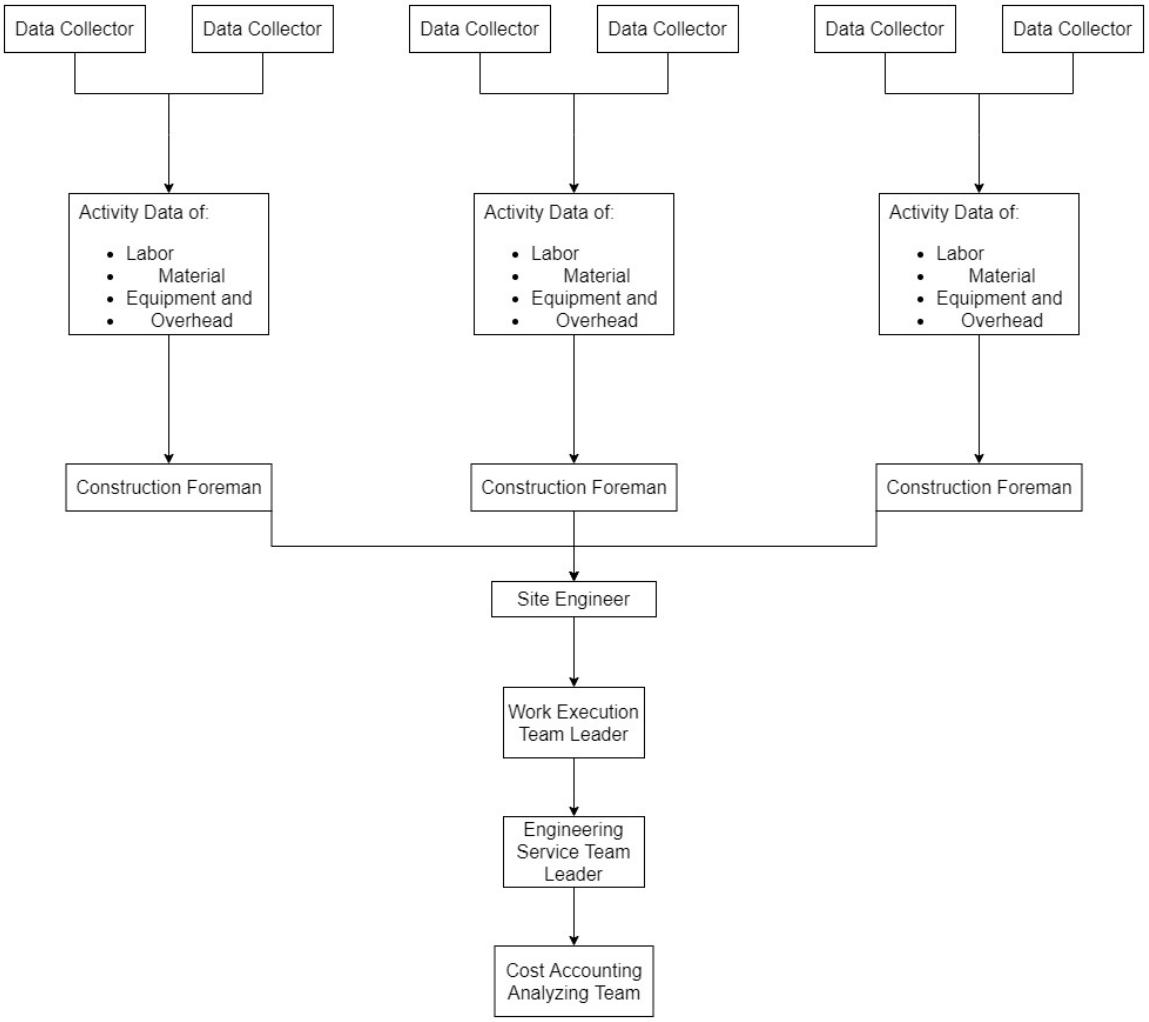

Figure 33: Data collection procedure

ECWC TICS had been capturing performance and cost data using the card recording system. The daily cost and performance data are recorded by the data collector in the daily data recording formats of the company. The format includes the crew of manpower which are involved in such activity, material consumed and operated equipment for performing an activity. Then the raw data collected by the data collectors are signed by the foremen and approved by the work execution team leader, then send to the office engineer for further analysis. Work Execution team leader is responsible for the daily field data collection of resource utilization of labor, equipment, material and site overhead for actual cost accounting.

4.5.8 Data processing in ECWC TICS

As stated in the literature data processing is a process of accumulation, classification and recording of received information into some recognized and meaningful manner to facilitate identification of significant deviations from plans and or standards. The data capturing stage provides cost data uses to answer most of the questions that form the aim and objective of performance measurement. In order to present the raw data in an understandable and meaningful way, some computational and analytical routine is needed.

In ECWC TICS the captured raw data were classified, accumulate and analyzed in order to give meaningful information for the decision-makers and evaluating the performance. Beliveau (1984) and Clough, (1979) suggested that data processing on construction sites be carried out in a standardized format, preferably similar to the data capture approach. The raw cost data gathered from the data collector are inserted in a different excel spreadsheet to calculate the direct cost and total cost including the overhead cost. First, the daily activity cost data including labor, material and equipment cost were inserted in the daily actual cost analysis sheet. In this sheet, the direct cost for the executed quantity for each day and each activity was analyzed. Figure 34 indicates the direct cost analysis format of the company.

ETHIOPIAN CONSTRUCTION WORKS CORPORATION

TRANSPORT INFRASTRUCTURE CONSTRUCTION

Dulecha- Awash Arba Junction Road Upgrading Project

Daily Activity Actual Cost Analysis

Cut and Borrow To Fill

Actual labor index Factor:- 2.220 8/20/2019-9/19/2019

Act Work Item No	42.01(a)ii id Borrow to fill with unlimited hauling distance) Compacted to 95% of modified AASHTO D						Ex. Qty.	1255.1	m3	ST	59+740-60+000,100%					Mesfine	21-Aug-2019
Actual Labor Cost							Actual Material Cost					Actual Equipment Cost							
Crew Members	Mthly Salery	QTY	UF	Working Hrs	Indexed Hrly Cost	Indexed Daily Cost	Description	Unit	Qty. required	Unit price	Material cost	Type	Qu.	UF	hr	min.	Operation Hr.	Hourly Rate	Actual Equ.cost
Data collector	3493	1	0.5	10	41.32	206.59	Borrow Mat. Prod.	m3	1.00	24.73	24.73	Grader(0688)			9	50	9.83	1079	10,610.17
Time Keeper	2051	2	1	10	24.26	485.21	Borrow Mat. Hauling	m3	1.30	16.75	21.78	W/truck(10933)			7	55	7.92	430	3,404.17
Con. Forman 1	4246	1	0.5	10	50.22	251.12	Borrow Mat. Loading	m3	1.30	5.81	7.55	Roller(0535)			6	40	6.67	563	3,753.33
Laborer	2051	10	1	10	24.26	2,426.05						W/truck(05312)			9	10	9.17	430	3,941.67
Helper	2230	2	1	10	26.38	527.56													
Total						3,896.53	Total				54.05	Total							21,709.33
A=Actual Labor Unit Cost						3.10	B=Actual Material Unit Cost				54.05	C=Actual Equipment Unit Cost				17.30	Direct cost	74.46	25,659.92

Act Work Item No	42.01(a)ii id Borrow to fill with unlimited hauling distance) Compacted to 95% of modified AASHTO D						Ex. Qty.	669.9	m3	ST	59+180-59+330,100%					Mesfine	22-Aug-2019
Actual Labor Cost							Actual Material Cost					Actual Equipment Cost							
Crew Members	Mthly Salery	QTY	UF	Working Hrs	Indexed Hrly Cost	Indexed Daily Cost	Description	Unit	Qty. required	Unit price	Material cost	Type	Qu.	UF	hr	min.	Operation Hr.	Hourly Rate	Actual Equ.cost
Data collector	3493	1	0.5	10	41.32	206.59	Borrow Mat. Prod.	m3	1.00	24.73	24.73	Grader(0688)			8	20	8.33	1079	8,991.67
Time Keeper	2051	2	1	10	24.26	485.21	Borrow Mat. Hauling	m3	1.30	16.75	21.78	W/truck(16065)			8	35	8.58	430	3,690.83
Con. Forman 1	4246	1	0.5	10	50.22	251.12	Borrow Mat. Loading	m3	1.30	5.81	7.55	Roller(0535)			10	10	10.17	563	5,723.83
Laborer	2051	11	1	10	24.26	2,668.66						W/truck(16022)			7	35	7.58	430	3,260.83
Helper	2230	1	1	10	26.38	263.78													
Total						3,875.36	Total				54.05	Total							21,667.17
A=Actual Labor Unit Cost						5.78	B=Actual Material Unit Cost				54.05	C=Actual Equipment Unit Cost				32.34	Direct cost	92.18	25,596.58

Figure 34: Daily activity actual cost analysis

The summary of daily executed activity and their corresponding cost are listed in the summary of the daily activity cost sheet. In this sheet, the total cost of each executed activity (cost center) including the overhead cost are calculated to get unit cost of each activity.

The next step is collecting the executed quantity and costs of each day. The summary of the executed activity together with its actual unit cost are listed in this sheet. This sheet differs from the previous one by its calculation of actual cost. The total executed quantity of each activity is summed up and their earned cost for corresponding activity was summed and then the summed cost divided by the summed total executed quantity.

Finally, the overhead cost percentage rate will be allocated by multiplying with the total direct cost. Figure 35 shows the format of the sheet.

ETHIOPIAN CONSTRUCTION WORKS CORPORATION

TRANSPORT INFRASTRUCTURE CONSTRUCTION

Dulecha- Awash Arba Junction Road Upgrading Project

Actual Cost

8/20/2019-9/19/2019

Item	Activity	Actual Labor Cost(A)	Actual Equipment Cost(B)	Actual Material Cost(C)	Actual Overhead Cost(D)	Actual ActivityCostE=A+B+C+D
2100	**CLEARING AND GRUBBING**					
21.01	Clearing and grubbing	2493.56	17435.31	0.00	3696.80	23625.67
32.02(b)	Backfilling using imported selected material	51.07	144.32	127.39	56.64	379.42
32.07	Cast In Situ Concrete and Formwork					
32.07(f)	Class "C" Concrete (C-20)	696.26	2730.29	1592.96	903.51	5923.03
34.03	**STONE MASONRY WALLS**					
34.03(b)iii	Class 'B' Masonry for town Ditch	803.90	2096.59	238.50	565.02	3704.01
4000	**EARTHWORKS**					
42.01(a)ii	i) Compacted to 95% of modified AASHTO Density	4.42	54.05	26.90	15.37	100.75
42.01 (c)	Rock fill in embankment	3.91	22.81	193.09	39.56	259.37
5100	**SUBBASES**					
51.01	Gravel sub-base layer, 97% MDD, AASHTO T-180					
51.01(a)ii	AASHTO T-180	32.93	48.34	103.43	33.25	217.95
5200	**ROAD BASES**					
52.01	**Base layer construction**					
52.01(b) ii	200mm thickness, to 100% compaction	16.36	33.37	543.19	106.73	699.64
61.01	**Prime Coat**					
64.02	**Asphalt Sufacing**					
64.02 (a) (ii	50mm thick Asphalt Concrete Surfacing, 60/70 Penetration Grade Bitumen, Continously Graded, Medium Grade.	8.55	232.40	10.32	45.23	296.48

Figure 35: Summary of activity actual Cost

4.5.9 Performance evaluation in ECWC TICS

ECWC TICS executes performance evaluation to identify the deviation between the actual and target cost. From the different method of performance evaluation, a variance analysis is used in the company to know that work is carried out according to the budget. The analysis is done by comparing the actual cost with the budget or standard cost. The budget cost or standard cost in the case of the company is the contract unit rate. The

standard cost of an activity is the acceptable cost for a unit activity based on the market price of resources, overhead and updated CMS manual & procedures. CMS is a standard that has road construction activities together with their crew formation and expected productivity. The company uses the CMS manual prepared by the company itself based on the previously completed projects productivity experience and crew formation. Establishing of road construction activity standard costs is used as target costs or basis for comparison with the actual costs.

ECWC TICS uses CMS to evaluate the performance of a crew and its productivity. The CMS manual consists of different activity and their allowable crew formation. Every project has to form the working crew based on the manual and then the actual executed quantity will be compared with the expected productivity as per the standard. Currently, the company uses this standard for an effective measuring of productivity. If the productivity is less than the expected it is maybe because of inefficient uses of resources including labor, material, and machinery so the management can justify its loss and take a corrective decision.

Even if the literature puts the different types of variance analysis in construction such as; LRV = labour rate (price) variance, LEV = labour efficiency variance, MPV = materials price variance, MUV = materials utilization variance, MYV = materials yield variance, EEV = equipment efficiency variance, ERV = equipment rate variance, OHV = overhead variance and TCV = total cost variance, the company perform only the total cost variance at an activity and serious level. The following figure represents the variance analysis formats at the serious and activity level in ECWC TICS.

