



ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
FACULTY OF TECHNOLOGY
DEPARTEMENT OF CIVIL ENGINEERING

Improving Cost Management Practices of National Contractors
Focused On Building Construction Projects

By

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Abbreviations

BOQ	=Bill of Quantities
MoWUD	=Ministry of Works and Urban Development
OH	=Over Head Costs
WBS	=Work Break Down Structure
I.I	= Importance Index
EVT	= Earned value technique

Abstract

Construction firms, being project based organizations, have to develop their project management capacity in order to accomplish firm and project objectives successfully. Copare (1990) stated that, the number of business failures in the construction industry is high and the high failure rate is not because contractors do not know the techniques of construction but rather they have not developed their management skills. Among such skills one is the project cost management.

This research work presents several issues related to current project cost management practices of national contractors. The practice of 34 general and building contractors is investigated via questionnaires. Existing practices related with estimating and tendering, budgeting and cost controlling were assessed in view of identifying shortcomings and limitations associated with each functions.

The research findings indicated that the success rate of tender offers is below 50% for 80% of the surveyed contractors and 67% among these, have a success rate less than 25%. The highest ranking responsible factor is tough competition, which is also aggravated by absence or lack of bidding strategy by the contractors. The results moreover indicated that most of the surveyed contractors are unable to obtain the profit they anticipate from their projects. 86% of the contractors have obtained below 75% of the amount they expected from most of the projects they have undertaken so far. Among these, 48% obtained less than 50% of the anticipated amount. The major contributing factors, in the order of their influence are price escalation, delays caused by owners and/or consultants, inadequate financial planning practices, lack of cost controlling system and inaccuracy of the estimates prepared during the tendering stage.

According to the results of the research, factors contributing to the inaccuracy of cost estimates are unfamiliarity with different estimating methods, lack of up to date estimating manuals or standards on resources consumptions and productivity, inadequate search for information on project specific and contextual cost and non cost items, improper estimation of overhead costs, failures to evaluate and incorporate and/or difficulties in forecasting and

quantifying risk allowances and inadequate assessment of factors while determining mark up amount or profit margin.

Bill of quantity/ admeasurements and lump sum contracts types which are different versions of the fixed price contract, which place the economic risks on contractors, are the most widely used contract types in Ethiopia. The standard or traditional estimating method is the sole method used by the contractors for pricing construction contracts. None of the contractors adapt recent estimating techniques, such as the range estimating and parametric estimating methods, which consider risks and uncertainties, primarily or in addition to the standard method.

Lack of standard estimating manuals by the construction industry, and absence of a system which maintain records of actual on-site costs and productivities with in the contractors are the major causes for errors in estimating direct costs. Regarding overhead costs, even though the average ratio of over head costs to the total direct costs is as high as 25% majority of the contractors do not identify and estimate them properly. 52% of the contractors add on allowance arbitrarily to account for these costs. Only 38% of the contractors consider risks during tender pricing. Qualitative items like project type, size, complexity, contract period, statutory regulations and so on, which can affect the quality and accuracy of estimates negatively, receive little attention from the contractors, during estimation and pricing.

The results revealed that contractors' cost controlling process is not integrated with the budget prepared for the project. Budgetary control is not popular among the contractors. The process focuses mainly on revealing the amount of profit and fails to indicate/identify activities or operations which are being carried out uneconomically together with the underlying reasons. Moreover, it is not carried out in a way which provides feedback to the estimating process. The survey results further revealed the very limited application of project works classification /breakdown and works coding system for facilitating the cost management process.

Key words: Project cost management, competitive tendering, bidding strategy, direct and indirect costs, overhead costs, mark-up, estimating methods, budget, project works breakdown and coding system, cost controlling.

CHAPTER ONE

INTRODUCTION

1.1 General

Construction firms, being the key stakeholders of the construction industry, are the primary agents for meeting the demands made upon the industry. These firms in general, are project based organizations. They carry out the construction of public or private projects, which demand efficient management and coordination to make the best use of resources and ensure continuity of works and revenues. Failure to manage these projects properly will lead them to bankruptcy or undermine their organizational capacity. Hence, contractors need to focus on projects portfolio management. Copare (1990) stated that the number of failures of contractors in the construction industry is much higher than it should be. According to Copare, the high business failure rate is not because contractors do not know the techniques of construction, but rather they have not developed the necessary project management skills.

Project management is a wide process which encompasses several sub processes which deals with fulfilling predetermined project objectives. Among these processes, one is the project cost management process, which is the subject of this research.

As Perera and Imriyas (2003) indicated, construction projects cost management is a process which complements the broad functions of estimating and tendering, scheduling, cost control and financial control. Contractors, upon receipt of tender or work document, first make decision on whether to bid or not to bid based on assessment and evaluation of several internal and external factors. If the decision is to bid, then they submit their offer based on the estimates of direct and indirect costs, organizational considerations and evaluation of external factors which affect the project directly or indirectly. If the offer is accepted, they need to prepare plan of work or the project budget, which comprises time schedule and resource requirements. Once construction commence, project activities should be controlled, in order to carry out the works according to the budget and also to initiate corrective actions when deviations from the plan arises. Accordingly, contractors need to have a cost management system which spans from the tendering stage up to the completion stage and which integrates the tasks mentioned above, estimating and tendering, budgeting and controlling.

1.2 Background of the Problem

Construction companies, as project based organizations, mostly rely on the outcomes of the contracted projects for their survival and growth. Accordingly, they have to ensure that sufficient number of projects or optimum volume of work which is inline with their capacity and business strategy is secured at a time. Moreover, they have to make sure that the contracted projects are generating adequate amount of profit. Hence, contractors' overall business objectives should be directed towards the acquisition of sufficient volume of work at sufficient profit level. These two major goals can be fulfilled best, by employing or implementing an integrated project cost management system. An efficient cost management system, moreover, assists to minimize cash flow problem which most contractors face during the execution of projects. Cash flow problem is one of the major factors which contribute to the low performance of contractors with regard to fulfilling predetermined objectives associated with completion time, cost, quality, stakeholders' satisfaction and other particular requirements.

Hendrickson (2003) stated that contractors' gross profit at completion of projects is affected by the accuracy of the original estimate and the efficiency of the cost controlling system. Copare (1990) identified inaccurate cost estimates, inadequate accounting records and inefficient cost controlling practices as the major factors which hamper contractors from maintaining healthy cash flow and securing the anticipated profit amount from projects. The factors mentioned by both authors are closely linked with the major functions of an integrated cost management system, which were described in the previous section.

Also, as Plither (1992) stated, contractors in many instances do not clearly identify and understand the distinct tasks or functions that a cost management system comprises. In such cases, the processes are viewed as a single process and performed by a single individual over a relatively short period of time or the tasks do not receive a balanced attention. In other instances, contractors wait until the completion of projects to know whether there is a positive or negative difference between their price and the cost of the works.

The motivation for this study has emanated mainly from experience and observations and also from the results of previous studies conducted on the financial management practice of

domestic contractors. The result of the study conducted by SMEC international P.I (1999) reported that, most domestic contractors are characterized by lack of appropriate financial management system. The study report indicated that the detailed financial knowledge of contractors was in all, except one case, completely absent and there was little evidence of a system assisting management with timely and accurate financial information and providing cost information on projects.

However, the report apart from mentioning the incompetence of the practice in general, did not point out the specific areas or issues which need improvement intervention. This research will investigate the current cost management practices of contractors in depth in order to identify the particular areas which demand improvement interventions. Accordingly, it will investigate the existing practices on estimating, budgeting and cost controlling and identify shortcomings associated with each function. By improving their practice, contractors can minimize cash flow problems, maximize profit and consequently fulfill firm and project objectives. And, this is realized, to a satisfactory extent, through the implementation of an integrated cost management system, which facilitates systematic selection of projects to bid for, accurate cost estimation and budgeting before commencement of construction and efficient cost controlling, during construction.

1.3. The Research Problem, Objectives and Questions.

This research work is intended to be an applied research which contributes knowledge towards solving a practical problem. Accordingly, the research problem statement and the research objectives are formulated based on facts discovered by investigation. As indicated in the background section, national contractors are characterized by lack of an efficient project cost management system. Apparently, this study will examine the current cost management practice in detail, in order to identify the major weaknesses, shortcomings and draw backs associated with the tendering, budgeting and cost controlling practices, which are major functions of a comprehensive cost management system. The research aims at addressing the problems by proposing improvement interventions, based on the concepts and theories developed so far in the area.

In this regard, the problem statement of the research is formulated as, the need for identifying major shortcomings of the existing cost management practices to improve the project management capacity of national contractors. Based on the problem stated, the research is carried out in view of achieving the following four objectives:

1. To review project cost management concepts.
2. To investigate project cost management practices of national contractors.
3. To identify shortcomings, drawbacks and limitations of the existing practice.
4. To forward recommendations and interventions to improve existing practice.

With in the view of accomplishing these objectives, the research has posed the following three questions, which are to be addressed by the selected research instruments:

1. What are the existing project cost management practices?
2. What are the shortcomings, drawbacks and limitations of the practices?
3. What are and how wide are the impacts of the drawbacks and limitations?

1.4 The Study Scope and Limitations

Improved cost management capacity, though it is necessary for project owners and consulting firms, the research is undertaken only from the point of view of contractors. This is due to the researcher's notion that contractors are the one who suffer most from the consequences of incompetent cost management practices.

Despite the fact that construction projects undertaken by contractors range from light residential buildings to complex and heavy projects, the scope of this research work is limited to and focused on building projects. The need for limiting the research to building projects arises mainly due to two major reasons. The first reason is tied to the work experience of the researcher on building projects. The other reason is associated with the number of activities or work divisions involved in building projects, which is much higher than those in road or other projects. The high number of work divisions and items is accompanied by collection and interpretation of massive volume of information regarding resources' cost, productivity standards and so on, which inturn demands the employment of an efficient and effective cost management system.

1.5. Organization and Contents of the Research

This dissertation comprises six chapters. Chapter one is the introductory chapter which provides basic information about the research including back ground and statement of the research problem, research objectives and limitations of the research. The conceptual framework of the research is presented on chapter two and chapter three. Accordingly, chapter two gives an overview of the construction projects procurement and contract planning process. Chapter three presents theories and discussions related with the major functions of project cost management system and elements or components of project cost. A brief discussion on project works breakdown or classification and coding systems is also included in this chapter. Chapter four covers the research methodology. It presents an overview of the research process, the research's approach and instrument, questionnaire design and rationale of the questions, the research sample selection and methods of analysis of the research's data. Chapter five presents analysis of the research data, findings of the research and discussions. The last chapter is devoted to the research's conclusions and recommendations.

CHAPTER TWO

PROCUREMENT AND CONTRACT PLANNING IN CONSTRUCTION

2.1. General

A project is a one shot, time bound and goal oriented major undertaking that requires the commitment of varied skills and resources. Thus, project management is concerned with achieving a specific overall goal in a given time using resources available for that period only. The management of projects is a special kind of management which holds certain basic features that differs it from general management or the management of steady state organizations which run continuously. This is because, as Wibshet (2004) argued, every project is unique, temporary, complex and component of a certain business.

Construction works are time bound activities which involve heavy investments of capital and resources. Owing to these features, as Chikatra (2000) stated, the implementation of these works is undertaken by projecting them, i.e., by organizing them into one or more construction projects. Accordingly, the term 'construction project' refers to a high value, time bound construction mission with pre-determined performance objectives (Chikatra, 2000). In general construction project objectives are stated interms of project completion time, budgeted cost and stipulated quality specifications. Construction projects management is a process which encompasses various sub processes and functions that are necessary for ensuring that these objectives are accomplished.

Abebe (2003) defined construction project management as the over all control of the managerial process which encompasses the planning, executing and controlling sub processes, to optimize the three major attributes of the process, quality, schedule and cost. According to Abebe the construction management process has numerous objectives to accomplish, which includes:

- The production of construction works, which satisfy the client's functional requirement
- The completion of projects with in specified cost limits
- The completion of projects with in specified time limit
- Construction to specified standards.
- The preservation of the health and safety of the people involve.

2.2. Contract Planning in Construction Projects.

Procurement and contract management is a process which encompasses three major sub processes: Contract Planning, Procurement Management and Contract Management, (Wibshet, 2006). According to Wibshet, contract planning includes decisions on proposed delivery systems, procurement methods and contract types to be followed. On the other hand procurement management is a process of selecting individuals or organizations to carry out the intended services and / or works. It involves the preparation of procurement documents, the invitation and submission of tender proposals, and opening and evaluation of tenders. Contract management is a process of reaching contractual agreement for implementation, its administration and finally concluding the contract. It involves negotiation based on tender evaluation, recommendations and signing of contractual agreement followed by its administration for contractual implementation, progress tracking and changes, claims and disputes administrations, (Wibshet, 2006). Among these processes, the contract planning process which deals with contract delivery methods, procurement methods and contract types will be discussed briefly in the subsequent sections.

2.2.1. Construction Projects Procurement Methods

Procurement is a process used to select the lowest competitive and qualified bidders for procuring services or works or goods from potential competitors based on reasonable and relevant criteria. The most common and widely used procurement methods or pricing arrangements in the construction industry, according to Hendrickson (2003), are competitive tendering and negotiated tendering.

I. Competitive Tendering.

According to Hendrickson (2003), the basic structure of the bidding process consists of the formulation of detailed plans and specifications of a facility, based on the objectives and requirements of the owner and the invitation of qualified contractors to bid for the right to execute the project. Detailed plans and specifications are usually prepared by an architectural/engineering firm which oversees the bidding process on behalf of the owner. The final bids are normally submitted on either a lump sum or unit price basis, as stipulated in the tender document. A lump sum bid represents the total price for which a contractor offers to complete a facility according to the detailed plans and specifications. Unit price bidding is

used in projects for which the quantity of materials or the amount of labor involved in some key tasks is particularly uncertain. In such cases, the contractor is permitted to submit a list of unit prices for those tasks, and the final price used to determine the lowest bidder is based on the lump sum price computed by multiplying the quoted unit price for each specified activity by the corresponding quantity in the consultant's estimates for quantities. However, the total payment to the winning contractor will be based on the actual quantities multiplied by the respective quoted unit prices.

As Hendrickson (2003) stated, competitive bidding in construction projects involves decision making under uncertainty where one of the greatest sources of the uncertainty for each bidder is due to the unpredictable nature of his competitors. Each bid submitted for a particular job by a contractor will be determined by a large number of factors, including an estimate of the direct job cost, the general overhead, the confidence that the contractor has in his estimate, and the immediate and long-range objectives of the contractor. So many factors are involved that it is impossible for a particular bidder to attempt to predict exactly what the bids submitted by its competitors will be. It is useful to think of a bid as being made up of two basic elements, the estimate of direct job cost, which includes direct labor costs, material costs, equipment costs, and direct supervision costs and the markup or return, which must be sufficient to cover a portion of general overhead costs and allow a fair profit on the investment, (Hendrickson, 2003).

A large return can be assured simply by including a sufficiently high markup. However, the higher the markup, the less chance there will be of getting the job. Consequently a contractor who includes a very large markup on every bid could become bankrupt from lack of business. Conversely, the strategy of bidding with very little markup in order to obtain high volume of work is also likely to lead to bankruptcy. Somewhere in between the two extreme approaches to bidding lies an "optimum markup" which considers both the return and the likelihood of being low bidder in such a way that, over the long run, the average return is maximized.

II. Negotiated Contracts

Instead of inviting competitive bidders, private owners often choose to award construction contracts to one or more selected contractors. According to Ostwald (2001), the major reason

for using negotiated contracts is the flexibility of this type of pricing arrangement, particularly for projects of large size and great complexity or for projects which substantially duplicate previous facilities sponsored by the owner. An owner may value the expertise and integrity of a particular contractor who has a good reputation or has worked successfully for the owner in the past.

Here, it should be noted that projects, whether procured through competition or negotiation, need proper and careful estimation, planning and controlling of relevant costs. But, those which involve competition need great attention both during the tendering stage and the construction stage, owing to the fierce competition among contractors and the relatively small profit mark up introduced.

2.2.2. Construction Contract Types

A construction contract is a binding agreement, enforceable in law, containing the conditions under which the construction of a facility will take place. Construction contract types, though they are known by many titles and there are numerous variations, they fall into two fundamental categories, fixed price and cost reimbursable contracts. According to Ostwald (2001), the element of risk, the willingness of the parties, the competition, complexity of construction, and urgency may influence the general type of contract selected. In general, cost-reimbursable contracts transfer the economic risks to the owner, while fixed price contracts place the economic risks on the contractor.

I. Fixed Price Contracts

Fixed price contracts have in common that, a contractor is to deliver construction work in accordance with the terms and conditions of the contract and the client is to pay a price equal to that specified by the contract. The price is fixed for the life of the contract time, precluding changes allowed by the contract. However, the terms and conditions may allow for adjustments. Though, the fixed price contract arrangement provides the greatest risk to the contractor, it also offers incentive and opportunity to realize the greatest profit. The contractor fully recovers saving due to cost reduction. Thus, if actual costs are less than estimated costs, then greater profit is realized.

Since the total project cost can be determined in advance, almost all public project contracts as well as large portion of private construction projects are selected by fixed price competitive bidding. Competitive bid contracts for projects that are fixed price have numerous variations. A lump sum contract is one in which the contract sum is fixed and agreed before construction work commences, (Hendrickson, 2003). It is commonly used in the design-bid-build contract delivery system. As Ostwald (2001) argued, such contract type may bring financial difficulty to contractors in cases, where variations or changes of work scope are encountered. Another version of the fixed price contract type is the ad measurement contract. Ad-measurement contracts are based upon measuring the actual quantities of work carried out and valuing that work by applying the rates and prices quoted in the contract document. For ad measurement contracts a contractor is required to submit a priced bill of quantities or a schedule of rates with his tender, (Plither 1992).

Other variations of the fixed price contact type are productive labor rates and time and material contracts. With the productive labor rate type, contractors bid for work on the basis of a gross hour cost rate, by specifying a labor-rate schedule. Mark up rates depends on the skill, market demand and competitive pressures. A time and material contract is for work at a fixed and specified rate (hourly, daily etc) that includes direct labor, indirect costs, profit and materials. The materials may be at cost or cost plus profit. As Ostwald (2001) argued, this contract is suitable for construction where the amount or duration of work is unpredictable or insignificant. Repair work is often handled on a time and material contract. The labor is a fixed part, as the owner agrees to a pre established gross-hour wage schedules. The material is cost reimbursable, since the nature of repair materials is unknown at the time of contract.

II. Cost Reimbursement Contracts

If a project can not be accurately estimated, then the fixed price contract may not be suitable and the use of cost reimbursable contracts is preferable. Large complex constructions are candidates for this type of contract. These contracts involve recording the total actual costs of materials, plant and labor, known as the allowable or prime costs, incurred in order to carry out the works and then adding to them a previously agreed fee to cover profit and overhead costs, (Plither, 1992). Such a contract is used for work where it is not possible to prepare accurate definitions of the extent and nature of the works involved, prior to commencing

construction work. Prime cost plus percentage fee is one contract type under cost reimbursement contracts, where the fee consists of a fixed and previously agreed percentage of the total incurred prime costs. Another arrangement in this contract type is cost plus fixed fee, where a predetermined fixed fee is added to the prime costs. The fixed fee is either tendered by the contractor as a lump sum or alternatively it may be negotiated, (Plither, 1992). Third type of arrangement in cost reimbursement contracts is target cost plus fee, where a target cost of the work is agreed before any work is carried. According to Plither, this is commonly facilitated by using a priced bill of quantities for the prime costs, the bill of quantities being used in valuing any variations in the scope of work as well as dealing with fluctuations of cost as a result of inflation. The cost reimbursable contracts in general, place the economic risks on the owner.

It is obvious that the type of contract adopted, has significant impact on the contractor with regard to cost or financial out come of the project. As Tadesse (2006) indicated construction contracts have direct impact on the cost estimation of construction projects. The estimation of costs for fixed price contracts should be accurate to the extent possible, as any error can result in over or under estimation, which in turn lead to losing bids during tendering and no or negative profit, at completion of project

CHAPTER THREE

THE CONSTRUCTION PROJECT COST MANAGEMENT PROCESS

3.1. General

Project cost management, has a broader view of life-cycle costing, and incorporates the effect of project decisions on the cost of using, maintaining and supporting the product service or results of the project. However, it is primarily concerned with the cost of resources needed to complete scheduled activities during the execution stage, (PMBOK, guidelines, 2004). This research also focuses on the cost management by contractors, at this stage.

The execution stage includes tendering and construction. As Plither (1992) noted, contractors, on receipt of work tender, prepare cost estimates and based on the estimates, they quote the estimated price of the works. Then, depending upon the contracting method, i.e. tendering or negotiation, the quoted price or an improved one will be the financial commitment for executing the work. Next, they will draw up their plan of work based on the quantities and costs reflected in the bill of quantities (BOQ). According to Plither, the plan forecasts the contractors' commitment for resources and input costs and consequently, the revenue which they expect. Once construction commences, contractors attempt to perform the work in a way that keep the cost of carrying out the work, with in the money that will be reimbursed to them as a result of valuation of completed works.

The processes described above, comprise the tasks which most contractors are involved and which need systematic approach. Estimation of project cost involves identification quantification and valuation of the various direct and indirect cost components. The budget which is prepared based on these cost components will be the baseline for the cost controlling process. Accordingly, contractors' cost management system should consider and integrate these tasks.

3.2. Components of Project Cost

Plither (1992) quoted "the estimated cost of carrying out the works of a construction project is composed of the direct cost of the works to which are added the site overhead costs." Plither further added that the estimated cost ,which he referred to as construction cost, together with

general or company overhead costs, would form the "net cost". As shown in Figure 3.1, mark-up or margin for profit and risk is added to the net cost to establish the construction tender price. Also, Tadesse (2006) quoted "the cost of any construction project comprises direct costs which include the direct cost of materials, labor as well as equipment and indirect costs which include but not limited to head office and site overhead costs." According to Tadesse the total construction cost of a project is composed of four cost categories; direct costs, indirect costs, risk allowances and profit.

In general, construction cost is a production cost which is composed of two cost categories: direct costs and indirect costs. Direct costs are those costs that can be correlated to specific activity or a work-item, and all other costs that are incurred to accomplish an activity but can not be correlated directly, are indirect costs. The construction price is established by introducing a mark-up or an allowance to the estimated cost, for profit, risk etc.

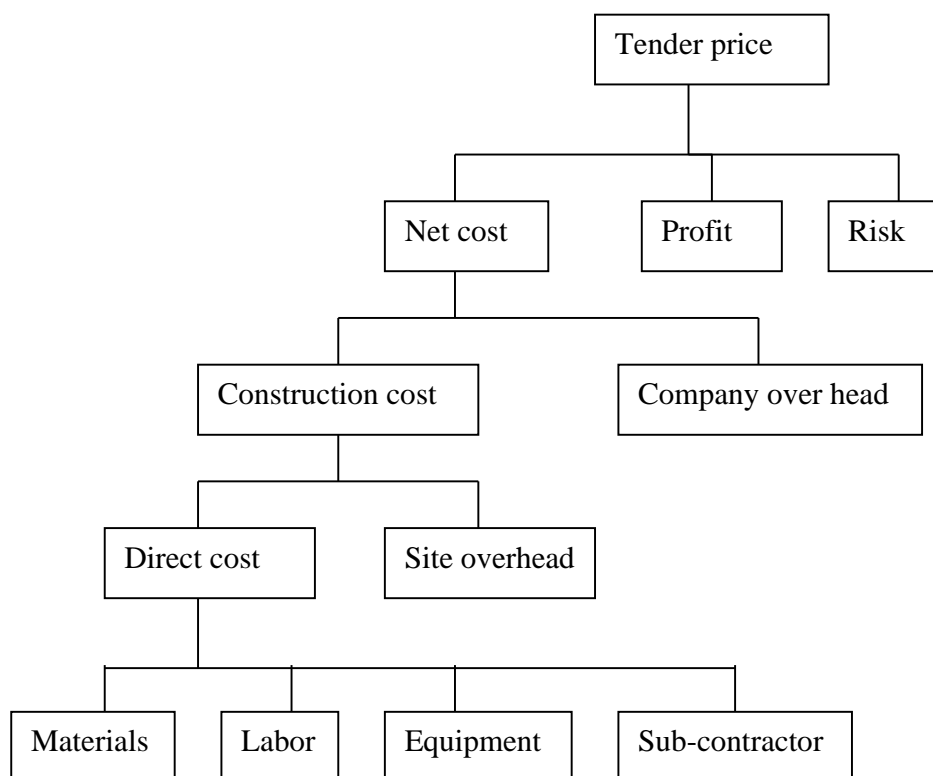


Figure 3.1 Components of construction cost, Source, Roy Plither, 1992

As described above, construction project cost and/or price is composed of different cost components. A brief description of each cost component is presented below

3.2.1. Direct costs

Direct construction costs are all costs that can be specifically booked with an activity in a project, (Tadesse, 2006). Direct cost consists of the cost of materials, labor, equipment and subcontractors needed to carry out a specific, well-defined item of work. According to Plither (1992), direct cost is obtained by establishing the measured quantities in the item of work, defining the resources that will be used to produce the work and the duration of time over which each will be required, and then applying cost rates to the quantities and durations.