ETHIOPIAN CONSTRUCTION WORKS CORPORATION

TRANSPORT INFRASTRUCTURE CONSTRUCTION

Dulecha- Awash Arba Junction Road Upgrading Project (KM 40+000 - KM93+127)

Variance Analysis - At Series Level

8/20/2019-9/19/2019

Activity Reference		General	Site Clearance	Drainage	Earth Works	Sub-Base,Road base&Gravel Wearing Course	BITUMINOUS SURFACING AND ROAD BASE	Structures	Ancillary Works	Day work	Total Cost
		Series 1000	Series 2000	Series 3000	Series 4000	Series 5000	Series 6000	Series 8000	Series 9000	Series 11000	
A	Performance achieved per standard(BOQ)rate		10,232.07	89,476.17	2,713,600.30	723,741.23	464,245.60				4,001,295.38
B	Actual cost incurred based on actual Cost rate		11,340.32	158,297.57	3,231,594.63	671,691.75	539,601.98				4,612,526.25
C=A-B	Variance	-	(1,108.25)	(68,821.40)	(517,994.33)	52,049.49	(75,356.38)				(611,230.87)
E=C/A	Variance (%)										-15.3%

Figure 36: Variance Analysis

The variance is calculated by summing up the labor, material and equipment cost of each activity, then by the total cost from the budget cost. The calculated variance may be negative or positive depending on the cost. If the variance is negative something has gone wrong and if it is positive then nothing is wrong but it doesn't mean that the project is safe to get the planned profit. Since the company computes variance analysis only for total cost at an activity and serious level the cause for variance can't be determined so it is complicated to take a proper corrective measure on the result.

4.5.10 Decision making in ECWC TICS

As discussed in the literature review after analyzing and evaluating the performance the final stage is making a corrective decision. Managements are concerned about what must be done immediately to restore performance to the desired level or correct standards and the basic causes of deviation. To overcome the deviation of the performance corrective decisions have to be taken at the right level and at the right time as soon as possible.

The cost accounting manual of the company states that the analysis report should be sent weekly to the head office for project management purposes. Furthermore, the summarized monthly cost accounting analysis report should be compiled with a monthly progress report and submitted to the road maintenance and road construction project management teams located at the head office. Accordingly, each project's cost accounting analysis reports are evaluated at the head office management staffs by referring the variances concerning actual costs and standard costs (BOQ rates). Then after feedback based on the analysis evaluation is forwarded to each project so that the project incorporates the suggested comments and manages project costs. However, the projects are sending the cost accounting reports on 15days and a monthly basis. This will leads to a lack of making corrective decisions on time. The project manager together with other project management staff has to be the primary user of the cost accounting reports so that they will decide on the time it will prevent the loss occurred during the time until the feedback has come from the head office.

During the case study, the researcher can observe that mostly in the cost accounting reports the comments or reasons out from the project management staffs are the negative variance of the cost stated as that it is occurred because of over expected productivity of standard or underestimation of the unit rate of the activity.

The researcher can observe that in the company taking corrective measures and decisions are less practiced. This is because of the less detail computation of the variance and the late reporting of the cost analysis. Mostly the cost accounting reports are prepared after 15days or a month of the completed activities. This can preserve the managers to make a decision on time. And due to less detailed computation of the variance, it is unable to know whether the variance is because of labor cost, material cost or equipment cost.

Identifying the cause of variance will lead to take the corrective decision so that restoring the performance to the desired level or correct the standard can be done. If a positive variance occurs in the analysis, the profitability analysis has to be done. Because sometimes there might be positive variance while there is the desired profit variance. In the ECWC TICS when there is a positive variance it simply took as the planned performance achieved but the profitability has to be done.

After reviewing the cost accounting report the feedback about the overall reports sent to the project from the head office. This feedback control comments about the variance, crew formation together with their productivity, costs of labor, material and equipment and overhead. The feedback is done to correct the action and overall system in the project for the future.

4.5.11 Comparison between ECWC TICS system and ICAI or IFAC

ICAI and IFAC list outs different major requirements for cost accounting system which are designed to apply in every organization. The requirements can be used as a benchmark to evaluate the cost accounting system of any organization. The comparison between those requirement and ECWC TICS are shown in table 15.

Table 15: Comparison between ECWC TICS system and ICAI or IFAC

ICAI/IFAC cost accounting system requirements	ECWC TICS system
❖ Determination of product cost on per unit basis or total cost.	❖ Cost of activities are determined on per unit basis and total cost, for example, cost per cubic meter, meter, kg, liter, etc.
❖ Providing relevant data to the managements about the actual cost of a product for evaluating, future planning and decision making.	❖ Relevant cost data are reported from the project to the head office managements to evaluate the project performance.

❖ Evaluating the performance, analyzing and efficiency controlling by locating wastages and loopholes in the production processes.	❖ The cost accounting reports are prepared by including crew formation and productivity of each activity which enables the managers to control the performance and efficiency of each crew.
❖ Profit ascertainment in division, activity and unit wise.	❖ Profits are ascertained only on serious and activity level.
❖ Serving as effective information of system which enables to ascertain the cost at every level of production process and activity level.	❖ There are different costs which are not taken in to consideration in calculating the product cost so this makes the system unable to serve as an effective information system.
❖ Forecast the future cost from the past cause-and –effect relation.	❖ The cost accounting data are used by the engineering service and marketing team in order to estimate and fix the unit rate. However, cost data aren't considered in planning the budget of project.

4.6 Proposed cost accounting system

The aim of the alternative cost accounting system proposed in this section is to combine the identified criteria's for good cost accounting system as defined in the literature with the gathered investigation evidence of the company current practice to provide a more effective procedure free from the identified deficiencies. Accordingly the proposal made by this research concentrates on designing a procedure for executing clear costing system at the level of site operation.

Currently the company has practiced cost accounting system by focusing on the identification of the actual cost incurred for each cost object or activity during the production. It is done by identifying the direct costs incurred and allocating the indirect cost or overhead cost to the cost object. The direct cost is determined by summing up the costs which are incurred particularly to that activity or cost object such as; labor, material and equipment cost. Since the direct cost has a direct relation with the cost object it is easy to trace the cost to each cost object, whereas indirect cost are shared to each cost object by percentage allocation bases. The percentage value are taken from the estimated overhead sets in the fixed unit rate or calculated by dividing the total indirect costs to the expected revenue then the indirect costs are allocated by multiplying by the total direct cost of each cost object. From the investigation evidence the existing system has two main problems such as ignoring different expenses which are incurred and misallocate the cost to the cost objects.

The proposed approach classifies the cost accounting system into three main parts resource, responsibility center and cost objects. The system indicates that first all costs incurred with in a specific reporting period has to be list out and then identify the responsibility centers for the entire project. Depending up on their task the responsibility centers can be divided in to support center and product center then the costs will be allocated to each cost objects. Figure37 indicates the proposed cost accounting system structure.

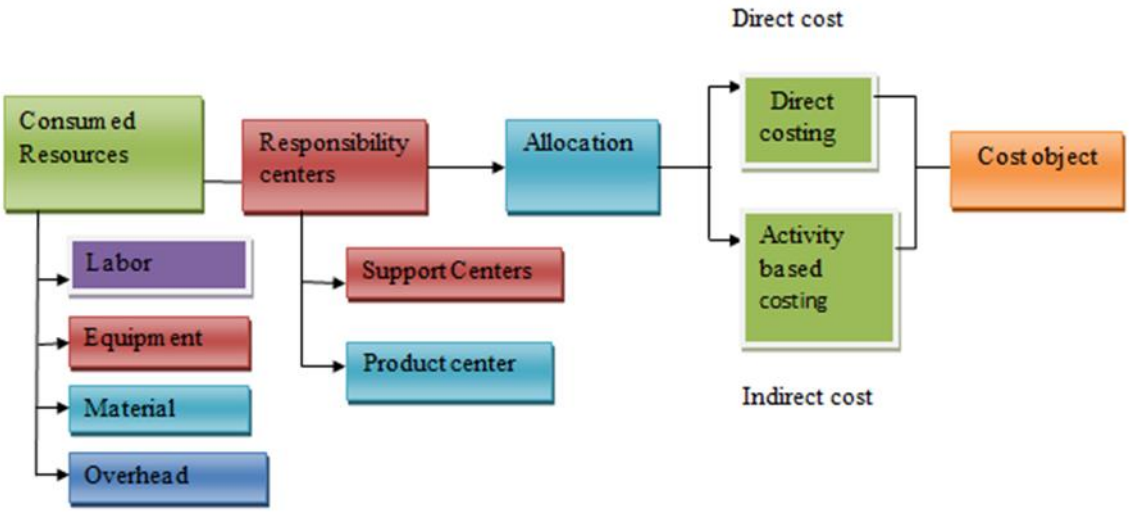

Figure 37: Proposed cost accounting system structure

I. Consumed resource configuration

The first part is related to the acquirement of resources. The costs of acquired resource with in specific period will be identified and classified on the basis of destination to the responsibility centers. Construction based on its nature of complexity different resources can be incurred which has to be allocates to cost objects. These costs can be labor, material, equipment and overhead. This first identification of cost aims to prevent the ignorance of cost in determination and allocation to cost objects.

II. Responsibility centers

After identifying the total acquired cost the next step is assigning those cost to the responsibility centers and grouped in cost pool. The responsibility center can be a unit or department in an organization for which the resources are acquired. Basically responsibility centers are classified as support center and product center. Support center are a department or a section which is not directly involved in performing the activity but it gives support to the production department or unit. For example, administrative department, equipment maintenance department, procurement and supply management team, etc. whereas product center has a direct relationship with the product or service such as, borrow material production, asphalt placing, sub base material production, etc.

III. Cost objects

Finally the costs in support and product center will be allocated to responsible cost objects. The direct and indirect costs will be allocated to the cost objects by using direct costing system and activity based costing system respectively.

4.6.1 Comparison between the existing system and proposed system

After investigating the current costing system of ECWC TICS, this research proposes the above cost accounting system structure. The proposed system focuses on fill the gaps in the existing system. The comparison between the existing and proposed system are indicate in table16.

Table 16: Comparison between the existing system and proposed system

Existing system	Proposed system
Cost determination	
❖ Costs are determined by using the crew worked hour report of each cost objects. Due to this there is a chance of ignoring different costs which are not done with a specific crew. For example, correction work and maintenance work.	❖ All costs incurred during the reporting period are listed and then allocated to the respective cost object through responsibility center. First identification of all acquired costs is done to overcome the problem of distorted cost allocation and ignorance of different cost.
Responsibility center identification	
❖ There is no responsibility center identification process. The costs are allocated to the cost centers based on their crew formation and worked hour.	❖ Responsibility centers for each incurred resources are identified as support center and product center and their corresponding cost will be allocated. This is done to prevent the occurrence of inaccurate cost

	allocation.
Overhead cost allocation	
❖ Head office overhead costs are either taken as a specific percentage amount of direct cost or not consider in cost determination of cost objects. So the cost ascertainment process will be distorted ❖ Uses a predetermined overhead percentage rate or they calculate the percentage of project overhead cost by dividing the sum of indirect cost of the project to the expected revenue from the executed work.	❖ The actual head office overhead cost of a specific project will be calculated and allocated to the project and then to the cost objects. ❖ The actual project overhead costs for a specific reporting period will be computed and allocated to each cost objects by using percentage rate. The overhead percentage rate is calculated by dividing the actual overhead amount of the specific period to total direct cost of executed quantities.
Variance analysis	
❖ The variance analysis is done at serious and general activity level.	❖ Variance analysis is done to the activity and resource level in order to evaluate the performance of the project. The resource cost variance of labor, material, equipment and overhead from the standard is computed in order to ascertain which resource is the cause for the negative or positive variance
Data presentation	

❖ Cost data is presented only in table format which is complicated and difficult to understand.	❖ The arranged cost data are presented to the concerned body in easy and understandable way. In addition to the table presentation format the cost variance of each activities and resources are presented graphically in order to easily indicate the varied activity and resource from the standard.

4.6.2 Test the implementation

In order to assess the proposal made for improving the effectiveness of the system and to provide a basis for obtaining useful recommendations from this research it was necessary to test the proposal in real-life situations and evaluate the results of the test against currently available system. Accordingly, this chapter presents the procedures carried out to test the proposed cost accounting system the results obtained from the test and an analysis of the results. The company is divided into different departments that are chosen as cost centers. All the expenses, direct and indirect, sustained by the project in a specified period of time are grouped based on their nature and then shared considering the required resource. This means divide the company into product centers and support centers and so, for each center, determine the respective expenses in order to calculate costs.

The reference of Dulecha-Awash Arba , Dimma-Rad and Jinka Mender road construction projects cost data is taken to test the proposed system.