3.2.1.1. Material Cost

Ostwald (2001) quoted “material that is required to satisfy the construction of a design is classified as direct material. As Tadesse (2006) explained, the direct material cost refers to the cost of materials, consumables and components used for executing an activity including the allowances for scrap and wastages. In general, cost of materials is composed of several cost items. According to Chikarta (2001), the direct material cost generally includes:

- Purchase costs, ex-factory or specified delivery location.
- Transportation costs, custom clearance, insurance and handling charges till arrival at site.
- Site manufacturing and fabrication costs to transform raw materials in to products for use in permanent works.

Here, Chikatra suggested that it may not be necessary to have detailed costing of all types of materials that go in to the production of an item of work or activity. Minor materials like screws, nails and tradesmen tool can best be grouped under one head titled minor materials and tools’ under the indirect cost category

3.2.1.2. Labor Costs.

Direct labor is the work that transforms materials from one state to another value added condition. Carpenters, masons, steel setters, heavy equipment operators, plumbers and electricians are typical titles for direct labor, (Ostwald, 2001). Ostwald considers time keepers, watchmen, secretary and so on as indirect labor. Direct labor costs are all costs that

are related to workers working on a specific activity, which include basic wages, over time and allowances, compensations and accommodations. Chikatra (2001) consider insurances, medical expenses, benefits and statutory regulation compensation expenses such as earned leave, provident fund as direct labor costs, where as Tadesse (2006), categorize such costs in to indirect costs.

3.2.1.3. Equipment and Plant Costs

These costs refer to the costs of machineries and plants used in executing a specific activity, (Tadesse, 2006). The cost of equipment involves ownership, operation, maintenance, moving, set up and tear down. According to Ostwald (2001), equipment costs for construction work can be calculated specifically for the job or can become a part of the overhead costs. But the finding of the cost of equipment for each job is preferred than general cost recovery by overhead methods from the point of view of accuracy.

3.2.1.4. Subcontract Costs

Where specific activities are sublette to subcontractors the sub contract price will be considered as the direct cost of the activity, (Tadesse, 2006).

3.2.1.5. Other direct costs

According to Chikatra (2001), such costs include all other expenses on account of services rendered and which can be directly attributed to and clearly identified with the execution of an activity or work-item. These include costs of temporary activities required for a specific work like erecting a scaffolding plat-form for plastering work, or expenses related with investigations or tests necessary to establish procedures for undertaking the construction of a given work or activity.

3.2.2. Indirect Costs

Indirect costs include all costs which are attributable to a given project but can not be identified with the performance of a specific activity or a work-package, (Chikatra, 2001). In other works all costs other than direct costs are covered under indirect cost. In construction projects, indirect costs constitute a significant portion of the total construction cost. Chikatra (2001) quoted “the range of indirect costs, depending upon the nature of the project may vary

from 7.5% to 35% of the total cost". Tadesse (2006), referred these costs as overhead costs and categories them in to head office overhead costs and site overhead costs, where as Chikatra (2001) classified indirect costs into production overhead costs, site overhead costs and head office overhead costs.

3.2.2.1. Production Overheads

Production overheads include indirect material, labor and other indirect expenses. According to Chikatra (2001), these include indirect material costs such as tradesmen's tools, minor equipment and consumable materials. Ostwald (2001) emphasized that, regardless of their insignificance, tools which range from simple hand tools to powered electric/pneumatic tools etc, need to be considered. According to Ostwald, cost of tools can be estimated as a percentage of the direct labor cost, the percent ranging from 0.1% to 2%.

3.2.2.2. Site or Job Overheads

Ostwald (2001) defined job overheads as those costs that do not become an integral part of the construction, but are directly chargeable to the contract. On the other hand, Tadesse (2006) stated that site overhead costs are all costs required to run the whole operation of a specific construction project at site level. In general as Ostwald and Tadesse stated, site overheads are the costs that are needed to operate the site work production activities, but that can not be attributed to direct costs. Site overhead costs are expenses that are not associated with specific activity in a project, but rather shared proportionally by all activities with in the project.

Each construction project may require a special analysis to determine its own site overhead items. But, there are items which can be applied to the majority of construction projects. Typical site overhead items listed by Plither (1992) include, site management and supervision offices, canteen, storage sheds, cars and other transport, temporary roads and services and general labor not assigned to production. Tadesse, on top of these, includes mobilization and demobilization costs, tender expenses, expertise service costs, office furniture and equipments, office running expenses, radio communications, camp facilities, water and power supply, workshops, garages and warehouses, bank charges for money borrowed to purchase materials or machineries for the specific project, insurance charges. Ostwald (2001),on the

other hand, include permits and fees, performance bond, depreciation, surveying, parking areas and first aid in to site overhead costs.

3.2.2.3. Head Office or General or Company Overheads

Company overhead, which is also called general and administrative overhead, includes all costs incurred by the construction firm in maintaining the firm in business and supporting the production process, but are not directly related to a specific project, (Assaf, 2001). These charges are incurred for the benefit of the contractor's over all business and, as Tadesse (2006) indicated, should be shared proportionally by all projects under the company. Company overheads, according to Ostwald (2001), include general expenses such as head office rent, office insurance, light, supplies, furniture, telephone, legal expenses, donations, travel, advertising, bidding expenses and salaries of the executives and office employees. Tadesse (2006) included expertise service costs such as the services of external auditors, lawyers, management consultants and external trainings, workshops, garages and warehouses, bank charges, insurance charges, transportation and travel expenses, reception charges in to the head office overheads.

3.2.3. Risk Allowances

Another major component of construction tender price is the mark-up introduced to take care of possible risks. According to Plither (1992), there are some risks that contractors assume as a matter of course which include, but not limited to, ability of the contractor to manage the productivity of resources that was assumed during the estimation, bad weather and the interference with production and programme that it may cause, the availability of materials for incorporation in the work, delays due to industrial disputes, the financial stability of the client and the performance of equipment. Another important area where contractors are at risk is in cases where change orders or changes to the scope of the contract are made. In such cases, even if the additional cost of the changed work is reimbursed, it is often difficult to substantiate and thus cover all the costs of delays and reprogramming.

On the other hand, Tadesse (2006) indicated that contractors incorporate risk allowances in their tender or construction price to compensate the negative impact of contractual, technical, political and economic risks. According to Tadesse, contractual risks are those risks which

stem from the contractual agreements made between the contractor and the owner and/or between the contractor and sub-contractors and suppliers. The technical risks are those associated usually with the clarification of the technical specifications, working drawings, construction technology and difficulties in understanding new method of constructions. Political and economic risks, according to Tadesse, reflect the impact of political situations, stability of economic policies, inflation and price escalation on the execution of the intended construction project, (Tadesse, 2006).

In general, an assessment should be made during the estimating or pricing stage, in order to identify the different risks that might occur during the course of construction. Based on the result of the assessment and evaluation, allowances should be incorporated to form the total construction cost, the amount or proportion depending on the type, size and nature of the project, contractor's experience and other related factors.

3.2.4. Profit

Construction projects, though they can be executed by the owners or on force account, in most cases, they are executed by contractors, where by the contractors commit to invest their capital to get maximum possible profit from the contracts. Profit is the sum of money that will remain with the contractor after the project is completed and once the costs of carrying out the works have been paid, (Plither, 1992). Plither quoted "an important influence on the percentage of profit added is the evaluation of risk in the project as risk and cost tend to be synonymous". Tadesse (2006) on the other hand, stated that profit margin entirely depends on the market competitiveness and company strategy.

3.3. Elements of the Project Cost Management Process

According to PMBOK guidelines (2004), the project cost management process includes the sub processes involved in planning, estimating, budgeting and controlling costs so that the project can be completed with in the approved budget. But, it identified cost estimating, cost budgeting and cost controlling as the main and discrete processes of a cost management system. Kodikara and Mccaffer, (1993) and Wang, (1997), identified the anatomy of an integrated construction cost management to complement estimating and tendering, purchasing, planning and scheduling, site management and control and financial control,

(Cited by Pereira and Imriyas, 2003). Pereira and Imriyas (2003) on the other hand, argued that construction cost management deals with a broad range of functions such as estimating, scheduling, cost control, resource costing and financial control. Perera and Imriyas, based on these functions have developed an integrated project cost management system. The sub systems and the relationships between them in the integrated system, as presented by Perera and Imriyas, are shown in Figure 3.2.

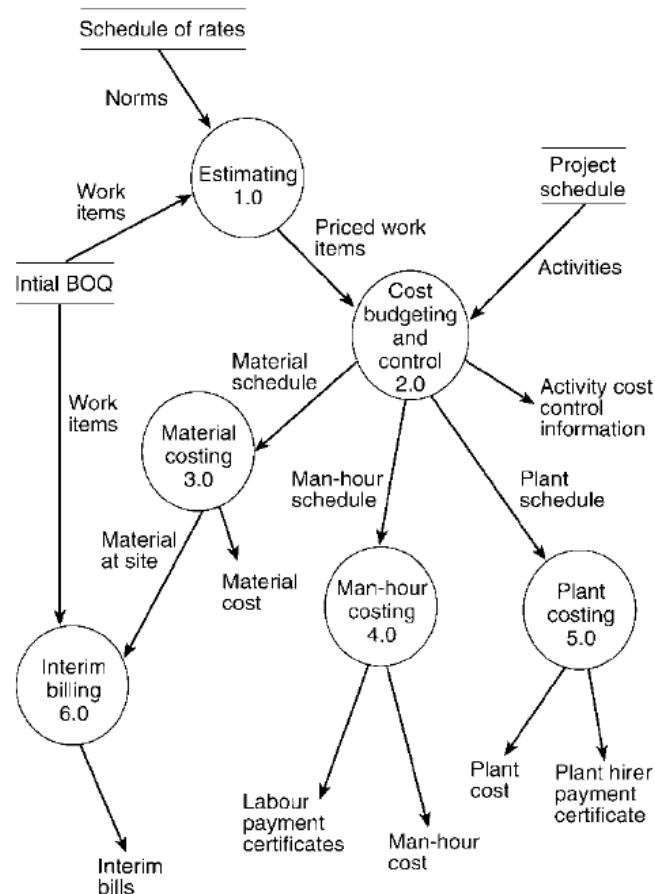


Figure 3.2 Data Flow diagram for a cost management system, Pereira and Imriyas, (2003)

Pereira and Imriyas on their research have identified variables that are necessary to establish an effective cost management system. Next, they defined the relationships among these variables and established a model that shows the work flow and the relationships between the variables. Later, owing to the large volume of data involved in the system, they converted the model into computer software using the MS Project and MS Access softwares. The cost management system model as presented by Perera and Imriyas is shown in Figure 3.3. As

depicted on the figure, they have split the project life-cycle in to two stages: the pre-contract stage and the post-contract stage. The pre-contract stage comprises activities related with estimating and/or tendering and budgeting, while the post-contract stage focuses mainly on controlling project activities and associated costs.

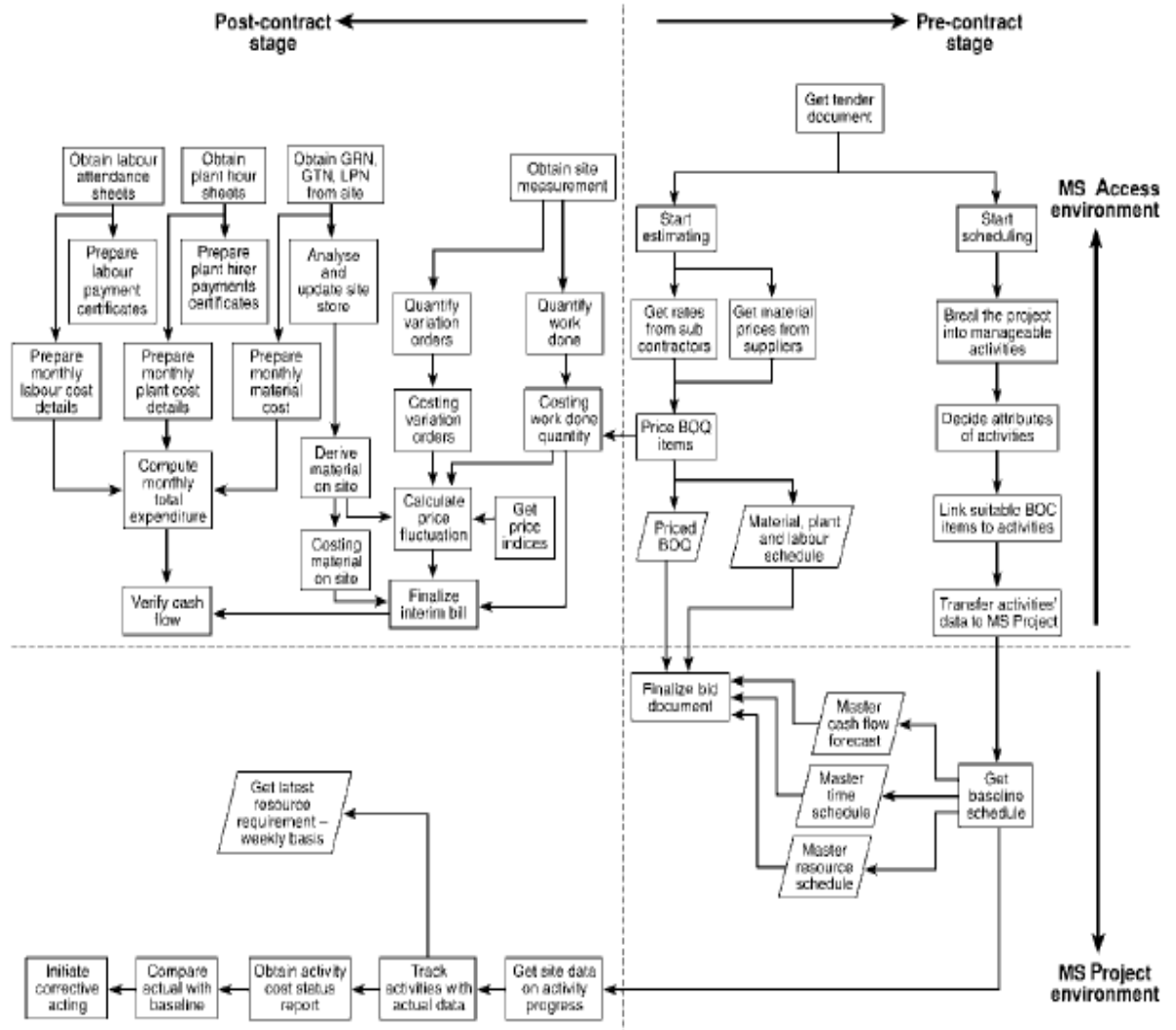


Figure 3.3 Work flow diagram for a cost management system, Pereira and Imriyas, (2003)

Also, Plither (1992) has mentioned the importance of estimating, budgeting and controlling for the effective performance of contractors with regard to cost. He emphasized the use of cost control system during the execution stage, as it enables contractors to draw immediate attention to any operation that is proving to be uneconomic to them. Plither stressed the

importance of budget for the controlling process as cost control is facilitated through budgeting. Budget is a plan for the future against which actual results are measured. Plither further added that the estimate prepared for any contract must be the basis for the cost control of that contract. Chikatra (2001), on the other hand argued that the construction cost management has, as its aim, the planning judgment, costing techniques and accounting discipline for developing standard costs, financial forecasts, project budget and cost control with the ultimate goal of achieving project profit or cost objectives.

As explained by the different authors an integrated project cost management involves the tasks of estimating and tendering, budgeting or the distribution of estimated costs and expected revenue, and controlling costs by comparing actual costs with the estimated costs. This research also considers these functions as the main elements or components of a cost management system.

3.3.1. Tendering and Cost Estimating

The code of estimating practice produced by the chartered institute of building (CIOB, 1997) defined estimating as the technical process of predicting costs of construction and tendering as a separate and subsequent commercial function based up on the estimated, (cited by Akintoy, 2000). Estimating is a process which is used to predict the cost of undertaking a construction work while tendering is a process where by a contractor given the cost estimates, converts this to the sum what will actually be submitted to the client.

The outline of the process of tendering for a contract of traditional type, from the point of view of a contractor, as given by Plither (1992) is shown in Figure 3.4. This process is one where by a contractor can produce a detailed estimate of the cost of carrying out a construction project by taking into account the cost of labor, materials, equipment and finance, together with the cost of sub contract work, overheads and profit.

If the invitation to tender is accepted by the contractor, the estimating process starts in which the contractor's total cost of carrying out the work defined in the tender document is estimated in detail. At this stage that much of the cost calculation is carried out and a cost is derived upon which the bid may be based. Once the estimated cost of the project is determined, the

estimating process is completed and the tendering process begins. As Plither (1992) indicated, the tendering process is primarily concerned with:

- determining the margin or mark up that will be added to the estimated cost.
- making a review of the direct cost so that no major errors have been made,
- effecting any adjustments that are necessary.
- reviewing the likely influence of inflation on the contract price, and
- adding into the tender, the cost of financing the contract working capital.

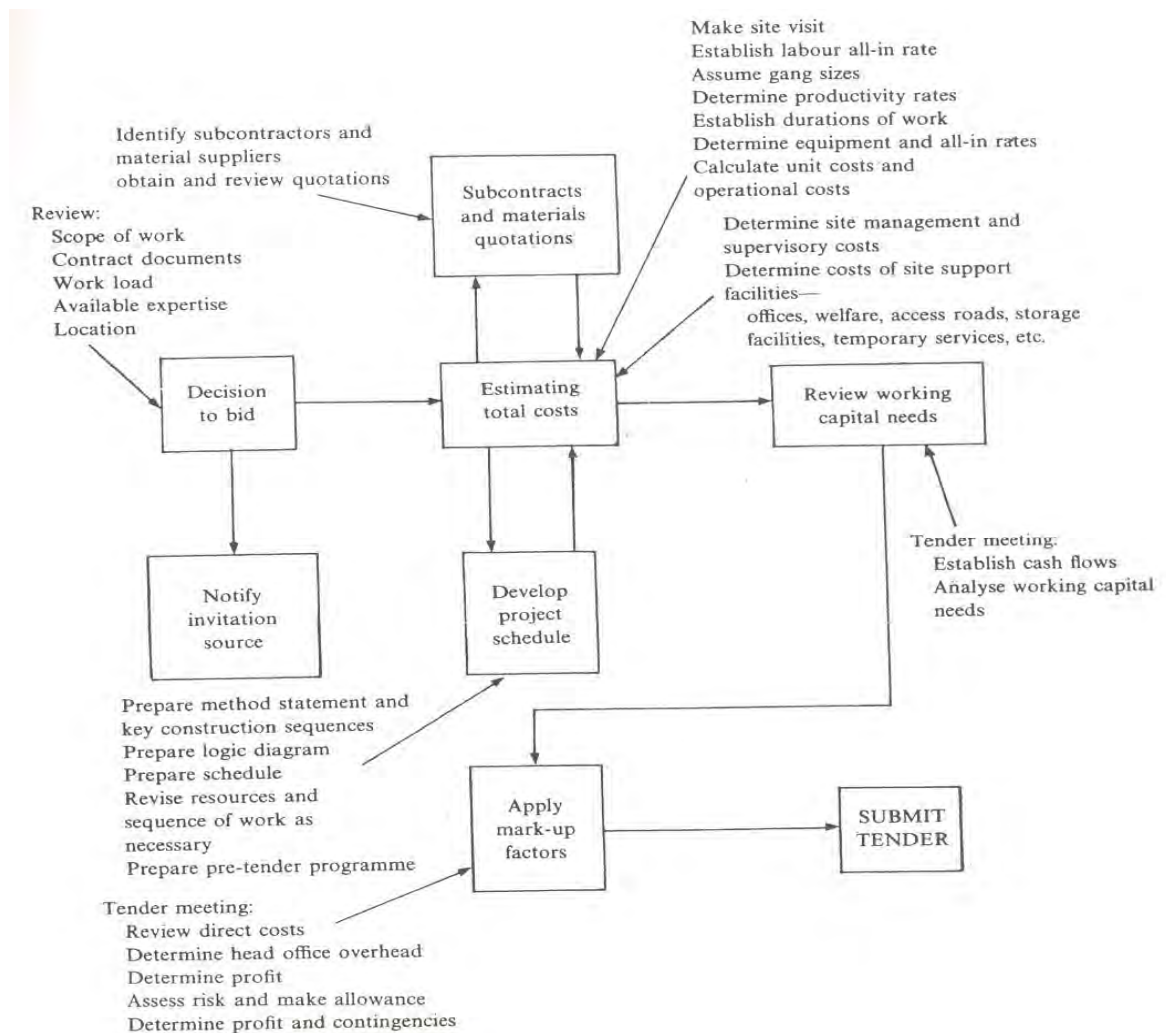


Figure 3.4. The tendering process, Plither 1992

3.3.1.1. The Bidding Process

The first decision to be made by contractors when invited to submit tender is whether a bid will be submitted or not. The decision should follow, as Plither (1992) underlined, a detailed

examination of the contract document to see if there are any unusual requirements that will involve greater than normal risks of higher expenses. Another factor to be considered at this stage concerns the present workload of the company. This is often a difficult area to assess, because a contractor may already have submitted many tenders that await adjudication, some of which may be for very large projects. The company will perhaps have little idea at this stage where it stands with regard to the bulk of these tenders. A sudden excess of successful tenders may overload the company in respect of technical resources and finances. Another important factor to be considered before making decision is the project location. If it is in an area where other company projects are being undertaken, this may lead to some economies as a result of existing local knowledge and possible coordination and collaboration over resources. The nature of the work also influences the decision. Other factors include the availability or not of any necessary specified equipment and technical expertise, and the bond capacity that is available to the company. In addition, consideration must be given to the company's business plan, its need to achieve a sales target. During making the decision on whether to bid or not, Shash (1995) recommended contractors to look into the following four points:

- Project characteristics which include all qualities that describe the project such as size, duration, owners identify etc. Project documents include all factors and characteristics of the bidding documents, including the type of contract, design quality and owner special requirements.
- Company characteristics are factors relevant to the company such as the need for work, current workload and experience in similar projects.
- The bidding situation includes competition, required bonding etc.
- Economic situation which include all economic indicators that may influence the project such as labor availability and governmental regulations.

In general, contractors must consider and evaluate many factors before deciding to bid or not. The major among these are type of job, need for work, owner's identity, historic profit trends, degree of risk, project location, type and size, labor environment, type of contract and contract conditions, availability of required cash, availability of qualified staff, experience on similar projects, number of contractors bidding and current workload.

If a contractor decides to bid, he has to decide on the bid price also. Determining the bid price under the traditional cost plus mark up pricing model requires the contractor to calculate the cost of direct and indirect labor, equipment and materials that will be used in the project. The contractor then marks up the estimated cost by a certain percentage to cover overhead costs and profit.

In a competitive bidding environment contractors' desire is to submit a bid at the highest price that will win the award with a comfortable margin for profit. Therefore, contractor's overall strategy must be directed toward the acquisition of a sufficient volume of business at a sufficient profit to achieve the firm's objective. As Yanoviak (1985) stated strategy combines the art of and science of making important decisions which involve a high degree of uncertainty. A competitive bidding strategy can help contractors identify the contractor's optimum mark up for each job to bid. Yanoviak further indicated that formulation of a successful bidding strategy needs maintaining records of bidding activities of competitors so that an evaluation can be made each time a bid is to be submitted. Referring to the records, a contractor can quickly determine the bidding patterns of his competitors. Another input for the strategy, according to Yanoviak, is the "spread", the difference between the low bid and the second low bid. Often referred to as "money left on the table", it usually illustrates the intensity of competition among bidders.

Yanoviak (1985) stated that, for each project which contractors bid, there is an optimum mark up which will enhance the contractors' possibilities of getting the job at a respectable profit. Data to be used in analyzing the optimum mark up should be available from the contractor's own cost estimating records and tabulation of previous bid results. Several factors directly impact on a contractor's optimum mark up, but those which are most significant, as Yanoviak argued, are number of bidders and size of job. He indicated that optimum bid amount decreases with increasing number of competitors and increasing project size.

3.3.1.2. The Cost Estimating Process

Akintoye and Fitzgerald (2000) indicated that contractors undertake cost estimating, predominantly for construction planning purposes including the preparation of tenders and cost control of projects during the execution stage and to a lesser extent for construction

projects evaluation. But, most of the time cost estimating by contractors is geared towards pricing bills of quantities which are prepared in accordance with a standard method of measurement. The process of cost estimating is very important as it enables contractors to determine what their direct costs will be and to provide a bottom line cost below which it would not be economical for them to carry out the works.

3.3.1.2.1. Inputs to the Cost Estimating Process

This section gives a comprehensive but not exhaustive list of information items and inputs to the estimating process.

a) Contract Documents

The contract document, which comprises the General and particular conditions of contract, technical specifications, drawings, estimated bill of quantities, method of measurement and other supporting documents, should be analyzed thoroughly during the cost estimation as it influences the process and the out come of the estimates.

b) Project Scope Statement

It provides a list of deliverables and acceptance criteria for the project.

c) Construction Method Statement

After having a clear picture of the project through site visits and the contract document the next crucial step in the process of cost estimation is the preparation of construction method statement. Construction method statement details the methods of carrying out every project activity. According to Tadesse (2006), the statement should clearly indicate the skill and number of man power required, type and specification of equipment required, quantity and quality of materials required, proposed working crew, estimated crew productivity, estimated duration for completion and expected defects and remedial measures.

d) Project Works Break Down Structure

As important as preparing the method statement for the estimating process is breaking down the works to be estimated in to work tasks, (Plither 1992). A work task, some times called a work activity is a specific item of work that can be clearly identified in such a way that its resource requirement, commencement, content and completion time can readily be recognized. The work break down structure (WBS) shows the hierarchy of a project. It helps in establishing suitable work tasks, their relationships and the future schedule. The different

levels and components of the WBS are also important for facilitating the budgeting and controlling processes.

e) Project Works Coding System (Activity codes and cost codes)

Project coding system and related detailed statements of work; provide an identification of the description of the work in each WBS component.

e) Commercial data base

This helps in providing resource cost rates for labor, materials and equipments, (PMBOK guidelines, 2004). Historical information and project files if maintained properly can provide detailed information for developing cost estimates.