4.6.2.1 Resources

The analysis of all the project cost incurred during the specified period is the first task that has to be occurred. This is important firstly to identify the consumed resources in the project and then to classify them into direct and indirect which is fundamental for the configuration of costs. In addition it also prevents the chance of cost ignorance which is

one of the problems of current system. Table17 shows all the resources or cost incurred in the project during the specified period

Table 17: List of consumed resource, Dulecha – Awash Arba road project

I.N	Consumed resource
I	**Labor cost**
1	Daily labor
2	Time keeper
3	Data collector
4	Labor Forman
5	Construction Forman
6	Overtime Payment
7	Deseret allowance
II	**Equipment cost**
8	Rental equipment expense
	Own equipment Expense
9	Fuel
10	Oil & lubricant
11	Spare parts
12	Tyre & tubes
13	Equipment maintenance
14	Depreciation
III	**Material cost**
15	Sand
16	Gravel
17	Stone
18	Asphalt
19	Borrow material
20	Sub- base
21	Base course
22	Electric supplies
IV	**Administrative expense**
23	Permanent Emp. Salary & Pension
24	Contract employees payment
25	Overtime Payment
26	Deseret allowance
27	Communication expense
28	Fuel

29	Oil & lubricant
30	Spare parts
31	Tire & tubes
32	Electrical Supplies
33	Equip. Rent expense
34	Entertainment
35	clothing and linen supplies
36	Food & Supplies
37	Medical supplies
38	Travel & perdiem
39	Office supplies
40	Repairs & maintenance of office & Building.
41	Janitor Supplies
42	Miscellaneous
43	Head office overhead cost

4.6.2.2 Responsibility centers

After identifying the resources the second step is determining the responsibility centers for each incurred resources. Based on relation with the final product or cost object responsibility centers are divided in to support center and product center. Support center are centers which don't have direct relation to final products or cost object but they allow production with their support. Whereas product centers has direct relation with the final product. The responsibility centers for the incurred resource are listed in the table 18.

Table 18: List of responsibility centers for Dulecha –Awash Arba project

I/N	Product center	Support center
1	Borrow material production	Administration team
2	Borrow material hauling	Financial Management team
3	Borrow material loading	Engineering service team
4	Borrow material fill	Procurement and supply management team
5	Drilling & Blasting	Equipment administration and maintenance team
6	Quarry Rock Material Production	
7	Quarry RockMaterial loading	
8	Quarry Rock Material Hauling	
9	Rock fill	
10	Rock sealing	
11	Sub-Base Material Production	
12	Sub-Base material hauling	
13	Sub-Base material loading	
14	Sub base layer construction	
15	Base course material production	
16	Base course material hauling	
17	Base course material loading	
18	Base Course material mixing	
19	Base course layer construction	
20	Asphalt batch plant opreation	
21	Asphalt hot mix hauling	
22	Asphalt surfacing	
23	Stone masonary	
24	Sand Production	
25	Sand Hauling	
26	Aggregate3/4 production	
27	Aggregate3/4 Hauling	
28	Aggregate3/8 production	
29	Aggregate3/8 Hauling	
30	Concrete mixing	
31	Concrete placing	
32	Selected Material Production	
33	Selected Material Hauling	
34	Back filling	

4.6.2.3 Cost allocation to support centers

The total cost for support centers are calculated and allocated to the responsible support centers. Since support centers are supportive unit the costs incurred has to be equally shared to the cost object based on their earned service. The costs which are allocated to support centers for the project for the specified period are listed in the table 19 below.

Table 19: List of cost allocated to support center for Dulecha –Awash Arba project

I/N	Indirect expense	Cost
1	Permanent Emp. Salary & Pension	608,669.75
2	Contract employees payment	428,130.90
3	Overtime Payment	489,717.03
4	Deseret allowance	130,942.05
5	Communication expense	42,032.38
6	Fuel	97,951.37
7	Oil & lubricant	8,578.12
8	Spareparts	25,974.45
9	Tyre & tubes	34,695.00
10	Electrical Supplies	
11	Equip. Rent expense	
12	Entertainment	7,466.93
13	clothing and linen supplies	68,720.43
14	Food & Supplies	1,085.24
15	Medical supplies	
16	Travel & perdiem	100,400.00
17	Office supplies	13,177.36
18	Repairs & maintenance of office & Building.	4,779.99
19	Jaintor Supplies	25,024.73
20	Miscellanous	45,869.07
21	Headoffice overhead cost	585,468.01
Total Cost		**2,718,682.81**

4.6.2.4 Cost allocation for product centers

All the total cost incurred for the product center are calculated and allocated to each responsible product center. Table 20 indicates the allocated cost to the product center. The costs are identified based on multiplying the executed quantity to each activity unit price.

Table 20: List of cost allocated to product centers Dulecha –Awash Arba project

I/N	Product center	Unit	Excuted Quantity	Cost per unit	Total cost (birr)
1	Clearing and grubbing	ha	0.48	19,928.87	9,565.86
2	Borrow material production	m3	8,277.50	24.73	204,702.58
3	Borrow material hauling			21.78	180,283.95
4	Borrow material loading			7.55	62,495.13
5	Borrow material fill			31.33	259,334.08
6	Drilling & Blasting	m3	9,244.20	31.75	293,503.35
7	Quarry Rock Material Production			74	684,070.80
8	Quarry RockMaterial loading			28.6	264,384.12
9	Quarry Rock Material Hauling			119.09	1,100,891.78
10	Rock fill			26.72	247,005.02
11	Rock sealing	m3	1,312.00	63.18	82,892.16
12	Sub-Base Material Production	m3	1,734.60	23.35	40,502.91
13	Sub-Base material hauling			37.75	65,481.15
14	Sub-Base material loading			28.65	49,696.29
15	Sub base layer construction			81.28	140,988.29
16	Base course material production	m3	420.00	292.23	122,736.60
17	Base course material hauling			145.41	61,072.20
18	Base course material loading			74.36	31,231.20
19	Base Course material mixing			31.2	13,104.00
20	Base course layer construction			49.72	20,882.40
21	Asphalt batch plant opreation	m2	1,820.00	224	407,680.00
22	Asphalt hot mix hauling			7.89	14,359.80
23	Asphalt surfacing			18.87	34,343.40
24	Stone masonary	m3	9.24	3139	29,004.36
25	Sand Production	m3	3.78	14.462963	54.67
26	Sand Hauling			10.10	38.19
27	Aggregate3/4 production			207.14	783.00
28	Aggregate3/4 Hauling			9.57	36.18
29	Aggregate3/8 production			51.76	195.66
30	Aggregate3/8 Hauling			2.39	9.05
31	Concrete mixing			4027.29	15,223.16
32	Concrete placing			696.3	2,632.01
33	Selected Material Production	m3	268.00	23.67	6,343.56
34	Selected Material Hauling			79.79	21,383.72
35	Back filling			195.39	52,364.52
Total Cost					**4,519,275.13**

4.6.2.5 Cost allocation for cost objects

Finally the cost allocated to the product and support centers are allocated to each cost objects. Cost objects are a product or activity which has a payable value or fixed unit price in the contract agreement. The allocations of costs are done in two ways. Since direct costs has a direct relation with the cost object it can be easily trace by direct costing system, whereas indirect costs are allocated based on the performed activity. The total sum of all indirect costs is divided by the direct costs incurred with in the specified period, and then the value will be allocated based on the activity. Table 21 shows the allocation of support and product center cost to each cost object.

Table 21: Allocation of cost to cost objects for Dulecha –Awash Arba project

I/N	Support center	Cost	Product center	Excuted Quantity	Unit	Cost per unit	Total cost	Cost objects	Allocation	
									Direct cost	Indirect cost
1	Permanent Emp. Salary & Pension	608,669.75	Clearing and grubbing	0.48	ha	19,928.87	9,565.86	Site clearing	9,565.86	5,754.58
2	Contract employees payment	428,130.90	Borrow material production	8,277.50	m3	24.73	204,702.58	Cut and borrow to fill	706,815.73	425,202.65
3	Overtime Payment	489,717.03	Borrow material hauling			21.78	180,283.95			
4	Deseret allowance	130,942.05	Borrow material loading			7.55	62,495.13			
5	Communication expense	42,032.38	Borrow material fill			31.33	259,334.08			
6	Fuel	97,951.37	Drilling & Blasting	9,244.20	m3	31.75	293,503.35	Rock fill in embankment	2,672,747.23	1,607,857.84
7	Oil & lubricant	8,578.12	Quarry Rock Material Production			74	684,070.80			
8	Spareparts	25,974.45	Quarry RockMaterial loading			28.6	264,384.12			
9	Tyre & tubes	34,695.00	Quarry Rock Material Hauling			119.09	1,100,891.78			
10	Electrical Supplies		Rock fill			26.72	247,005.02			
11	Equip. Rent expense		Rock sealing	1,312.00	m3	63.18	82,892.16			
12	Entertainment	7,466.93	Sub-Base Material Production	1,734.60	m3	23.35	40,502.91	275mm max.thickness gravel sub-base layer, 97% MDD,AASHTO T-180	296,668.64	178,468.43
13	clothing and linen supplies	68,720.43	Sub-Base material hauling			37.75	65,481.15			
14	Food & Supplies	1,085.24	Sub-Base material loading			28.65	49,696.29			
15	Medical supplies		Sub base layer construction			81.28	140,988.29			
16	Travel & perdiem	100,400.00	Base course material production	420.00	m3	292.23	122,736.60	Crushed ston base,compacted in layers of maximum 200mm thickness, to 100% compaction	249,026.40	149,808.05
17	Office supplies	13,177.36	Base course material hauling			145.41	61,072.20			
18	Repairs & maintenance of office & Building.	4,779.99	Base course material loading			74.36	31,231.20			
19	Jaintor Supplies	25,024.73	Base Course material mixing			31.2	13,104.00			
20	Miscellanous	45,869.07	Base course layer construction			49.72	20,882.40			
21	Headoffice overhead	585,468.01	Asphalt batch plant opreation	1,820.00	m2	224	407,680.00	50mm thich asphalt concrete surfacing	456,383.20	274,548.71
22			Asphalt hot mix hauling			7.89	14,359.80			
23			Asphalt surfacing			18.87	34,343.40			
24			Stone masonary	9.24	m3	3139	29,004.36	masonary	29,004.36	17,448.30
25			Sand Production	3.78	m3	14.462963	54.67	Class 'C' concrete	18,971.92	11,413.03
26			Sand Hauling			10.10	38.19			
27			Aggregate3/4 production			207.14	783.00			
28			Aggregate3/4 Hauling			9.57	36.18			
29			Aggregate3/8 production			51.76	195.66			
30			Aggregate3/8 Hauling			2.39	9.05			
31			Concrete mixing			4027.29	15,223.16			
32			Concrete placing			696.3	2,632.01			
33			Selected Material Production	268.00	m3	23.67	6,343.56	Backfill using selected material	80,091.80	48,181.22
34			Selected Material Hauling			79.79	21,383.72			
35			Back filling			195.39	52,364.52			
Total Cost		**2,718,682.81**	**Total Cost**				**4,519,275.13**			

4.6.2.6 Variance analysis

The final step after identifying the cost of each cost object is evaluating the performance and presenting the result to the decision makers. As discussed in the literature review one of method of evaluating performance is variance analysis. The variance analysis is done by comparing the actual cost with the estimated or standard cost. As shown in the table 22 two types of variance analysis is performed rate variance and cost variance. Rate variance are calculated by subtracting actual cost from standard cost and the cost variance are calculated by subtracting actual cost from the earned value. As indicated in the figure 38 the variance analysis results of the project except sub base layer activity all costs earns negative variance which indicates that the project is under high risk. The rock fill activities get the first place in earning high loss in the specified period.

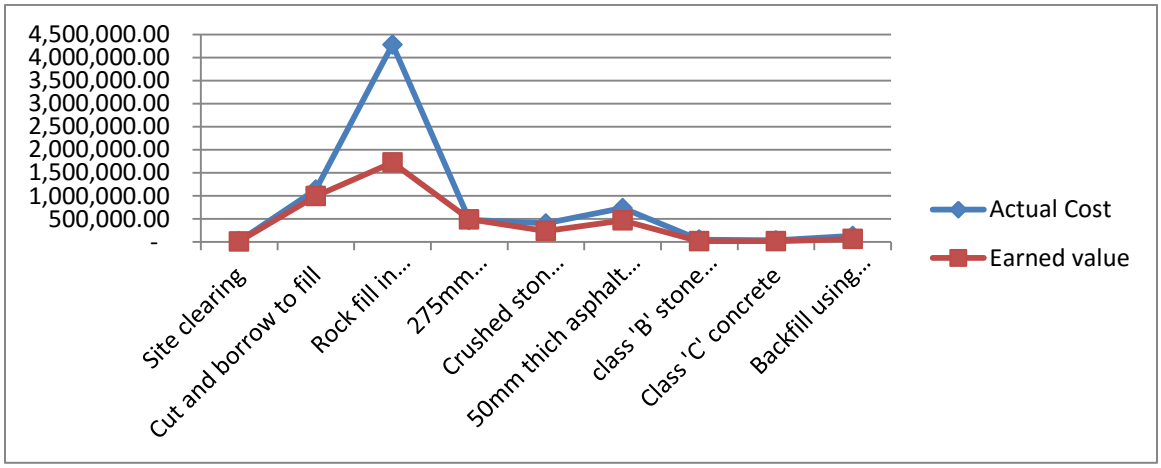

Figure 38: Actual cost and earned value variance analysis for Dulecha –Awash Arba project

During the specified period a total of 3,236,488.35 birr loss is incurred. This result indicates the project is performing its work below the specified unit rate. The loss can be because of the work methodology, ideal hours of man power and machineries or poor productivity of the crews. For decision maker the result shown in table 22, is not enough to identify the real cause of the loss. The cause of the loss can be occurred on labor, material, equipment and overhead cost. Therefore, further detailed variance analysis is necessary.