3.3.1.2.2. Estimating Techniques

Available cost estimating techniques range from extremely detailed cost break downs to overall cost analysis used for comparison and control purposes, (Hendrickson, 2003). Many standard text books and research papers on cost estimating have identified several techniques. Among these, the most commonly used techniques are presented below.

a) The Standard Estimating Procedure or Traditional Method.

As Akintoye and Fitzgerald (2000) argued, the standard estimating procedure, in which the cost of construction (Labor, material plant, sub contractors) are established and to which a allowance for overheads and profit is added, is a method used by many construction companies. This technique which is also referred to as bottom up estimating by PMBOK guidelines 2004, involves estimating the cost of individual work packages or individual schedule activities with the lowest level of detail. The detailed cost is summarized or ‘rolled-up’ to higher levels for reporting and tracking purposes. The technique employs two methods for preparing estimates:

Total quantity method: In the total quantity method, an item of work is divided into five subdivisions of materials, labor, plant, overheads and profit. The total quantities of each kind or class of material or labor are found and multiplied by their individual unit cost. Similarly, the cost of plant, overhead expenses and profit are determined. The costs of all the five sub-heads are summed up to give the estimated cost of the item of work.

Unit quantity method: In the unit quantity method, the project work is divided into as many work-packages or activities as are required. The total quantity of work under each item is taken out in the proper unit of measurement. The total cost per unit quantity of each item is analyzed and worked out. Then the total cost for the item is found by multiplying the cost per unit quantity by the number of units. This method has the advantage that the unit costs on various jobs can be readily compared and that the total estimate can easily be corrected for variations in quantities.

b) Analogous Estimating

Analogous estimating means using the actual cost of previous similar projects as the basis for estimating the cost of the current project (PMBOK guidelines, 2004). It uses expert judgment and it is most reliable when previous projects are similar in fact, and not just in appearance. Ostwald (2001) named this method "comparison method". Ostwald indicated that using this method, contractors will avoid estimating from zero bases of information and adding or deducting begins with a selection of the boundary estimates. The lower or upper bound is the reference to either add or deduct costs for elements that are known. Akintoye and Fitzgerald (2000) noted that the comparison with similar past projects can be based either on personal experience or on documented facts.

c) Probability Approaches

As usually prepared, estimates represent an average concept, (Ostwald, 2001). Nor does the estimate reveal anything about the probability of the expected values. It uses information that is called certain, or deterministic. The recognition that cost is a random variable leads to the concept of range estimating. A random variable is a numerically valued function for the outcomes of a sample of data. According to Ostwald (2001), finding the mean or standard deviation, for example, using sample information gives a random variable. This notion introduces an important improvement to single valued estimating. The range method involves making three estimates for each major cost element. Then a most frequent or modal estimate value is assigned for each cost element. This forms the basis for range estimating.

d) Parametric Estimating

Parametric estimating is a technique that uses a statistical relationship between historical data and other variables to calculate a cost estimate for a scheduled activity, (PMBOK, guide lines, 2004). But as Koenigseker (1982) pointed, parametric estimating is not used much by contractors due to the fact that it is not intended for the creation of detailed estimates, (Cited by Akintoy and Fitzgerald, 2000). Akintoy and Fitzgerald indicated that this method could assist contractors to verify the accuracy of their detailed cost estimates produced by any of the conventional techniques and to determine the approximate value of the project in order to make a decision on whether or not to tender for the project.

e) Other Techniques

Akintoye and Fitzgerald (2000) noted that other estimating techniques includes usage of soft wares, using simple arithmetic formulas or complex statistical formulas, using published price information, sharing information from other construction firms, guessing and intuition.

3.3.1.2.3. Estimating the Direct Costs and Overhead Costs

A cost estimate is made up of different cost categories which include direct and indirect costs. Each cost category should be properly assessed during the cost estimation stage.

I. Estimating Direct costs

As Chikatra (2001) indicated the direct cost of a work-package or an activity in a standard work-unit can be estimated using the following relation ships:

Direct cost = Direct material cost + Direct labor cost + Direct equipment utilization cost...[3.1]

Direct material cost is the total cost of materials required to execute a unit of specific activity in a project.

Material unit cost = \sum (Material consumption quantity standard x Material's unit price).....[3.2]

Material consumption standard is the quantity of material required to execute a unit of specific activity or work including allowances for wastages and material unit price is defined

as the estimated all-in price of the unit quantity of an item, delivered at the project site which includes price at source, wastage costs, transportation costs and taxes involved.

Direct Labor cost is the cost of labor that is incurred to execute a unit of specific activity in a project. According to Ostwald (2001), the unit of time for calculating labor cost can be hour, day, month or year. But hour is the most commonly used unit. In calculating the direct labor cost contractors need to calculate the direct labor hourly cost which is the total hourly cost of labor crew required to execute a specific activity, (Tadesse, 2006). According to Tadesse, in estimating direct labor hourly cost the contractor shall obtain the number of labor, skill and labor utilization factor (UF) required for executing the activity from his construction method statement as well as the labor basic salary and labor index from his previous records and the labor market.

$$\text{Direct labor hourly cost} = \sum (\text{No of labor} \times \text{Basic salary} \times \text{Labor index} \times \text{UF}) \dots \dots \dots [3.3]$$

Labor index is a multiplying factor of the basic salary which represents the additional benefits a worker gets such as over time payments, annual leave pay, severance pay, bonus and other benefits. UF is used for calculating the contribution of a crew member who is assigned to two or more activities. The direct labor unit cost can be computed in two ways, either by using worker's productivity standards or estimated hourly crew productivity as indicated below.

$$\text{Direct labor unit cost} = \text{Direct labor hourly cost} / \text{hourly crew productivity} \dots \dots \dots [3.4]$$

$$\text{Direct labor unit cost} = \text{Direct Labor hourly cost} \times \text{Worker's productivity standard} \dots \dots \dots [3.5]$$

The two formulas are similar except in that Worker's productivity standard is the effort in man-hours needed for accomplishing a unit quantity of work, while Hourly crew productivity is the crew output or quantity of work per unit hour. According to Ostwald (2001) man-hour is the out put by a worker, executing a specific activity for one hour. (Example 3hr/m² for form work activity). Worker's productivity standards and hourly crew productivity can be obtained from records or past performance data, national and international performance standards, commercially available database, expert advice, field research, manufacturers'

recommendations, project team knowledge and experiences, and time and motion studies so on, (Tadesse, 2006 and Ostwald 2001). In Ethiopia, according to Tadesse (2006), even though there are no reliable collected data or research, there are basically two proposed performance standards, Construction Performance Standard developed by the Ethiopian Building Construction Authority and EBCS 14: Building Construction output Standards in Ethiopia, developed by the Ministry of Works and Urban Development.

Direct Equipment cost is the cost of equipment that is required to execute a specific activity in a project. According to Tadesse (2006), in order to calculate the direct equipment cost contractors need to calculate the direct equipment hourly cost which is the total hourly cost of equipment crew required to execute a specific activity. In estimating the direct equipment hourly cost the contractor shall obtain the number of equipments, capacity and equipment utilization factor and the equipment hourly cost.

In calculating the equipment hourly cost the contractor may execute the project works using either owned or rented equipments. If owned equipments are assumed, contractors need to calculate hourly owning costs, operating costs and operator's cost. On the other hand if rented equipments are assumed the hourly rental rate shall be considered. As Tadesse (2006) indicated equipment hourly cost can be computed as:

$$\text{Direct equipment hourly cost} = \sum (\text{No of equipment} \times \text{Hourly cost} \times \text{UF}) \dots \dots \dots [3.6]$$

The estimation of equipment hourly rate involves the estimation of equipment owning and operation costs:

$$\text{Equipment rate per hour} = \text{owing cost per hour} + \text{operating cost per hour} \dots \dots \dots [3.7]$$

Where, Owing cost = Depreciation

Operating cost = Fuel cost + Maintenance cost + Major repair cost + Operator's cost + Tyre replacement cost (for rubber tyred equipment).

In cases where equipment is assigned to work for two or more working crews, the utilization factor shall be calculated to indicate its contribution in each working crew. Hourly equipment crew costs can be obtained from the manufacturers' manual or past performance data of previous projects. Accordingly the equipment direct cost will be:

$$\text{Direct Equipment cost per unit work} = \text{Direct equipment hourly cost} / \text{Hourly crew productivity}$$

II. Indirect costs

The indirect costs are detailed at the time of estimation of project costs (Chikatra, 2001). The estimator uses various methods for absorbing these indirect costs in to production costs. These costs can be charged (or added) to the direct costs on a proportionate basis. In some contracts, most of the indirect costs are priced under the preliminaries section of the bill of quantities and the balance is distributed proportionately in the remaining items of the bill of quantities.

There is no tailor made solution for sharing of indirect costs. The methods vary from project to project and from company to company. But according to Chikatra (2001) the most widely used method is the absorption costing technique, where the overhead costs are absorbed using predetermined absorption rate which is obtained by dividing the total over head costs to the projects total direct costs.

As Tadesse 2006 stated indirect costs are calculated as a percentage of the direct unit costs. Accordingly:

➤ Site over head costs= $K_1 \times$ Direct unit cost.....[3.8]

Where $K_1 = \text{Total site overhead cost} / \text{Total project direct cost}$

➤ Head office over head costs= $K_2 \times$ Direct unit cost.....[3.9]

Where $K_2 = \text{Annual head office over head costs} / \text{Average annual direct cost turn over}$

Indirect unit cost= $\text{Site over head costs} + \text{Head office over head costs}$[3.10]

3.3.1.3. The Pricing Process

The tender sum combines a cost estimate and mark-up, where mark-up comprises an allowance for general overhead and profit, (Plither, 1992). Tenders are based on a detailed analysis of the project and other factors in addition to the detailed costing. Tendering is the process where by a contractor, given the net cost, converts this to the sum what will actually be submitted to the client. At this stage the principal discussions are concerned with the profit and risk, together known as the margin or the mark-up. In order to determine the margin an assessment of the probabilities of over or under estimation of the costs is made. Another factor to be taken into account at the tendering stage is the financial effect that taking on the contract may have payment for work completed is almost always in arrears and therefore a contractor who has yet to make sufficient profit on a contract to meet those arrears must provide sufficient working capital to keep the work going until that stage is reached. Working capital has either to be borrowed at the cost of the interest rate or else be provided from company resources.

Shash (1995) emphasized that in determining the mark up amount, contractors need to consider, the degree of risk, type of job, current work load, project size, type of contract, project duration, uncertainty of the cost estimate, project cash flow, availability of equipment, the degree of difficulty associated with the project, the need for work, contract conditions, anticipated value of liquidated damage, owner's identity and completeness of the tender document.

3.3.2. The Construction Budget

The project budget is a planning document which reflects the financial plan of the project activities, with specific goals clearly out lined along with the costs expects to be incurred, (Chikatra, 2001). The primary purpose of having a budget is to assign financial targets and resources to each activity to form the basis for controlling performance and to make participants of the project cost conscious. Cost budgeting, in projects, involves aggregating the estimated costs of individual schedule activities or work packages to establish a total cost base line for measuring project performance (PMBOK guidelines, 2004). As Plither (1992) indicated, the budget is also used to determine the amount of liquid cash that will be required over the various periods of a construction work. In general the project budget integrates

monetary objectives, responsibilities and allocated resources. The base of the budget is the project plan and the schedule of work.

In construction projects, both owners and contractors prepare budget. But contractors' budget is resource-cost and earned value or revenue oriented budget, (Chikatra, 2001). It includes monthly or quarterly financial statement of income and expenditure and forecast of financial statements of projected balance sheet, cash flow, profit and loss and performance measuring baselines. Contractors, in preparing a budget, may encounter numerous problems. Among these the major one, as Chikatra (2001) argued, is frequent changes of production costs with market trends or inflation. Therefore the project budget needs to be reviewed regularly as it can not take care of all eventualities and unforeseen circumstances.

3.3.2.1. Inputs to a Construction Budget.

a) Work Break Down Structure.