Table 22: Cost Variance Analysis for Dulecha –Awash Arba road project

I/N	Cost objects	Unit	Excuted Quantity	Total cost (DC+IC)	Actual Unit rate	Budgeted Rate	Actual cost	Earned Value	Variance	
									Rate	Cost
			(A)	(B)	(C=B/A)	(D)	(E=A*C)	(F=A*D)	(G=D-F)	(H=F-E)
1	Site clearing	ha	0.48	15,320.44	31,917.58	21,316.81	15,320.44	10,232.07	(10,600.77)	(5,088.37)
2	Cut and borrow to fill	m3	8,277.50	1,132,018.37	136.76	119.76	1,132,018.37	991,313.40	(17.00)	(140,704.97)
3	Rock fill in embankment	m3	9,244.20	4,280,605.07	463.06	186.31	4,280,605.07	1,722,286.90	(276.75)	(2,558,318.17)
4	275mm max.thickness gravel sub-base layer, 97% MDD,AASHTO T-180	m3	1,734.60	475,137.07	273.92	282.14	475,137.07	489,400.04	8.22	14,262.98
5	Crushed ston base,compacted in layers of maximum 200mm thickness, to 100% compaction	m3	420.00	398,834.45	949.61	558.37	398,834.45	234,515.40	(391.24)	(164,319.05)
6	50mm thich asphalt concrete surfacing	m2	1,820.00	730,931.91	401.61	255.08	730,931.91	464,245.60	(146.53)	(266,686.31)
7	class 'B' stone masonary	m3	9.24	46,452.66	5,027.34	1,460.74	46,452.66	13,497.24	(3,566.60)	(32,955.42)
8	Class 'C' concrete	m3	3.78	30,384.95	8,038.35	3,581.38	30,384.95	13,537.62	(4,456.97)	(16,847.34)
9	Backfill using selected material	m3	268.00	128,273.02	478.63	232.99	128,273.02	62,441.32	(245.64)	(65,831.70)
Total Cost			**21,777.80**	**7,237,957.94**			**7,237,957.94**	**4,001,469.59**		**(3,236,488.35)**

A. Variance analysis at resource level

As discussed in the literature review the aim of cost accounting is to determine the cost of cost objects which helps the decision makers in making corrective decision. In order to make the decision makers able to take a corrective measurement on negatively performed activity the detailed variance analysis of labor, material, equipment and overhead cost have to be done. In this level of analysis the estimated labor, material and equipment cost are compared with the actually incurred cost. Thus, the decision makers can easily identify which resource is acquired above the expected cost in order to make corrective measures. Table 23 indicates the detailed resource cost variance.

Table 23: Cost variance at resource level for Dulecha –Awash Arba project

Summary of cost for site clearing (Birr/ha)						
I/N	**Cost**	**Total cost**	**Labour cost**	**Material cost**	**Equipment cost**	**Overhead cost**
1	Actual cost	31,917.58	2,493.56	-	17,435.31	11,988.71
2	Estimated cost	21,316.81	1,419.69	-	16,800.00	1,821.97
Variance		**(10,600.77)**	**(1,073.87)**	**-**	**(635.31)**	**(10,166.74)**
Summary of cost for cut and borrow to fill (Birr/m3)						
1	Actual cost	136.76	4.42	54.06	26.09	52.19
2	Estimated cost	119.76	5.05	54.67	42.64	10.24
Variance		**(17.00)**	**0.63**	**0.61**	**16.55**	**(41.95)**
Summary of cost for Rock fill in embankment (Birr/m3)						
1	Actual cost	463.06	3.91	316.68	22.81	119.66
2	Estimated cost	186.31	2.61	139.35	17.28	15.92
Variance		**-276.75**	**(1.30)**	**(177.33)**	**(5.53)**	**(103.74)**
Summary of cost for sub-base layer construction(Birr/m3)						
1	Actual cost	273.92	32.93	89.75	48.34	94.06
2	Estimated cost	282.14	4.92	201.52	34.70	24.11
Variance		**8.22**	**(28.01)**	**111.77**	**(13.64)**	**(69.95)**
Summary of cost for base- course layer construction(Birr/m3)						
1	Actual cost	949.61	16.36	543.20	33.37	356.68
2	Estimated cost	558.37	4.75	437.35	35.14	47.72
Variance		**-391.24**	**(11.61)**	**(105.85)**	**1.77**	**(308.96)**
Summary of cost for Asphalt concrete surfacing construction(Birr/m2)						
1	Actual cost	401.61	8.55	231.89	10.32	150.85
2	Estimated cost	255.08	1.00	208.76	8.26	21.80
Variance		**-146.53**	**(7.55)**	**(23.13)**	**(2.06)**	**(129.05)**
Summary of cost for class 'B' stone masonary construction(Birr/m3)						
1	Actual cost	5027.34	803.90	238.50	2,096.59	1,888.35
2	Estimated cost	1460.74	263.85	850.10	134.58	124.85
Variance		**(3,566.60)**	**(540.05)**	**611.60**	**(1,962.01)**	**(1,763.50)**
Summary of cost for class 'C' concrete construction(Birr/m3)						
1	Actual cost	8,038.35	696.26	1,593.00	2,730.00	3,019.09
2	Estimated cost	3,581.38	209.59	1,526.54	232.33	1,612.92
Variance		**-4456.97**	**(486.67)**	**(66.46)**	**(2,497.67)**	**(1,406.17)**
Summary of cost for backfill with selected material construction(Birr/m3)						
1	Actual cost	478.63	51.07	103.46	144.32	179.78
2	Estimated cost	232.99	11.08	136.74	51.32	19.91
Variance		**-245.64**	**(39.99)**	**33.28**	**(93.00)**	**(159.87)**

I. Variance analysis for site clearing

As figure 40 indicates the site clearing activity has earned a negative cost variance in all resources as compared with the standard. Especially the variance due to the overhead is too high. This indicates that the project is performing the site clearing activity above the expected expenditure. The exceeding payment for labor and equipment from the estimated costs are the cause for negative variance of labor and equipment. As indicated in the figure 39 the overhead variance takes the highest portion. It is because of the project has high overhead and lower executed activities. Therefore the decision makers have to find a solution for the loss by taking a corrective measure. The measure can be changing the work methodology, reducing the ideal hours, reducing the overhead cost or take any other action to solve the problem.

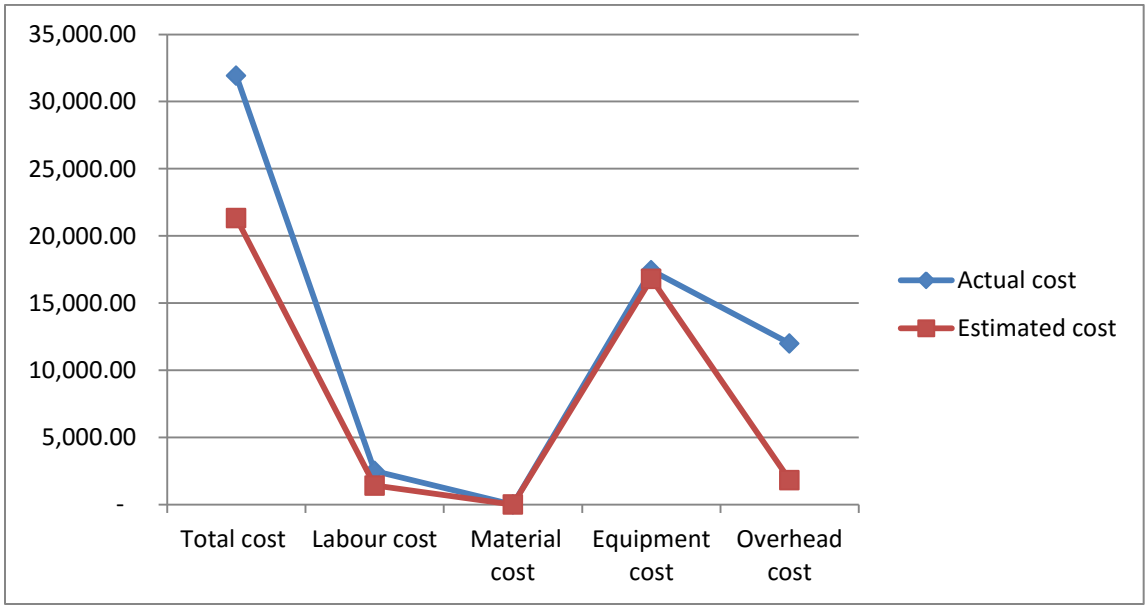

Figure 39: Variance analysis for site clearing for Dulecha –Awash Arba project

II. Variance analysis for cut and borrow to fill

In this activity the variance of labor, material and equipment are positive and the overhead cost incurred negative variance. The result tells that the project has a high overhead cost. In order to overcome this loss the decision makers have to focus in increasing the volume of executed quantity of the project or reducing the overhead of the project. Also the project has to keep and improve the positive cost variance of resources.

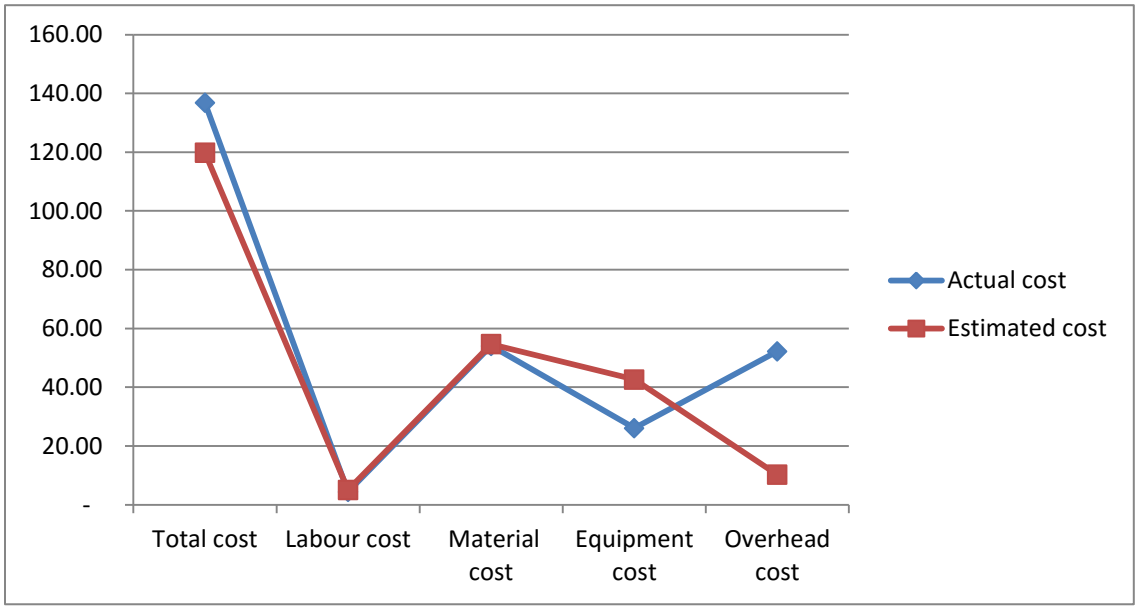

Figure 40: Variance analysis for cut and borrow to fill for Dulecha –Awash Arba project

III. Variance analyses for Rock fill in embankment

The figure 41 shows that the rock fill activity has a negative cost variance in all resource. Especially the material cost variance is too high about 177.33 birr/m3 which needs a high attention. It is caused by under estimation of the material cost and unavailability of rock material on the project site. Also there is a high negative cost variance in overhead cost. The decision makers have to check the work methodology and other factors which can cause this negative value.

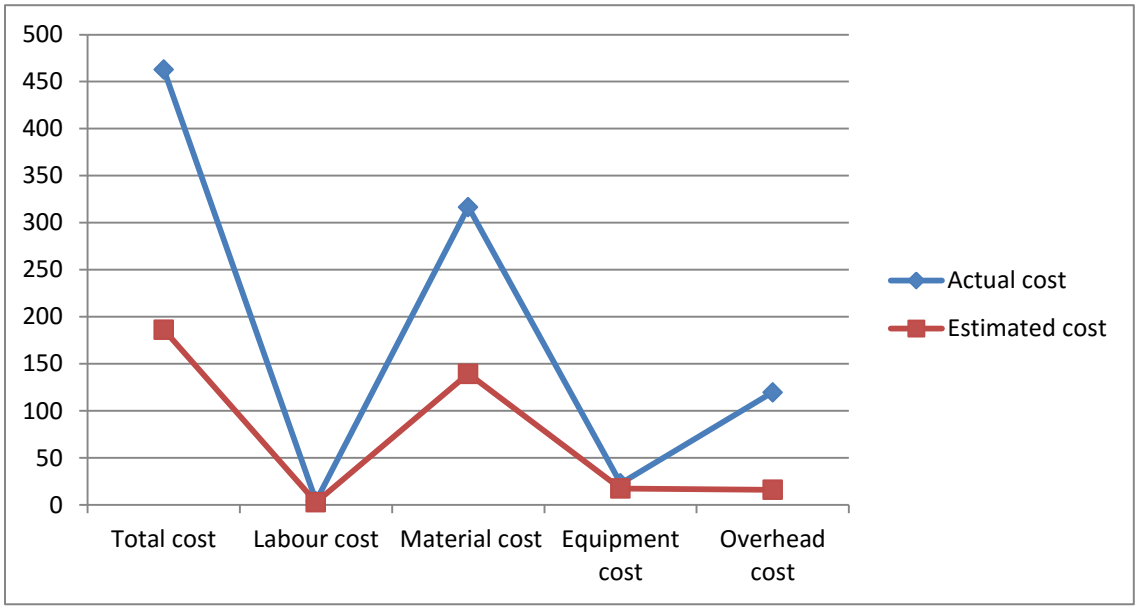

Figure 41: Variance analyses for Rock fill in embankment for Dulecha –Awash Arba project

IV. Variance analysis for sub-base layer construction

The total cost variance for sub base layer construction activity is positive. This result doesn't mean that all resources are performed based on the standard and acquire the expected profit. Except material cost all of the remaining items incurred loss. The material cost of the estimated value is greater than the actual cost it is about 111.77birr/m3. It is good for the project to keep the method of work for material. But the remaining resources loss has to be minimized or covered. In order to remove this loss the decision makers have to give a special consideration in the crew productivity, work methodology and the overhead cost of the project.