The project works break down structure (WBS) provides the relationship among all the components of the project and the project deliverables. The project break-down process enables splitting of the project work in to hierarchical work-break down levels which represent an identifiable job which consumes time and resources. The process assists to identify activities, so that duration and cost of the activities can be identified and correlate the activities and work items with budgeted earned value. The work break down levels used in the cost budgeting should match with those used during the cost estimating or the levels used during ht estimating process should form the basis for those used for preparing the budget.

b) Cost Accounts or Codes

Codes are used to identify the cost data connected with each activity or work package. In developing or implementing a system of cost accounts, an appropriate numbering or coding system is essential to facilitate communication of information and proper aggregation of cost information. Particular cost accounts are used to indicate the expenditures associated with specific projects and to indicate the expenditures on particular items throughout an organization.

c) Activity or Work Package's Cost Estimates

The cost estimate for each schedule activity with in a work package or other work break down levels are aggregated to obtain a cost estimate for each work package or work break-down level. Chikatra (2001) stated that for budgeting and accounting purposes, production costs and earned sales values are identified for each activity or work break down level. Production costs are obtained by summing the direct and indirect costs associated with the activity which are also identified during the cost estimating process. The earned value or the activity contract value is the value of the work done which the client has agreed to pay for the satisfactory completed works. In addition to cost amounts, information a material quantities and labor inputs with in each job account is also typically retained in the project budget.

d) Project Schedule.

The project schedule includes planned start and finish dates for the project's schedule activities schedule mile stones, work packages and control accounts. According to PMBOK guidelines (2004), this information is used to aggregate costs to the calendar periods when the costs are planned to be incurred.

e) Contracts

The contract documents specify mode of payment for work completed which is used for forecasting cash flows.

3.3.2.2. Components of Project Budget.

The project budget integrates and summarizes the project functional budgets. As Chikatra (2001) indicated, the text of a typical project budget summarizes the following:

a) Revenue or Earned Value Budget.

This is the anticipated value of work planned or the sum payable to the contractor, as a result of valuation of completed works in accordance with prearranged contract values. It reflects the monthly or quarterly financial targets for the over all project and its break down for each work-package. The first step in the preparation of revenue budget is to develop the monthly physical targets to be achieved which are stated in the form of planned progress of work package. The earned value of work done can then be computed by assigning standard sales

value for each work package, and then aggregating this, month wise to derive the work done earned value.

b) Production Cost or Expenditure Budget.

The production cost budget details the resources and costs planned for achieving phased objectives. The expenses of accomplishing planned tasks in a given accounting period can be determined by summing up the standard or estimated costs of corresponding work packages constituting the tasks. Production cost budget can be further split up in to direct costs and indirect costs.

c) Cash Flow Forecasts

Despite the progressive payment stipulations in the contract, the client as well as the contractor do face liquidity problem. The project funding pattern can be determined by making a cash flow forecast that predicts the monthly net effect of the cash inflow and out flow. Contractors cash flow forecast is more detailed and complex as it has to cater for cash in flow as well as cash out flow. While the contractor's cash in flow or project revenue receipts can be easily derived from the revenue or sales budget, the difficulty arises in determining cash out flow. Some of the aspects that need to be incorporated in cash out flow budget, according to Chikatra (2001), are working capital requirement, major equipment costs, material costs man power mobilization costs and temporary works and utility installations construction costs.

The detailed working of the month-wise cash out flow for each of the above items of expenditure is a tedious process. However, the cash out flow on account of the above expenditures can be determined by splitting up the expenditures in to one time costs and time related costs and then preparing monthly schedule of expenditures. The difference between cash in flow and cash out flow, month wise gives the cash flow pattern.

d) Profit Forecasts

In construction projects, gross operating profit at a given point of time can be determined by evaluating the difference between the total revenue and the total cost of production at that point of time. Generally the gross profit can be forecast by plotting the cumulative work

revenue and production costs in the project time-related 'S' curve chart. The schedule of project work forms the basis for plotting the 'S' curve. The extent of profit or loss at a given point of time can be estimated by measuring the vertical gap in monetary value between the cumulative revenue and production cost curves.

3.3.3. The Project Cost Controlling and Monitoring Process

An efficient project cost control system should generate information that can improve the productivity of resources, enable understanding of time and cost behavior, provide early warning of ensuring dangers, update resources planning and costing norms (Chikatra 2001). Contractors who execute contracted works bear the cost of input resources and site expenses which include the cost of labor, materials, machinery and capital. Besides, contractors, incur expenditure on interest on loans, statutory payments, insurance, and depreciation and so on. Accordingly they need to control their finance in order to meet the cash requirements from time to time.

The cost control by contractors, as Plither (1992) argued, has three functions. Accordingly, the first and most important day-to-day use of a cost control system is that of drawing immediate attention to any operation that is being pursued on a contract and is proving to be uneconomic to the contractor. The second function of a cost control system is to provide feedback to the estimator who was responsible for pricing the tender in the first instance and will be responsible for pricing more tenders in the future. Thirdly, cost control system will provide data for the valuation of variations that may occur during the course of the contract. The maintenance of proper cost records enable contractors to strengthen the case for build up of new rates.

3.3.3.1. The cost controlling process

Planning, executing, accounting, monitoring and re-planning (when necessary) is a continuous controlling process that goes on till the completion of a project. As Chikatra (2001) noted, the steps involved in any controlling process are:

- Defining the parameters to be controlled
- Establishing base lines for measuring performance

- Accounting performance which includes measuring recording and reporting performances and deviations
- Monitoring performances.

Accordingly, the performance parameters used in the cost controlling process are project revenue (earned value), project costs and work package costs, while revenue budget, project budget and standard work package costs being the performance base lines. The control parameters and the performance base lines are used to control costs at the different hierarchical levels of a project. The first two parameters enable the controlling of costs in relation with the project time schedule.

3.3.3.2. Project Revenue or Earned Value Control.

Earned value or revenue at the project site is made up of the value of work done at predetermined prices, the cost of materials inventory to be paid at an agreed percentage of the purchased cost and the value of work changes or over contracted quantities (Chikatra, 2001). The revenue control aims at the analysis of variances for the work executed. As Chikatra noted, variance in the total revenue comes from contract price variance and work done quantity variances. The revenue and variances accrued from a variation order is not added to the revenue from items of the original work contract and each is treated separately. The work done quantity variance determines the changes in the quantity of work done from the budgeted quantities of work, while the price variance shows the difference between the standard/contract prices and actual prices. The budgeted revenue variance is accounted, as Chikatra (2001) indicated by:

- a) Measuring quantities of work done and its value.
- b) Stock taking of direct materials and other payable items at the site.
- c) Evaluating change orders.
- d) Comparing the revenue actually obtained and the revenue planned as per budget and analyzing the causes of variations

As Chikatra indicated the revenue variance can be computed as

- Budget variance = Budgeted or forecast revenue – Actual revenue (approved).....[3.11]

- Work done value or quantity variance = Budgeted or forecast revenue – Contract value of work done.....[3.12]
- Price variance =Contract value of work done – Actual (approved) revenue.....[3.13]

3.3.3.3. Budgeted cost control

Budget relates costs with time progress. Control of budgeted cost involves evaluation of cost variances by comparing actual costs with budgeted costs to determine cost over run / under run and computing schedule variances by comparing budgeted costs of work scheduled and work performed to determine deviations from the schedule. Further, it is used to estimate project cost at completion (PMBOK guidelines, 2004).

One of the budget monitoring or cost performance measurement techniques is the earned value technique (EVT). According to PMBOK guidelines (2004), the earned value technique compares the cumulative value of the budgeted cost of work performed (earned) at the originally allocated budget amount, to both the budgeted cost of work scheduled (planned) and to the actual cost of work performed(actual).

Budgeted cost of work scheduled (BCWS) or planned value (PV): Planned value is the budgeted cost for the work scheduled to be completed on an activity or work break-down structure component up to a given point in time. It shows what is planned for execution

Budgeted cost of work performed (BCWP) or earned value (EV): Earned value is the budgeted amount for the work actually completed on the schedule activity or work break down structure component during a given time period.

Actual cost for the work performed (ACWP) or actual cost (AC): Actual cost is the total cost incurred in accomplishing work on the schedule activity or WBS component during a given time period. It is obtained by summing up the actual cost incurred to date in progressing work package.

The AC must correspond in definition and coverage to whatever was budgeted for the PV and the EV, (PMBOK guidelines, 2004). The different parameters of the EVT technique, as described by Wibshet, 2004 are shown in Figure 3.3.

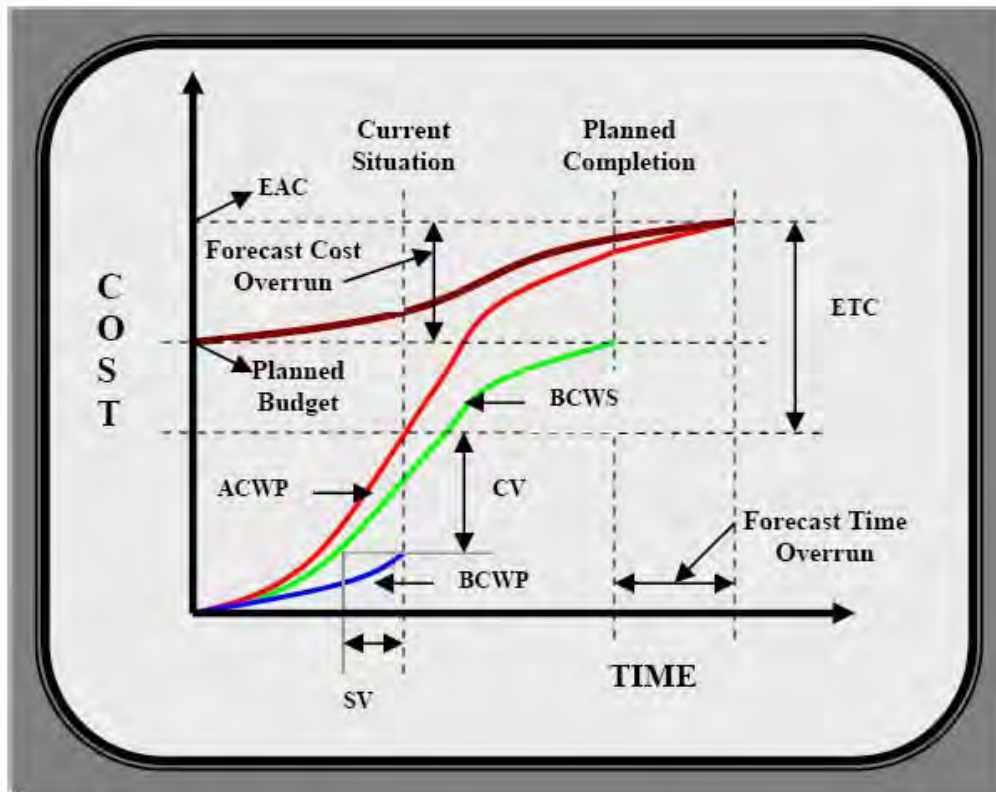


Figure 3.5 Cost and Schedule Variances, Source Wibshet, 2004

An important part of the cost control is to determine the cause of variance, the magnitude of the variance and to decide if the variance requires corrective action. The earned value technique involves developing these key values for each schedule activity, work package or control account. The PV, EV and AC values are used in combination to provide performance measures of whether or not work is being accomplished as planned at any given time. According to PMBOK guidelines (2004), the most commonly used measures are cost variance (CV) and schedule variance (SV).

Cost variance: CV is computed by comparing actual performance with the budgeted cost of work performed. CV equals EV minus actual cost (AC).

$$CV = EV - AC \dots \dots \dots [3.14]$$

The cost variance at the end of the project will be the difference between the budget at completion (BAC) and the actual amount spent.

Schedule variance: SV is computed by comparing budgeted cost of work performed with the budgeted cost of work scheduled.

$$SV = EV - PV \dots \dots \dots [3.15]$$

Schedule variance will ultimately equal zero when the project is completed because all of the planned values will have been earned. If schedule variance is positive, then the project is ahead of its planned cost, i.e. earned value of the work performed is higher than the planned or schedule earned value. If it is negative than the planned or schedule earned value. If it is negative then the project is behind its planned cost.

3.3.3.4. Direct Cost Variance Analysis

Direct cost control is exercised by comparing the actual direct costs with the standard direct costs, analyzing the reasons for variations and applying corrective measures to improve the performance. Standards in construction are usually set by estimating the possible out come from the historic performance and experience or in special cases from the use of work measurement techniques, (Plither, 1992).

Initial budgets for work packages are established from estimated costs and the variance between the actual and estimated is calculated. If the actual cost is greater than the standard then the variance is negative or unfavorable. In the reverse situation the variance is favorable. The prerequisite for controlling direct costs is that the standard must be expressed in terms of the physical and monetary value of each item of resources needed for accomplishing the work package. Like wise the actual direct cost must aim out measuring the actual quantity and cost of the resources in the same unit as that of the standard. Direct cost control involves the evaluation and analysis of the following variances, (Chikatra, 2001).

a) Material Cost Variance

This is the difference between the estimated/standard direct materials cost and the actual materials cost for the same out put.