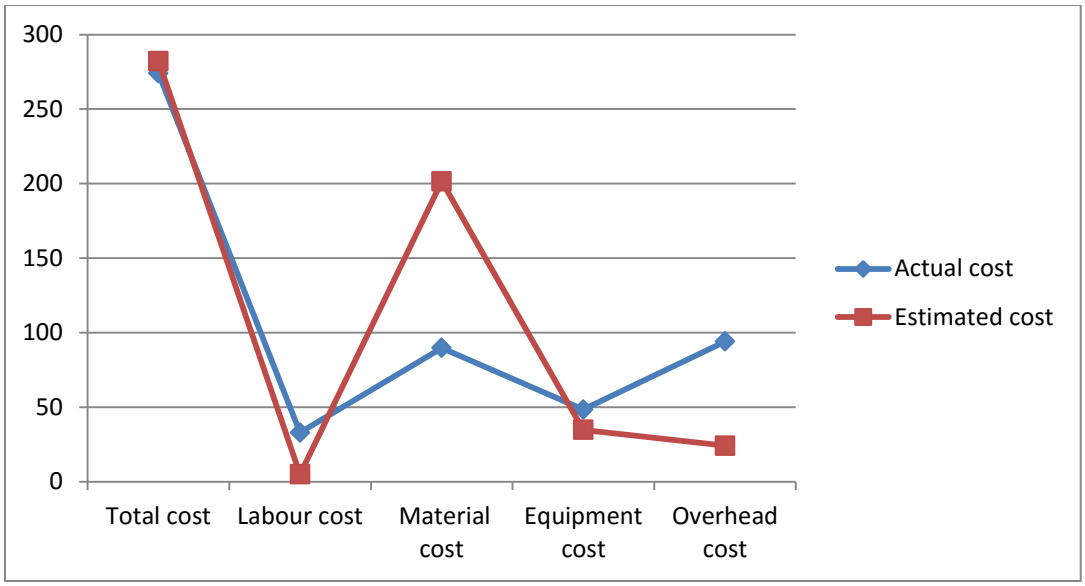

Figure 42: Variance analyses for sub-base layer construction for Dulecha –Awash Arba project

V. Variance analysis base- course layer construction

Except equipment cost the variance of base layer construction activity all resources are negative. The figure 43 indicates every resource acquire loss especially the overhead cost. The decision makers have to take corrective measure to clear the loss for the future.

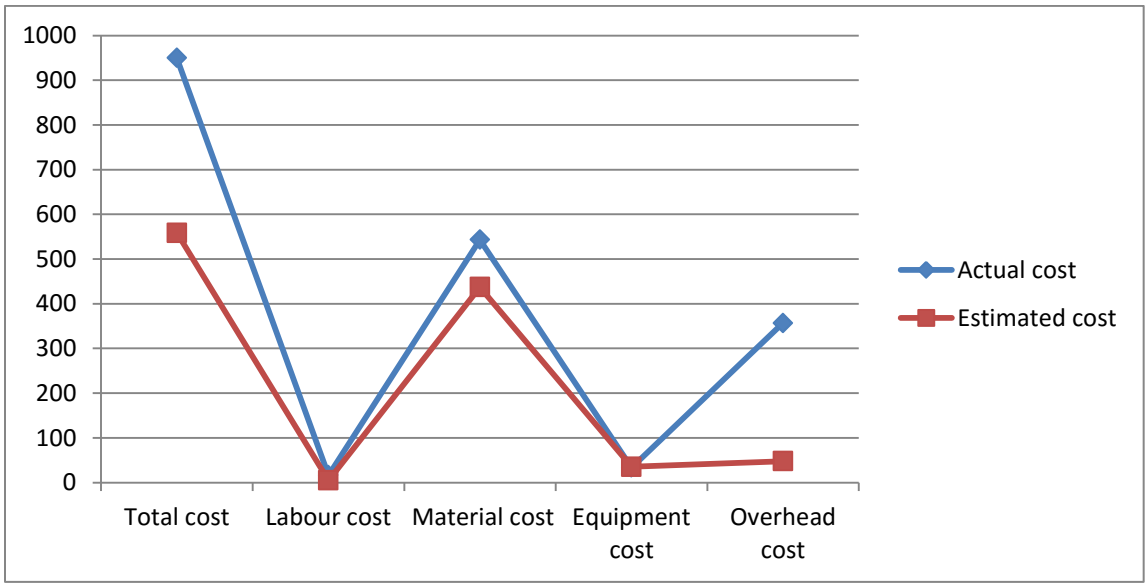

Figure 43: Variance analyses for base- course layer construction for Dulecha –Awash Arba project

VI. Variance analysis for Asphalt concrete surfacing construction

As the figure 44 shows the actual cost incurred in asphalt surfacing activity are greater than the estimated or standard. The highest loss was come from the overhead. Therefore

the decision makers have to give a method to minimize the overhead and increase the productivity.

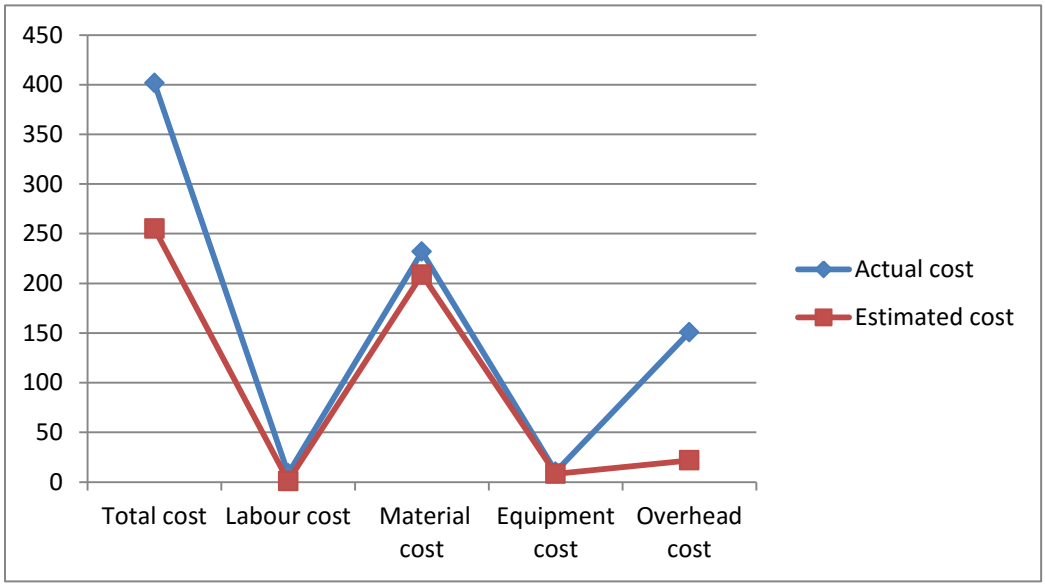

Figure 44: Variance analyses for asphalt concrete surfacing construction for Dulecha –Awash Arba project

VII. Variance analysis class 'B' stone masonry construction

In class 'B' stone masonry activity both positive and negative variance has occurred. Material cost can experience positive cost variance whereas the labor, equipment and overhead incurred high negative variance. The ideal hours of equipment are the main cause for negative variance. The decision makers have to check their work methodology and take corrective measure in order to clear the loss for the future.

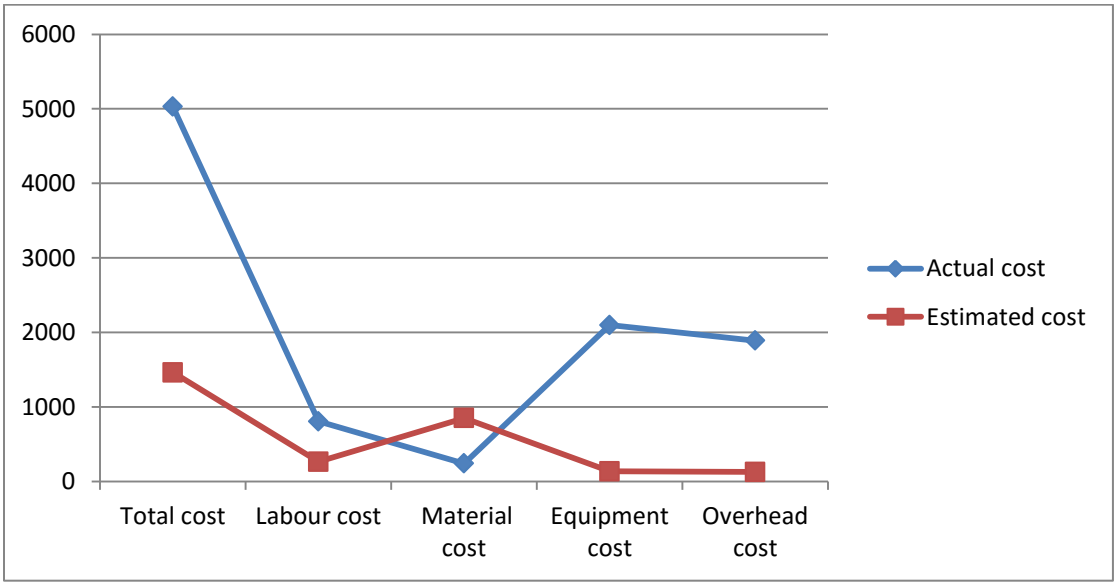

Figure 45: Variance analyses for class 'B' stone masonry construction for Dulecha –Awash Arba project

VIII. Variance analysis for class 'C' concrete construction

Figure 46 shows under the class ‘C’ concrete activity indicates a high negative variance in all resources specially equipment and overhead cost. Higher rental rate of equipment than the estimated are the cause for the variance. The decision makers have to take a corrective measure to change this loss for the future.

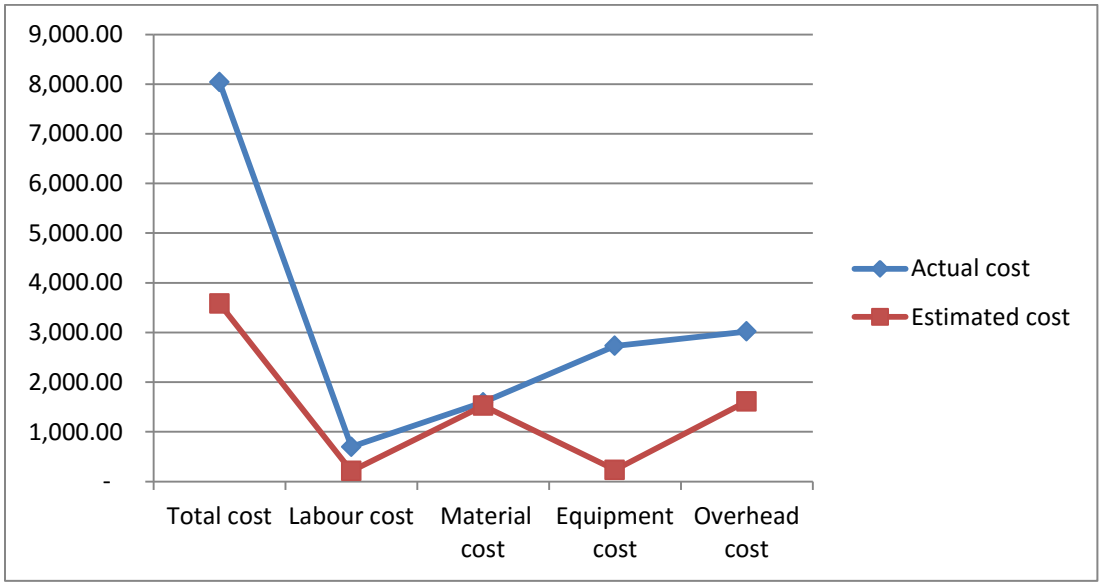

Figure 46: Variance analyses for class 'C' concrete construction for Dulecha –Awash Arba project

IX. Variance analysis for backfill with selected material construction

Under backfilling with selected material activity material cost can experience positive variance. But the remaining earns negative variance which makes the activity to got loss. It is because of difference in rental rate of equipment and payment for labour. The decision makers can change this result by changing the methodology or taking any corrective decision.

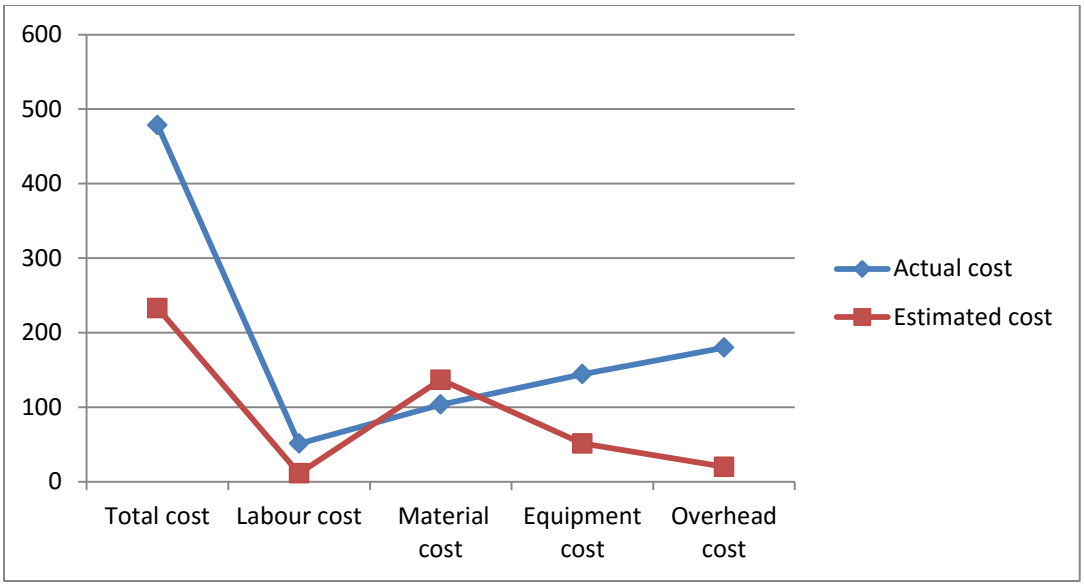

Figure 47: Variance analyses for backfill with selected material construction for Dulecha –Awash Arba project

B. Summary of results

The above results show that Dulecha-Awash Arba project has incurred negative variance during the specified reporting period. Most of the variances are caused by underestimation of the cost of resource and very high overhead cost. The contractual unit rates of most activities are not well considering manpower and material availability in the project. Most materials are available in the project far from the expected location and also the actual equipment rental rates are higher than the expected. As indicated in the above variance result overhead costs are the main causes for loss in all activities. The overhead is estimated to be 10% of the direct cost but the actually calculated rate is 60% of the direct cost. The cause for this high cost of overhead is the presence of large number of unnecessary manpower hired to create work chance for the society. In order to minimize loss the project should either reduce the overhead or increase the volume of executed quantity.

By the same procedure the system was tested for Dimma- Rad and Jinka- Mender road projects. The system result for both projects is described below.

Responsibility centers for Dimma-Rad road construction project.

Table 24: List of responsibility center for Dimma-Rad road construction project

I/N	Product center	Support center
1	Borrow material production	Administration team
2	Borrow material hauling	Financial Management team
3	Borrow material loading	Engineering service team
4	Borrow material fill	Procurement and supply management team
5	Capping layer material production	Equipment administration and maintenance team
6	Capping layer material hauling	
7	Capping layer material placing	
8	Sub-Base Material Production	
9	Sub-Base material hauling	
10	Sub-Base material loading	
11	Sub base layer construction	
12	Base course material production	
13	Base course material hauling	
14	Base course material loading	
15	Base Course material mixing	
16	Base course layer construction	
17	Asphalt batch plant opreation	
18	Asphalt hot mix hauling	
19	Asphalt surfacing	
20	Stone masonary	
21	Sand Production	
22	Sand Hauling	
23	Aggregate3/4 production	
24	Aggregate3/4 Hauling	
25	Aggregate3/8 production	
26	Aggregate3/8 Hauling	
27	Concrete mixing	
28	Concrete placing	

Cost allocation to support center for Dimma-Rad road construction project

Table 25: List of cost allocated to support center for Dimma-Rad road construction project

I/N	Administrative expense	Cost
1	Permanent Emp. Salary & Pension	594,460.91
2	Contract employees payment	327,744.70
3	Overtime Payment	423,252.28
4	Deseret allowance	160,689.41
5	Housing allownace	18,142.46
6	Communication expense	
7	Fuel	153,354.49
8	Oil & lubricant	3,979.97
9	Spareparts	51,834.19
10	Tyre & tubes	
11	Electrical Supplies	
12	Equip. Rent expense	
13	Entertainment	
14	clothing and linen supplies	132,965.28
15	Food & Supplies	4,210.00
16	Medical supplies	
17	Travel & perdiem	208,289.70
18	Office supplies	14,144.13
19	Repairs & maintenance of office & Building.	
20	Jaintor Supplies	150,906.14
21	Miscellanous	54,873.75
22	Head office overhead cost	676,896.33
Total Cost		**2,975,743.74**

Cost allocation for product centers

Table 26: List of cost allocated to support center for Dimma-Rad road construction project

I/N	Product center	Excuted Quantity (m3)	Cost per m3	Total cost
1	Borrow material production		36.32	151,962.88
2	Borrow material hauling		48.02	200,915.68
3	Borrow material loading			-
4	Borrow material placing	4,184.00	48.89	204,555.76
5	Capping layer material production		37.78	13,600.80
6	Capping layer material hauling		61.22	22,039.20
7	Capping layer material placing	360.00	61.27	22,057.20
8	Sub-Base Material Production		37.25	19,332.75
9	Sub-Base material hauling		54.72	28,399.68
10	Sub-Base material loading			-
11	Sub base layer construction	519.00	82.29	42,708.51
12	Base course material production		318.94	171,908.66
13	Base course material hauling		114.67	61,807.13
14	Base course material loading			-
15	Base Course material mixing			-
16	Base course layer construction	539.00	77.32	41,675.48
17	Asphalt batch plant opreation		205.342	2,213,586.76
18	Asphalt hot mix hauling		1.616	17,420.48
19	Asphalt surfacing	10,780.00	11.145	120,143.10
20	Stone production		481.71	149,484.25
21	Stone hauling		94.2	29,232.14
22	Stone masonary construction		1795.2	557,086.46
23	Stone dressing	310.32	55.77	17,306.55
24	Aggregate production		1743.15	35,560.26
25	Aggregate Hauling	20.40	136.76	2,789.90
26	Concrete mixing & placing		1952.37	39,828.35
27	Stone production (retainig wall)		394.34	7,855.25
28	Stone hauling		63.75	1,269.90
29	Stone masonary construction	19.92	1479.09	29,463.47
Total Cost				**4,201,990.61**

Cost allocation to cost object for Dimma –Rad road construction project.

Table 27: List of cost allocated to cost objects for Dimma-Rad road construction project

I/N	Support center	Cost	Product center	Excuted Quantity	Unit	Cost per unit	Total cost	Cost objects	Allocation	
									Direct cost	Indirect cost
1	Permanent Emp. Salary & Pension	594,460.91	Borrow material production	4,184.00	m3	36.32	151,962.88	Cut and borrow to fill	557,434.32	387,357.06
2	Contract employees payment	327,744.70	Borrow material hauling			48.02	200,915.68			
3	Overtime Payment	423,252.28	Borrow material loading			-	-			
4	Deseret allowance	160,689.41	Borrow material placing			48.89	204,555.76			
5	Housing allownace	18,142.46	Capping layer material production	360.00	m3	37.78	13,600.80	Capping layer	57,697.20	40,093.36
6	Communication expense		Capping layer material hauling			61.22	22,039.20			
7	Fuel	153,354.49	Capping layer material placing			61.27	22,057.20			
8	Oil & lubricant	3,979.97	Sub-Base Material Production	519.00	m3	37.25	19,332.75	275mm max.thickness gravel sub-base layer, 97% MDD,AASHTO T-180	90,440.94	62,846.75
9	Spareparts	51,834.19	Sub-Base material hauling			54.72	28,399.68			
10	Tyre & tubes		Sub-Base material loading				-			
11	Electrical Supplies		Sub base layer construction			82.29	42,708.51			
12	Equip. Rent expense		Base course material production	539.00	m3	318.94	171,908.66	Crushed ston base,compacted in layers of maximum 200mm thickness, to 100% compaction	275,391.27	191,367.39
13	Entertainment		Base course material hauling			114.67	61,807.13			
14	clothing and linen supplies	132,965.28	Base course material loading				-			
15	Food & Supplies	4,210.00	Base Course material mixing				-			
16	Medical supplies		Base course layer construction			77.32	41,675.48			
17	Travel & perdiem	208,289.70	Asphalt batch plant opreation	10,780.00	m2	205.342	2,213,586.76	Asphalt concrete surfacing	2,351,150.34	1,633,797.28
18	Office supplies	14,144.13	Asphalt hot mix hauling			1.616	17,420.48			
19	Repairs & maintenance of office & Building.		Asphalt surfacing			11.145	120,143.10			
20	Jaintor Supplies	150,906.14	Stone production	310.32	m3	481.71	149,484.25	Cement-mortared stone masonry walls (Class 'B' stone masonry)	753,109.40	523,330.25
21	Miscellanous	54,873.75	Stone hauling			94.2	29,232.14			
22	Head office overhead cost	676,896.33	Stone masonary construction			1795.2	557,086.46			
23			Stone dressing			55.77	17,306.55			
24			Aggregate production	20.40	m3	1743.15	35,560.26	Cast In situ concrete and formwork grade	78,178.51	54,325.68
25			Aggregate Hauling			136.76	2,789.90			
26			Concrete mixing & placing			1952.37	39,828.35			
27			Stone production	19.92	m3	394.34	7,855.25	Stone masonry walls (b) Cement-mortared stone	38,588.63	26,814.96
28			Stone hauling			63.75	1,269.90			
29			Stone masonary construction			1479.09	29,463.47			
30			General	1.00	Ls	80,316.00	80,316.00	General	80,316.00	55,811.00
Total Cost		**2,975,743.74**	**Total Cost**				**4,282,306.61**			

Variance analysis at the activity level for Dimma- Rad road project.

Table 28: Variance analysis at activity level for Dimma-Rad road construction project

I/N	Cost objects	Unit	Excuted Quantity	Total cost (DC+IC)	Actual Unit rate	Budgeted Rate	Actual cost	Earned Value	Variance	
									Rate	Cost
			(A)	(B)	(C=B/A)	(D)	(E=A*C)	(F=A*D)	(G=D-F)	(H=F-E)
1	Cut and borrow to fill	m3	4,184.00	944,791.38	225.81	166.06	944,791.38	694,795.04	(59.75)	(249,996.34)
2	Capping layer having a CBR Value not less than 15% at a compaction level of	m3	360.00	97,790.56	271.64	201.08	97,790.56	72,388.80	(70.56)	(25,401.76)
4	275mm max.thickness gravel sub-base layer, 97% MDD,AASHTO T-180	m3	519.00	153,287.69	295.35	246.64	153,287.69	128,006.16	(48.71)	(25,281.53)
5	Crushed ston base,compacted in layers of maximum 200mm thickness, to 100% compaction	m3	539.00	466,758.66	865.97	612.77	466,758.66	330,283.03	(253.20)	(136,475.63)
6	50mm Asphaltic surfacing with (penetration grade 60/70 bitumen)	m2	10,780.00	3,984,947.62	369.66	358.21	3,984,947.62	3,861,503.80	(11.45)	(123,443.82)
7	Cement-mortared stone masonry walls (Class 'B' stone masonry)	m3	310.32	1,276,439.65	4,113.30	2,584.49	1,276,439.65	802,018.94	(1,528.81)	(474,420.71)
8	Cast In situ concrete and formwork grade 25	m3	20.40	132,504.19	6,495.30	5,229.61	132,504.19	106,684.04	(1,265.69)	(25,820.15)
9	Stone masonry walls (b) Cement-mortared stone walls in check dams , retaining walls , end wall, Inlet, gutter & curb stone.	m3	19.92	65,403.58	3,283.31	2,584.49	65,403.58	51,483.04	(698.82)	(13,920.54)
10	General	Ls	1.00	136,127.00	136,127.00	186,175.00	136,127.00	186,175.00	50,048.00	50,048.00
Total Cost				**7,258,050.34**			**7,121,923.34**	**6,233,337.85**		**(1,074,760.49)**

Variance analysis at resource level for Dimma- Rad road project.