- Materials cost variance = standard materials cost – Actual materials cost.....[3.16]

The direct materials cost variance is made up of materials usage variance and materials price variance.

Material cost Variance = Material usage variance + Materials price variance[3.17]

Where,

Materials usage variance = Standard rate (standard quantity – Actual quantity)

Materials price variance = Actual quantity (standard rate – Actual rate)

b) Labor Cost Variance

This is the difference between the estimated/standard direct labor cost and the actual labor cost for the same out put.

- Direct Labor cost variance = Standard materials cost – Actual labor cost[3.18]

The two components of labor cost variances are:

Labor operating or productivity variance = standard rate (Standard time – Actual time), and

Labor rate variance = Actual time (Standard rate – Actual rate)

c) Direct Equipment Cost Variance

This is the difference between the standard equipment cost and the actual equipment cost for accomplishing the same out put. The equipment variance analysis is

- Equipment cost variance = Standard equipment cost – Actual equipment cost[3.19]

The equipment cost variance be further split up in to

Equipment productivity variance = Standard rate (Standard time –Actual time), and

Equipment rate Variance = Actual time (Standard rate – Actual rate)

3.3.4. Relationship between Estimating, Budgeting and Controlling

Budget and project cost control are inseparable. Project cost control aims at controlling changes to the project budget. Budgetary control makes use of budget and budgetary reports to compare the actual with budgeted standards to bring out the extent of variations, it reasons out the causes for significant variations, brings out actions necessary to achieve objectives and provides a base for its revision when necessary.

As Hendrickson (2003) stated, for cost control and monitoring purposes, the original detailed cost estimate is typically converted to a project budget, and the project budget is used subsequently as a guide for management. The final or detailed cost estimate provides a baseline for the assessment of financial performance during the project. Specific items in the detailed cost estimate become job cost elements. Expenses incurred during the course of a project are recorded in specific job cost accounts to be compared with the original cost estimates in each category. Thus, individual job cost accounts generally represent the basic unit for cost control. Alternatively, job cost accounts may be disaggregated or divided into work elements which are related both to particular scheduled activities and to particular cost accounts. To the extent that costs are within the detailed cost estimate, then the project is thought to be under financial control.

In addition to cost amounts, information on material quantities and labor inputs within each job account is also typically retained in the project budget. With this information, actual materials usage and labor employed can be compared to the expected requirements. As a result, cost overruns or savings on particular items can be identified as due to changes in unit prices, labor productivity or in the amount of material consumed.

For project control, contractors would focus particular attention on items indicating substantial deviation from budgeted amounts. In particular, the cost overruns in the material and labor would be worthy of attention. A next step would be to look in greater detail at the various components of these categories. Overruns in cost might be due to lower than expected productivity, higher than expected wage rates, higher than expected material costs, or other factors. Even further, low productivity might be caused by inadequate training, lack of required resources such as equipment or tools, or inordinate amounts of re-work to correct quality problems.

3.4. Project Works Break Down and Coding Systems.

Chikatra (2001) quoted “construction projects are best managed by work packages which in turn are best planned and monitored by activities”. Further, he states that a project planner uses activity as the common data base for planning and monitoring progress of projects works. The inputs of labor, material and machinery needed for execution of each activity

enable preparation of resource fore casts. The activity's sale or contract price is used to determine the income and cash-flow fore casts. Halpin and Woodhead (1976) also argue that project works are disaggregated/broken down for the purpose of time and cost control (E.g., the project activity and the project cost account). Project work break down levels are applied to a given project depending up on the Master project plan type, the nature and complexity of the project and expected degree of control.

3.4.1. Construction Projects Work Break Down Levels

The project work break down process involves splitting of the project works in to manageable constituents arranged in a hierarchical order till the desired level. Chikatra (2001) breaks projects in to five work breaks down levels, which comprise, the sub project level, the task level, the work package level, the activity level and the operational level, arranged in a descending hierarchical order. Halpin and Woodhead on the other hand, defined four levels of project work break down. The levels defined by Halpin and Woodhead, arranged in a descending hierarchical order are the activity level, the operational level, the process level and the work item level.

But, splitting a project further below the activity level, for the purpose of project management (scheduling, cost and time control, for instance) is not important, as the levels are more linked to construction methods and technological processes which are more related with field agents (site engineers, foremen etc.). For instance, if a project activity is broken further in to operations, the manager or the planner will be involved into unnecessary details as a construction operation is closely related to the means of achieving an end product (the construction method) rather than the end product itself. For the purpose of this research projects are broken in to four work break down levels.

a) Sub project level

According to Chikatra, sub-projects are derived by dividing the project work into independent large volume mini projects or task groups. In projects, each group of major works which can progress in a systematic manner, with out interference form other works can be termed as a sub-project. For instance, in a public Housing Project, each type of residential, educational and other types of buildings can be taken as a sub-project.

b) Tasks level

A project or sub-project work can be split up in to various tasks. A task is an identifiable and deliverable major work, (Chikatra, 2001). It is an entity in it self and can be preformed with out much interference from other tasks. In the public housing project considered above, the construction work in each residential building can be grouped under foundation, superstructure and finishing work tasks.

c) Work-packages level

A project's work task can be further subdivided in to one or more work packages. A work package contains a sizeable, identifiable, measurable, costable and controllable package of work. As Chikatra argued, work packages form a common base for linking the common functions in project management including designing, estimating planning, organizing, directing and controlling. In the project master plan or the work control plan each work package is assigned performance objectives which are generally stated in terms of completion period, standard cost, resource productivity standards and the standard sale price. For the public housing project mentioned above, the foundation work task can be broken into three work packages, footing, foundation columns and grade beam work packages.

d) Activity level

A work package can further be broken down in to various activities. An activity is a time and resource consuming element of a project normally defined for the purpose of time and cost control by a planner, estimator and scheduler or cost engineer. An activity is usually related to the production of a physical segment of the required finished product. It may refer to an actual item of work listed in the itemized bill of quantities or to portion of the project defined by contract drawings. In some cases an activity refers to a servicing function such as the procurement of materials or inspection, where the time impact of the servicing function on the project is to be considered. In the example project, a footing work package can be split in to shuttering, reinforcement and concreting activities.

In general, for the purpose of project planning, estimating monitoring and controlling, work packages or activities should be used as common data base. The inputs of labor, material and machinery needed for execution of each activity enable preparation of resource forecasts. The

activity price is used to determine the income and cash-flow forecasts for the work packages and the entire project. The activity base is vital for monitoring progress of the project work.

3.4.2. Codification in construction projects

Many categories of work are involved in a construction project. Each activity or category of work defined for a project would be identified by a pre-defined code specific to that activity. Also for each project activity an estimate of materials, labor, equipment and so on is necessary. Hence, it is important to keep some sort of order to prepare a scheme that segregates those descriptions and costs. According to Ostwald (2001), an art of classification, known as coding, gives an advantage in estimate preparation, cost control and assurance and data management. Ostwald further indicated that codes are the glue between designing, estimating, purchasing, scheduling and cost controlling and accounting. In particular, coding systems are adopted to provide a numbering system to replace verbal descriptions of items. These codes reduce the length or complexity of the information to be recorded. Common coding systems also aid in the retrieval of historical records of cost productivity and duration on particular activities.

One system for organizing and coding construction work, which has been in existence since the 1970s, is the MASTERFORMAT system, developed by the Construction Specifications Institute (CSI) of the United States and Construction Specifications Institute of Canada, (Hendrickson, 2003). MASTERFORMAT provides a standard identification code for nearly all the elements associated with building construction. The sixteen major divisions in the UCI/CSI MASTERFORMAT system are shown in Table 3.1.

Table 3.1 Major divisions in the UCI\CSI MASTERFORMAT

No	Title	No	Title
1	General requirements	9	Finishes
2	Site work/site construction	10	Specialties
3	Concrete	11	Equipment
4	Masonry	12	Furnishings
5	Metals	13	Special construction

6	Wood and plastics	14	Conveying system
7	Thermal and moisture prevention	15	Mechanical
8	Doors and windows	16	Electrical

It involves a hierarchical coding system with multiple levels plus key work text descriptions of each item. In the numerical coding system, the first two digits represent one of the sixteen divisions for work. In the latest version a third digit is added to indicate a sub division within each division. Each division is further specified by a three digit extension indicating another level of subdivisions. Sub divisions of Division 3 (Concrete) of the MASTERFORMAT code which can provide a comprehensive view of the classification scheme are presented below.

031.00 Formwork

031.10 Form work material and accessories

031.20 Fabricating, erecting, stripping and moving form work

031.21 Foundations

031.22 Slabs on grade

031.23 Columns

031.24 Walls

031.25 Elevated slabs

032.00. Reinforcing

032.10 Reinforcing materials and accessories

032.20 Sorting and placing reinforcing

032.21 Foundations

032.22 Slabs on grade

032.23 Columns

032.24 Walls

032.25 Elevated slabs

033.00 Placing and finishing

033.10 Materials and accessories

033.20 Concrete placement

033.21 Foundations

033.22 Slabs on grade

033.24 Columns

033.24 Walls

033.25 Elevated slabs

Code extensions are added in addition to the digits in the basic MASTERFORMAT codes for more specific information such as location of work or responsible organization. For example a typical extended code might have the following elements.

0534.02220.21. A.00.cf34

The first four digits indicate the project for this activity which refers to an activity on project number 0534. The next five digits refer to the MASTERFORMAT secondary division (site preparation under the division –site work). The next two digits refer to specific activities defined with in this MASTERFORMAT code. The next character refers to the block or general area on the site that the activity will take place. In this case block A is indicated. Finally the characters cf34 refers to the particular design element number for which the work is intended, column number 34 on block A, for instance.

3.4.3. Project Cost Coding Systems

All cost control systems depend on a project cost code (Pierce, 2006). Information on cost and performance is collected and represented in the form of lots of numbers, labor hour worked, money spent etc. Consequently, there should be a means of classifying the numbers in to categories meaningful. A coding system provides such a means. According to Pierce, while there is no such thing as one standard project cost coding system, most numbering schemes contain all or most of the following elements.

Project number: usually the project number corresponds to a specific contract that the company has undertaken. Area or location of project, job type or other sub classification code can be assigned together with the project number.

Work type: This is probably the most essential part of the code from the standpoint of detailed project cost control. It is this number that separates different materials and trades on

the job. The starting point for a work type code is the project work break down codes which were discussed in section 3.3.

Type of expense category: .Expenditures in a project can be recognized as one of the four types of spending; labor, material, equipment and sub contract costs. These classifications are sometimes called cost distributions.

According to Chikatera (2001), the basic database for cost accounting is the work-package. For the accounting purpose, construction or direct costs and indirect costs of each work-package are developed. After computing the above costs by work package or jobs, actual costs incurred for a work package is compared with the standard or budgeted costs. On the other hand, for correlating the work-package earned value with its production cost the work package is split in to work items as listed in the bill of quantities. Generally the bill of quantities sequential code is adopted to account for the earned (sale) value of each item. By this way, costs of a work package are correlated with the contract value of each work package as well as each item of BOQ.

CHAPTER FOUR

THE RESEARCH DESIGN AND METHODOLOGY

4.1. Overview of the Research Process.

Owing to the desire of the researcher to undertake an applied research, which aims at contributing knowledge towards solving a practical problem, the research started by investigating a practical problem. Experience, observations and results of previous studies form the ground for formulating the research problem statement and the research questions.

Based on the problem statement, first an extensive review of literatures on the subject was undertaken. Next, an investigation on the existing project cost management practice of national contractors was carried out, with the view of discovering whether it matches to what has been discussed in the literature or not. Results of the investigation gave clear picture of the existing practice and assisted in identifying the major shortcomings and limitations of the practice, which were used to propose the improvement interventions.

4.2. The Study Approach and the Research Instrument

As described earlier, the motivation for the research has emanated mainly from observations and experience of the researcher serving as site engineer and project manager in different public construction projects. But, the need for proving the existence of the problem demanded a methodological approach for collecting, analyzing and interpreting data related to the subject under consideration. Accordingly, questionnaire survey was selected as the research instrument owing to its suitability to the level of information required, the high number of participants and cost and time limitations. Informal interviews were also conducted with some contractors while distributing and collecting the questionnaire form. The interview provided additional information, either which were not included in the questionnaire or which participants failed to mention on the form.