Table 29: Variance analysis at resource level for Dimma-Rad road construction project

I/N	Cost	Labour cost	Material cost	Equipment cost	Overhead cost
Summary of cost for cut and borrow to fill					
1	Actual cost	9.91	84.34	38.98	91.93
2	Estimated cost	5.82	96.09	21.10	30.75
Variance		**(4.09)**	**11.75**	**(17.88)**	**(61.18)**
Summary of cost for capping layer					
1	Actual cost	10.79	99.01	50.48	110.59
2	Estimated cost	10.16	105.03	33.75	37.24
Variance		**(0.63)**	**6.02**	**(16.73)**	**(73.36)**
Summary of cost for sub-base layer construction					
1	Actual cost	14.91	91.97	67.39	120.25
2	Estimated cost	12.79	125.12	44.78	45.67
Variance		**(2.12)**	**33.15**	**(22.61)**	**(74.57)**
Summary of cost for base- course layer construction					
1	Actual cost	14.79	433.61	62.53	352.54
2	Estimated cost	12.96	393.07	47.85	113.47
Variance		**(1.83)**	**(40.54)**	**(14.68)**	**(239.07)**
Summary of cost for Asphalt concrete surfacing construction					
1	Actual cost	2.34	206.96	8.80	150.49
2	Estimated cost	1.27	260.34	3.70	66.33
Variance		**(1.07)**	**53.38**	**(5.10)**	**(84.16)**
Summary of cost for Stone masonry walls in check dams, retaining walls, end wall,					
1	Actual cost	1,284.07	458.09		1,202.09
2	Estimated cost	920.11	869.03	125.29	478.61
Variance		**(363.96)**	**410.94**	**125.29**	**(723.48)**
Summary of cost for cast in situ concrete construction					
1	Actual cost	812.15	1,879.90	1,140.21	2,644.26
2	Estimated cost	569.38	2,792.83	511.56	968.44
Variance		**(242.77)**	**912.93**	**(628.65)**	**(1,675.82)**
Summary of cost for cement-mortared stone masonry walls (Class 'B' stone masonry)					
1	Actual cost	1,018.97	575.91	832.29	1,674.75
2	Estimated cost	920.11	869.03	125.29	478.61
Variance		**(98.86)**	**293.12**	**(707.00)**	**(1,196.14)**

Responsibility centers for Jinka - Mender road project

Table 30: List of responsibility center for Jinka Mender project

I/N	Product center	Support center
1	Borrow material production & hauling	Administration team
2	Borrow material placing	Financial Management team
3	Common excavation	Engineering service team
4	Rock material production & hauling	Procurement and supply management team
5	Rock material placing	Equipment administration and maintenance team
6	Sub-Base material production & hauling	
7	Sub base layer construction	
8	Base course material production & hauling	
9	Base course layer construction	
10	Asphalt batch plant operation & hauling	
11	Asphalt surfacing	
12	Stone production & hauling for retaining wall	
13	Stone masonry construction for retaining wall	
14	Stone production & hauling for town ditch	
15	Stone masonry construction for town ditch	
16	Curb stone material production	
17	Curb stone placing	

Cost allocation to support center for Jinka - Mender road project.

Table 31: List of cost allocated to support center

I/N	Indirect expense	Cost
1	Permanent Emp. Salary & Pension	631,099.74
2	Contract employees payment	623,333.55
3	Overtime Payment	596,586.16
4	Deseret allowance	
5	Communication expense	3,249.95
6	Housing allowance	-
7	Employees training expense	-
8	Fuel	301,372.81
9	Oil & lubricant	95,496.72
10	Spareparts	28,572.69
11	Tyre & tubes	208,307.72
12	Electrical Supplies	-
13	Depreciation expense	13,330.47
14	Equip. Rent expense	
15	Entertainment	7,172.99
16	clothing and linen supplies	65,075.81
17	Food & Supplies	14,543.56
18	Medical supplies	4,256.00
19	Travel & perdiem	299,362.95
20	Office supplies	24,896.67
21	Repairs & maintenance of office & Building.	
22	Jaintor Supplies	36,935.39
23	Miscellanous	189,814.54
Total Cost		**3,143,407.72**

Cost allocation to product center for Jinka - Mender road project.

Table 32: List of cost allocated to product center

I/N	Product center	Excuted Quantity	Cost per unit	Total cost
1	Borrow material production & hauling		29.00	68,875.00
2	Borrow material placing	2,375.00	73.50	174,556.30
3	Common excavtion	11,701.00	28.99	339,211.99
4	Rock material production & hauling		180.99	407,218.00
5	Rock material placing	2,250.00	31.72	71,362.26
6	Sub-Base material production & hauling		0	-
7	Sub base layer construction	1,120.00	21.67	24,270.98
8	Base course material production & hauling		845.47	2,971,827.05
9	Base course layer construction	3,515.00	169.87	597,093.05
10	Asphalt batch plant opreation & hauling		191.96	940,604.00
11	Asphalt surfacing	4,900.00	20.63	101,087.00
12	Stone production & hauling for retainig wall		436.70	122,538.02
13	Stone masonary construction for retainig wall	280.60	527.08	147,898.65
14	Stone production & hauling for town ditch		615.78	248,356.39
15	Stone masonary construction for town ditch	403.32	390.82	157,625.52
16	Curb stone material production		185.32	61,805.24
17	Curb stone placing	333.50	218.37	72,825.27
Total Cost				**6,507,154.73**

Cost allocation to cost object for Jinka - Mender road project

Table 33: List of cost allocated to cost objects for Jinka - Mender project

I/N	Support center	Cost	Product center	Excuted Quantity	Unit	Cost per unit	Total cost	Cost objects	Allocation	
									Direct cost	Indirect cost
1	Permanent Emp. Salary & Pension	631,099.74	Borrow material production & hauling	2,375.00	m3	29.00	68,875.00	Cut and borrow to fill	243,431.30	167,652.93
2	Contract employees payment	623,333.55	Borrow material placing			73.50	174,556.30			
3	Overtime Payment	596,586.16	Excavtion	11,701.00	m3	28.99	339,211.99	Common Excavation	339,211.99	233,617.79
4	Deseret allowance		Rock material production & hauling	2,250.00	m3	180.99	407,218.00	Rock fill in embankment	478,580.26	329,601.74
5	Communication expense	3,249.95	Rock material placing			31.72	71,362.26			
6	Housing allowance	-	Sub-Base material production & hauling	1,120.00	m3	0	-	275mm max.thickness gravel sub-base layer, 97% MDD,AASHTO T-180	24,270.98	16,715.61
7	Employees training expense	-	Sub base layer construction			21.67	24,270.98			
8	Fuel	301,372.81	Base course material production & hauling	3,515.00	m3	845.47	2,971,827.05	Crushed ston base,compacted in layers of maximum 200mm thickness, to	3,568,920.10	2,457,941.49
9	Oil & lubricant	95,496.72	Base course layer construction			169.87	597,093.05			
10	Spareparts	28,572.69	Asphalt batch plant opreation & hauling	4,900.00		191.96	940,604.00	50mm thick asphalt concrete surfacing	1,041,691.00	717,420.24
11	Tyre & tubes	208,307.72	Asphalt surfacing		m2	20.63	101,087.00			
12	Electrical Supplies	-	Stone production & hauling for retainig wall	280.60	m3	436.70	122,538.02	Retaining wall construction	270,436.67	186,251.72
13	Depreciation expense	13,330.47	Stone masonary construction for retainig wall			527.08	147,898.65			
14	Equip. Rent expense		Stone production & hauling for town ditch	403.32	m3	615.78	248,356.39	Town ditch construction	405,981.91	279,602.73
15	Entertainment	7,172.99	Stone masonary construction for town ditch			390.82	157,625.52			
16	clothing and linen supplies	65,075.81	Curb stone material production	333.50	m3	185.32	61,805.24	Curb stone construction	134,630.51	92,721.02
17	Food & Supplies	14,543.56	Curb stone placing			218.37	72,825.27			
18	Medical supplies	4,256.00								
19	Travel & perdiem	299,362.95								
20	Office supplies	24,896.67								
21	Repairs & maintenance of office & Building.									
22	Jaintor Supplies	36,935.39								
23	Miscellanous	189,814.54								
24	Head office overhead	1,338,117.54								
Total Cost		**4,481,525.26**					**6,507,154.73**			

Variance analysis at activity level for Jinka- Mender road project

Table 34: List of variance analysis at activity level for Jinka- Mender project

I/N	Cost objects	Unit	Excuted Quantity (A)	Total cost (DC+IC) (B)	Actual Unit rate (C=B/A)	Budgeted Rate (D)	Actual cost (E=A*C)	Earned Value (F=A*D)	Variance	
									Rate (G=D-C)	Cost (H=F-E)
1	Cut and borrow to fill	m3	2,375.00	411,084.23	173.09	123.29	411,084.23	292,818.50	(49.80)	(118,265.73)
2	Common Excavation	m3	11,701.00	572,829.78	48.96	41.70	572,829.78	487,955.10	(7.25)	(84,874.68)
3	Rock fill in embankment	m3	2,250.00	808,181.99	359.19	259.99	808,181.99	584,970.75	(99.20)	(223,211.24)
4	275mm max.thickness gravel sub-base layer, 97% MDD,AASHTO T-180	m3	1,120.00	40,986.59	36.60		40,986.59	-	(36.60)	(40,986.59)
5	Crushed stone base,compacted in layers of maximum 200mm thickness, to 100% compaction	m3	3,515.00	6,026,861.59	1,714.61	612.52	6,026,861.59	2,153,011.32	(1,102.09)	(3,873,850.28)
6	50mm thich asphalt concrete surfacing	m2	4,900.00	1,759,111.24	359.00	308.56	1,759,111.24	1,511,919.50	(50.45)	(247,191.74)
7	Retaining wall construction	m3	280.60	456,688.39	1,627.54	1,674.24	456,688.39	469,792.87	46.70	13,104.48
8	Town ditch construction	m3	403.32	685,584.64	1,699.85	1,674.24	685,584.64	675,256.09	(25.61)	(10,328.55)
9	Curb stone consruction	m3	333.50	227,351.54	681.71	360.00	227,351.54	120,058.67	(321.72)	(107,292.87)
Total Cost			**29,231.00**	**10,988,679.99**			**10,988,679.99**	**6,295,782.79**		**(4,692,897.20)**

Variance analysis at resource level for Jinka - Mender road project

Table 35: List of variance analysis at resource level for Jinka- Mender project

I/N	Cost	Labour cost	Material cost	Equipment cost	Overhead cost
Summary of cost for cut and borrow to fill					
1	Actual cost	3.59	29.00	69.91	70.59
2	Estimated cost	3.51	58.26	33.07	18.97
Variance		**-0.08**	**29.26**	**-36.84**	**-51.62**
Summary of cost for common excavtion					
1	Actual cost	0.86	0.00	28.13	19.97
2	Estimated cost	1.74	0.00	30.74	6.50
Variance		**0.88**	**0**	**2.61**	**-13.47**
Summary of cost for Rock fill in embankment					
1	Actual cost	1.47	203.00	26.30	128.42
2	Estimated cost	13.66	149.70	36.63	40.00
Variance		**12.19**	**-53.3**	**10.33**	**-88.42**
Summary of cost for sub-base layer construction					
1	Actual cost	6.87	0.00	14.80	14.93
2	Estimated cost	0.00	0.00	0.00	0.00
Variance		**-6.868958276**	**0**	**-14.80156342**	**-14.93**
Summary of cost for base- course layer construction					
1	Actual cost	8.71	845.47	161.16	699.27
2	Estimated cost	2.82	441.06	27.29	94.23
Variance		**-5.89**	**-404.41**	**-133.87**	**-605.04**
Summary of cost for Asphalt concrete surfacing construction					
1	Actual cost	3.02	191.96	17.61	146.41
2	Estimated cost	0.74	231.42	5.19	47.47
Variance		**-2.28**	**39.46**	**-12.42**	**-98.94**
Summary of cost for retaining wall construction					
1	Actual cost	474.24	436.70	52.84	663.76
2	Estimated cost	307.96	880.48	99.44	257.58
Variance		**-166.28**	**443.78**	**46.6**	**-406.18**
Summary of cost for town ditch					
1	Actual cost	355.18	615.78	35.64	693.25
2	Estimated cost	307.96	880.48	99.44	257.58
Variance		**-47.22**	**264.7**	**63.8**	**-435.67**
Summary of cost for curb stone construction					
1	Actual cost	39.07	185.32	179.29	278.02
2	Estimated cost	21.39	251.09	4.44	55.38
Variance		**-17.68**	**65.77**	**-174.85**	**-222.64**

4.6.3 Summary

This section presented about the summary of proposed system of cost accounting for the company. The survey and desk study analysis revealed that the current system is unable to ascertain the cost which is the primary aim of implementing the system. This incorrect presentation of cost data will expose the managers to face unexpected cost overrun of the project without any chance to take corrective measures. Therefore proposing of the modified costing system is necessary to overcome those problems. The proposed system was focused on avoiding inconsideration of cost data and proper allocation of the cost to the eligible cost objects. The implementation of the proposed system is tested in three ongoing projects of the organization named as, Dulecha-Awash Arba, Dimma-Rad, and Jinka Mender road construction project. These three projects are similar as they are asphalt concrete road construction projects. However, their location, climate condition and contract delivery system are different. Dulecha –Awash Arba and Dimma-Rad projects are located in Afar and Gambella Regional state respectively and has a design bid build contract delivery system. Whereas, Jinka Mender road construction project are located in South nation and nationalities regional state which has a high rainy weather condition and use design build delivery system. The result from the proposed system revealed that Dulecha –Awash Arba road project has incurred 3,236,488.35birr loss during the reporting period. However, the result from the current system indicates only 611,230.87 birr loss. For Dimma-Rad road project has incurred 1,074,760.49birr loss while the current system indicates 190,177.73birr profit. This distorted system result will let the mangers to think that the project financial status is safe. For Jinka- Mender road project the current system indicates the project has incurred 3,234,628.57 birr loss but the result from the proposed system indicates the project loss is 4,692,897.20 birr. This high difference of the result between the current and proposed system arises from the lack of current system in considering head office overhead cost and computing and allocating of actual project overhead costs of the specified period.

5. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This research set out to study the construction cost accounting system of state-owned road contractors taking ECWC TICS as a case study. It sought to answer the following research questions,

- What is the knowledge of the company's professional staffs about cost accounting?
- Which costing system does the company use to determine the cost?
- How they implement the costing system?
- What are the problems encountered in implementing the costing system?
- Does the costing system provide relevant information to management for future planning and decision making?

Therefore, based on the data analysis result this chapter concludes the research finding as follows:

- The research established that professional staffs don't have adequate knowledge about cost accounting. There was a different answer from the respondent about the company's current costing system. 24% and 30% of the respondent from decision-makers and implementers responded that they don't know about which costing system is they currently use in the company.
- The finding indicates that the company doesn't have a structured and typical cost accounting system. 78% of the respondent responded that they allocate project overhead and the remaining 22% didn't allocate the project overhead cost when determining the cost of the project cost object. Most of the respondents, 59% don't allocate head office overhead to the project and 41% allocate. This result indicates the company has a lack of an organized cost accounting system in all projects. Also, the desk study findings revealed that the company uses the wrong overhead allocation bases. Therefore, the findings indicate that the company is not properly implementing an activity-based costing system.

- This research found that the implementation of cost accounting in the company is weak. The respondents were asked to evaluate the effectiveness of the company current system based on the different requirements of the costing system. The implementer rate the current system as poor in providing relevant data for decision-makers, performance evaluation, efficiency controlling, profit ascertainment, and forecasting ability. And also the response from 97% of the decision-makers revealed that they are not satisfied by the current. This poor implementation will make the system unfit for the intended purpose.
- The result from questionnaires confirms the findings of Nangan 2012, about different common problems which can occur in the implementation of cost accounting. The respondent identified several problems encountered during the implementation. The top three problems selected by cost accounting implementers are lack of training on updated cost accounting techniques, difficulties in data collecting and gathering and lack of implantation software. Decision-makers responded that most three problems as lack of adequate information about cost data, late reporting and incorrect perception about cost accounting. As Sartorius (2007) state the lack of implantation software and difficulties in identifying and defining cost drivers are selected as a problem by 78% and 74% respectively.
- The research revealed the ability of the current system in providing relevant information to the decision-makers for future planning and decision making was poor. The literature indicates that the costing system should provide cost data in a systematic manner and actual information about the cost to the management for the evaluating, future planning and decision making. Also IFAC, 2009 selects as one of the requirements of a good costing system. However, 44% and 41% of respondents from implementers and decision-makers rated the current costing system as poor in assisting the management or decision-makers for planning and decision making by providing relevant cost data.

5.2 Recommendations

Based on the findings of the study the following recommendations are made;

- The company should train the staffs about the different cost accounting systems and its different techniques to get certain cost results which will help the decision-makers to make decisions and corrective measures based on reliable data.
- An independent cost accounting team should be organized at the project level to execute clear and detailed costing reports to present for management staffs to take corrective measures on time.
- The cost accounting implementer team should include accountants in order to solve the problem of overhead cost computation and allocation.
- The company should use a structured and typical costing system for all projects. The lack of a standardized costing system will lead the decision-makers to evaluate the performance of the project based on unequal bases.
- The reporting period should be reduced to 15day in order to enable the decision-makers to take corrective measures timely.
- The project managers have to be the primary user of the cost accounting report and immediate corrective measures have to be done at the site level in order to ascertain the healthiness of the project's financial status.
- The feedback system should get more attention to use the cost accounting results for a better profit.
- The cost data acquires from the cost accounting reports should be used in project pricing and bidding to fix rates based on the actual performance.
- The company should create a proper and uniform cost sheet format for all projects.
- The company should avoid using a predetermined overhead rate. The updated actual overheads rate should be allocated to the cost objects by using the correct allocation bases.
- The company should use the proposed cost accounting system in this study which tries to overcome the problems with the current system.

5.3 Recommendation for Future Research

- Studies about an alternative site cost data recording method shall be carried out to avoid the problem occur in data gathering.
- Research on the cost predicting model shall be carried out based on the recorded actual cost data.
- Factors for direct cost variance shall be studied in order to prevent the project from the occurrence of loss.

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Appendices A: Covering letter

Dear Participant:

My name is Tigist Tsegaye Molla and I am a graduate student at Addis Ababa University School of civil and Environmental Engineering doing a research entitled ‘A study on the cost accounting system of state owned Road contractors a case study on Ethiopian construction works Corporation Transport infrastructure construction sector in fulfillment of Msc. Program in construction technology and management. I have designed this questionnaire which I request you kindly take a time to complete.

Please note that you do not need to divulge your name to this questionnaire and your response to this question shall be treated confidentially. Please be assured that the information you give will be used for this research and will not be passed to any parties.

Sincerely,

Researcher’s address

Name: Tigist Tsegaye

Phone: +251921402694

E-mail: tigisttsegaye63@gmail.com

Appendices B: Questionnaires for management staffs

Please give your response for the following questions either by writing your answers in the space provided or by putting X" or"✓"marks at your choice rectangle shown for questions having choice.

Career position: ----------

Educational back ground: Diploma ☐ B.Sc. ☐ MSc. ☐ Ph.D. ☐

Year of Experience 0-5 ☐ 6-10 ☐ Above10 ☐

1. Do you know about cost accounting?

   Yes ☐ No ☐

2. Do you think cost accounting system useful for your company?

   Yes ☐ No ☐

3. As a decision maker (management staff) what is your objective of implementing cost accounting?

   Please choose all your objectives.

   ☐ To determine the cost of an activity

   ☐ To control and reduction of cost

   ☐ To measure the performance

   ☐ To control efficiency

   ☐ To ascertainment of the profit

☐ To use as an effective information system

☐ Other_____

4. Do you know about different method of costing system?

Yes ☐ No ☐

5. Which costing system does your company use?

☐ Direct costing system

☐ Traditional costing system

☐ Activity based costing system

☐ I don't know

☐ Other _____

6. Do you use computer application software or tools in making decision depending on the cost accounting reports?

Yes ☐ No ☐

Only answer this question if the answer for question #6 was ''Yes'

7. Write type of computer software or tools used in making a decision.

Please write your answer here:

_____

_____

_____.

8. What are the common problems in cost accounting reports?

☐ Lack of adequate information about the cost data

☐ Incorrect assigning and allocation of cost to each activity (cost object)

☐ Difficulties in identifying the actual project and head office overhead cost

☐ Using of approximated data rather than collecting the actual cost data

☐ Incorrect perception about cost accounting doing it just for the purpose of reporting

☐ Late reporting which makes unable to make a decision on time.

☐ Absence of presenting easy and understandable cost accounting reports

☐ Absence of different decision making software or computer tools

☐ Lack of trainings on updated decision making techniques

☐ Other, Please write if there is other problem

_____

_____

9. Please rate the effectiveness of your company current cost accounting system based on the following requirement.

   Please choose the appropriate response by marking the appropriate box.

I. N	Cost accounting system requirements	Poor	Satisfactory	Good	Very good	Excellent
1	Determining the costs of a product on per unit basis or total cost, for example, cost per kg, cost per meter, cost per liter, cost per ton etc.					
2	Assisting the management for planning and decision making by providing relevant data in a systematic manner and actual information about the cost to the management for the evaluating, future panning and decision making.					
3	Allows evaluating and analyzing the performance.					
4	Control the efficiency by locating wastages, inefficiencies and other loopholes in the production processes/services offered.					
5	Ascertainment of the profitability in division wise, activity wise and unit wise.					
6	Serving as an effective information of system which enables to ascertain the cost at every level of production process and activity level					
7	Identifying profitable and unprofitable activities which help the management to reduce or eliminate wastages and inefficiencies such as underutilization, idle time, spoilage of material etc.,					

8	Ability to forecast from the past cause-and –effect relation.					

After rating your company costing system based on the above cost accounting system requirement please answer the following question.

10. Are you satisfied with the current cost accounting system?

Yes ☐ No ☐

Only answer this question if the answer for question #10 was ''Yes'

11. What do you need to add in the current costing system?

_____

_____.

Only answer this question if the answer for question #10 was ''No'

12. What do you suggest to amend the current system?

_____

_____.

Appendices C: Questionnaires for implementers

QUESTIONNAIRE

Please give your response for the following questions either by writing your answers in the space provided or by putting X" or"✓"marks at your choice rectangle shown for questions having choice.

Career position: ----------

Educational back ground: Diploma ☐ B.Sc. ☐ MSc. ☐ Ph.D. ☐

Year of Experience 0-5 ☐ 6-10 ☐ Above10 ☐

1. Do you know about cost accounting?

   Yes ☐ No ☐

2. Do you think cost accounting system useful for your company?

   Yes ☐ No ☐

3. What is your objective of implementing cost accounting?

   Please choose all your objectives.

   ☐ To ascertain the cost of an activity

   ☐ To fix the unit rate of an activity

   ☐ To control and reduction of cost

   ☐ To assist the management for planning and decision making

☐ To forecast the future cost

☐ To control efficiency

☐ To ascertainment of profit

☐ To measure the performance

☐ To use as an effective information system

☐ Other_____

4. Which costing system does your company use?

☐ Direct costing system

☐ Traditional costing system

☐ Activity based costing system

☐ I don't know

☐ Other _____.

5. Do you allocate head office overhead cost to the project?

Yes ☐ No ☐

6. Do you allocate project overhead to the works (project) section?

Yes ☐ No ☐

Only answer this question if the answer for question #6 was '‘Yes'

7. What are basis of allocating project overheads to works

☐ Value of section

☐ Direct labor

☐ ABC system

☐ Other _____

8. Does your organization have a cost accounting team?

Yes ☐ No ☐

9. Does your organization have a standard cost sheet that used to provide the cost data of the project?

Yes ☐ No ☐

10. Are computer application software or tools used in implementing the cost accounting system? Yes ☐ No ☐

Only answer this question if the answer for question #10 was ''Yes'

11. Write type of computer software or tools used in applying the cost accounting system?

Please write your answer here:

_____

_____

_____.

12. In which level of cost accounting system that you use computer application software or tools?

Please choose all levels that you use the software or tools

☐ In collecting of cost data

☐ In recording of cost data

☐ In allocating the cost to different activities (cost objects)

☐ In variance analysis

☐ In presenting relevant data or the statement to the decision makers

13. What are the common problems that are face during the implementing the cost accounting?

The problems are listed from three perspectives. Please choose the entire problem that you faced during implementing the cost accounting.

Top management support

☐ Lack of top management (head office) and internal project support

☐ Lack of trainings on updated cost accounting techniques

☐ Incorrect perception about cost accounting, doing it just for the purpose of reporting

Technical constraints

☐ Lack of basic knowledge and skill on cost accounting and its different techniques

☐ Lack of adequate information about the cost

☐ Difficulties in data collecting and gathering

☐ Difficulties in identifying and defining **cost centers** and **cost drivers**

☐ Difficulties in identifying the actual project and head office overhead cost

☐ Inadequate knowledge about allocation of overhead cost to each activity

☐ Difficulties in the assigning and allocation of cost to each activity (cost object)

☐ Using approximate data rather than collecting the actual cost

Resource constraints

☐ Lack of adequate number of employee resource in the cost accounting team

☐ Lack of implementation software or computer tools

☐ Other, Please write if there is other problem

_____

_____.

14. Pleases rate the effectiveness of your company current cost accounting system based on the following requirement.
    Please choose the appropriate response by marking the appropriate box.

I. N	Cost accounting system requirements	Poor	Satisfactory	Good	Very good	Excellent
1	Determining the costs of a product on per unit basis or total cost, for example, cost per kg, cost per meter, cost per liter, cost per ton etc.					
2	Assisting the management for planning and decision making by providing relevant data in a systematic manner and actual information about the cost to the management for the evaluating, future panning and decision making.					
3	Allows evaluating and analyzing the performance.					
4	Control the efficiency by locating wastages, inefficiencies and other loopholes in the production processes/services offered.					
5	Ascertainment of the profitability in division wise, activity wise and unit wise.					
6	Serving as an effective information of system which enables to ascertain the cost at every level of production process and activity level					
7	Identifying profitable and unprofitable activities which help the management to reduce or eliminate wastages and inefficiencies such as underutilization, idle time, spoilage of material etc.,					

8	Ability to forecast from the past cause-and –effect relation.					

After rating your company costing system based on the above cost accounting system requirement please answer the following question.

15. Are you satisfied with the current cost accounting system?

Yes ☐ No ☐

Only answer this question if the answer for question #15 was '‘Yes'

16. What do you need to add in the current costing system?

_____

_____.

Only answer this question if the answer for question #15 was '‘No’

17. What do you suggest to amend the current system?

_____

_____.