4.3 The Research Questionnaire Design

The research investigated the cost management practice of domestic contractors in depth by addressing questions focused on the three cost management functions, estimating and tendering, budgeting and cost controlling. The questionnaire design was based on a

combination of an extensive review of literatures dealing with project cost management and the researcher's knowledge on the current cost management practices of national contractors. The questionnaire form, which was accompanied by a covering letter, consisted four parts. The questionnaire was a mix of structured (closed) and unstructured (open) type of questions. Basically, the questions were structured or closed type questions. But, in view of obtaining as much information as possible, participants were encouraged to give additional information or comments on the open spaces provided under each question.

4.4 Rationale of the Research Questionnaire

The questionnaire form consisted four parts, organized in a logical pattern which resembles the cost management process. The first part contained general questions regarding category and class of the firms and average annual business turn over amount. Information on annual turn over amount was intended to reveal whether or not the practice changes with increasing amount. Moreover, as the research is focused on building projects, participants were asked to indicate the proportion of building projects out of total projects undertaken. This part also contained questions focused on the types of construction contracts and project procurement methods often practiced by the contractors. As discussed in the literature review section procurement methods and contract types have a direct influence on the cost management process and the financial out comes of projects.

In the second part, participants were asked to indicate and/or rate factors considered during the decision to submit a bid or not, number of tender offers submitted annually, success rate of the tender offers and factors contributing to the low success rate of tender offers, if their success rate is low. Also, questions regarding the amount of mark-up introduced for profit, risk and other expenses and basis used for deciding the magnitude of the mark-up were included in this part. Moreover, participants were asked whether they obtain the anticipated profit amount from projects at completion and to identify and/or rate major factors responsible, on a five point scale, if they don't.

Part three, which is on cost estimating practices, included questions on the estimating techniques commonly used by the contractors, information items and sources used during estimation. Besides, participants were asked to indicate the method/s employed for

incorporating overhead costs into a tender sum, ratio of site and company overhead costs to total project direct cost, method of incorporating taxes and risk allowances and the application of softwares for facilitating the cost estimation process. A question in this part has also explored current practices related with enclosing estimate supporting details with the tender document and keeping records of the details of the estimates.

The fourth and last part of the questionnaire contained questions focused on project costs budgeting and controlling. Accordingly, participants were asked whether they prepare budget for their projects and to indicate the components it comprises, if they do. It also contained questions regarding cost controlling and monitoring methodology adopted by the firms, frequency of checking projects' profitability, methods employed for accounting labor and equipment costs. Finally, the contractors were asked to reveal their opinion on the importance of having a project's activity classification and coding system, for facilitating effective management of project costs. This is owing to the fact that the different functions of cost management system are best facilitated by implementing project works break down system (WBS) and project works coding system.

4.5 The Research Sample Selection

The population of the study was limited to general (GC) and building (BC) contractors of class III and above. This is mainly due to the fact that these contractors, most of the times, involve in multi million projects which demand the implementation of an integrated and efficient cost management system. Participants of the research were selected from contractors' lists published by Ministry of Works and Urban Development (MoWUD) and Ethiopian Contractors Association. The list published by MoWUD contained name and address of 44 class I construction firms. As the research is focused on domestic building contractors, four foreign and two road contractors were excluded from the selection list. Moreover, three contractors whose head office is located out of Addis Ababa were also excluded. One contractor could not be reached. Accordingly, the questionnaire was delivered to the remaining 34 contractors, in person. Two contractors were not willing to collect the questionnaire. Of the 32 class I contractors who have collected the questionnaire form, 26 contractors have returned completed questionnaire and one contractor has returned partially completed form.

Regarding class II contractors, among the three contractors available on the list published by Ethiopian Contractors Association, two contractors have up graded their class. The remaining contractor could not be reached. Hence, the research sample did not include class II contractors. Concerning class III contractors, among the thirty three contractors which were available on the list, the questionnaire was delivered to fourteen contractors and among these, seven have returned completed questionnaires. The relatively small number of class III contractors, is mainly due to difficulties in reaching the firms with the telephone address available on the list.

4.6 Method of Analysis

The descriptive statistics is a method of analysis which provides a general overview of results. Frequency distribution, which shows the frequency of observation of each response to each variable under investigation, is used to analyze the result of some questions.

Rating scale is one of the most common formats for questioning respondents on their views or opinions of an event or attribute. In this regard, participants were asked to indicate the importance or level of influence of factors (research variables) by rating them on a four point scale, (0= Not important 1 = fairly important 2 = important and 3 = very important). This statistical technique is intended to establish the importance of the factors. Each of the factors has been assigned an importance index or severity index, to help rank them according to their importance, as follows.

$$\text{Importance index} = \left(\frac{\sum_{i=0}^3 W_i \times f_{xi}}{3n} \right) \times 100 \dots\dots\dots[4.1]$$

- Where W_i = weight given to i^{th} response; $i = 0, 1, 2, 3$
- f_{xi} = Responses frequency
- n = total No of responses (34 responses)

For example the importance index of the first factor “size of the new project” listed in table 5.10 is calculated as shown in Table 4.1.

Table 4.1 Example for computing importance index of 'size of the project'

Level of importance	Weight (W_i)	Response frequency (f_{xi})	($W_i \times f_{xi}$)
Very important	3	21	63
Important	2	12	24
Fairly important	1	0	0
Not important	0	1	0
Sum		34	87
Note : importance index = $87 \times \frac{100}{34} = 85.29\%$ (34 x 3)			

The ranking format was used for analyzing question in which respondents were asked to place a set of attitudes in ranking order, indicating their importance priorities or preferences.

CHAPTER FIVE

ANALYSIS AND DISCUSSION

5.1. General

5.1.1. Questionnaire Response Rates.

As mentioned in section 4.5, the questionnaire form was distributed to 46 contractors (32 class I and 14 class III) out of which 34 contractors returned completed forms, representing a 73.91% response rate. The response rate for class I contractors, 84.38%, is very good when compared to the response rate of class III contractors, which is 50%, Table 5.1.

Table 5.1 Frequency distribution of sample firms

Class	Questionnaires issued	Responses	% of response
Class I	32	27	84
Class III	14	7	50
Total	46	34	74

5.1.2. Respondents Characteristics

Of the responding 34 contractors, 19 are building contractors (BC) and 15 are general contractors (GC). The average annual business turnover for the majority, 56%, of the surveyed building contractors is above 15 million birr, while all of the responding general contractors have an annual turnover amounting more than 25 million birr, Table 5.2.

Table 5.2 Average annual turn over amount in birr for the past five years

Average annual turnover amount (million birr)	Building Contractors		General Contractors	
	Frequency	%	Frequency	%
Below 5	1	5.3	-	-
5-15	6	31.6	-	-
15-25	5	26.3	-	-
25-50	1	5.3	5	33
Over 50	3	15.8	4	27
Not responding	3	15.8	6	40

Initially, analysis of survey data was aimed to be carried out by grouping the contractors in two categories, large contractors and medium to small contractors, based on their annual business turnover amount. But, as a significant number of the participants were not willing to notify their annual turnover amount, the analysis is done with out considering turnover amount of the contractors. Moreover, owing to the small number of class III contractors which participated in the research and also due to the low response rate from them, it was not possible to carry out the analysis based on class of contractors.

An assessment was made to reveal the proportion of building projects among the projects undertaken by the firms over the past ten years. For 90% of the surveyed building contractors, building projects constituted more than 75% of their total work load. Building projects constituted major portion of the total work load of the general contractors too. As shown in Table 5.3, these projects represented more than half of the total work volume for 60% of the surveyed general contractors.

Table 5.3 Ratio of building works to total work volume

Ratio	Building Contractors		General Contractors	
	Frequency	%	Frequency	%
Below 25%	-	-	2	13
25-50%	-	-	4	26
50-75%	2	10	7	47
75-100%	17	90	2	13

The research indicated that contractors' approach to the acquisition on award of contracts is predominantly competitive. 91% of the surveyed contractors procured most of the projects they have undertaken so far, through tendering while the remaining contractors mainly by negotiation. As shown in Table 5.4, among the contractors who procure projects through tendering, 97% secured more than half of their work load through the competitive or open tendering, which involves tough competition.

Table 5.4 Percent of works obtained through competitive bidding

Range	Response distribution	
	Frequency	Percentage
Below 50%	1	2.94
50 – 75%	9	26.47
75 – 100%	21	61.76
Total	31	100

The findings of the survey indicated that majority of the contractors have been involved in projects in which the fixed price type of construction contract is used. As shown in Table 5.5, 68% of the participants are familiar only with the BOQ type of contract, while another 29% have exercised lump sum contract in addition to the BOQ type. BOQ and lump sum contracts, which are versions of the fixed price contractual arrangement, need detailed assessment and estimation of relevant cost elements before commencement of work and efficient cost controlling during construction as they, in most situations, place the economic risks on contractors. Cost reimbursement contracts on the other hand, transfer economic risks to the owner, most of the times.

Table 5.5 Common contract types in the construction industry of Ethiopia

Types of contract often encountered	Response distribution	
	Frequency	Percentage
BOQ only	23	68
BOQ and lump sum	10	29
BOQ and cost plus	1	3
Cost plus	0	0

5.2. An Overview of the Research's Data Analysis Process

This section is inserted for the sake of creating continuity of discussion between the research's objectives and questions which were mentioned in section 1.3 and the subsequent analysis and discussions.

The major objectives of the research were investigating the project cost management practice of national contractors, identifying the shortcomings and drawbacks associated with the practice and forwarding interventions to improve the practice.

The research questions which were formulated in view of achieving these objectives were:

1. What are the existing project cost management practices?
2. What are the shortcomings, drawbacks and limitations of the practices?
3. What are and how wide are the impacts of the drawbacks and limitations?

Analysis of the data collected through the research questionnaire has addressed these questions. For the purpose of relating the research questions with the analysis and also for the ease of presentation, the results and discussions are presented under three major themes. Section 5.3 presents the first theme which is linked with research question No 3. Accordingly, it presents the research findings with respect to the performance of national contractors on the two major goals of construction firms: success rate of tender offers and profitability of contracted projects. Moreover, analysis of factors responsible for low performance of contractors with regard to these goals, are presented.

Section 5.4 and 5.5 are devoted to the second and third themes, which are related to research questions No 1 and 2. Section 5.4 presents the findings and discussions made on the tendering practices of contractors. The Tendering process, from the point of view of contractors is a three staged process. The first stage (the bidding process) involves making decision on whether to submit a bid or not, upon invitation from clients. If it decided to bid, the tendering process is taken to the next stage in which the total cost of carrying out the work defined in the contract document is estimated in detail. At this stage much of the cost calculation is carried out and a cost is derived upon which the tender is based. Once the estimated cost of the project is determined, the estimating process is completed and the third stage, pricing, which involves preparing price quotation or tender price, begins. In this section current practices related with each stage, bidding, cost estimating and pricing are presented.

Section 5.5 presents the results of the investigation made on the cost controlling practice and the relevant discussions. Figure 5.1 depicts the overall procedure used for analyzing the research data and addressing the research questions.

5.3. Contractors' Performance With Regard to Two Major Goals.

Construction firms' survival and growth is closely linked with the acquisition of sufficient or optimum volume of work or number of projects. These firms usually obtain works through tendering. Hence, their performance in bids or tenders is decisive for ensuring continuity of works. On the other hand, the sustainability of their business and fulfillment of firm and project objectives is directly related with the amount or level of profit obtained from the projects. Therefore, contractors' business strategy should be directed towards securing optimum volume (with regard to organizational capacity) of work and ensuring that the projects are generating sufficient amount of profit.

In this regard, an assessment was made to reveal the average number of tender offers made by the contractors annually and the associated rate of success. The survey results indicated that the tender offer success rate for majority of the contractors is low. As shown in Table 5.6, the success rate for 80% of the contractors is below 50%, and 67% among these, have a success rate lower than 25%.

Table 5.6 Success rate for submitted tender offers

Range	Response distribution	
	Frequency	Percentage
Below 25%	18	54
25 – 50%	9	26
50 – 75%	7	20
75 – 100%	0	0

The major contributing factor for this, as indicated by the contractors, is tough competition followed by low pricing. Though, it has not an exaggerated influence like tough competition and low pricing, level of accuracy of the estimates, is ranked third with an importance index

of 32.26. Factors beyond contractors’ control (which are associated with wrong or unethical practices) are ranked fourth, Table 5.7.

Table 5.7 Mean rank of factors responsible for low success rate

S/N	Factors	Mean	Importance index	Rank
1	Tough competition	2.74	91.33	1
2	Low pricing	2.18	72.66	2
3	Shortage of time	0.84	27.96	5
4	Inaccuracy of the estimates	0.98	32.26	3
5	Performance history of the company	0.61	20.43	6
6	Factors beyond their control	0.90	30.11	4

Regarding contractors’ performance with respect to profit, the survey finding revealed that national contractors face serious challenges with regard to securing adequate profit or the expected profit amount from most of their projects. The survey results, as shown in Table 5.8, indicted that 85% of the surveyed contractors have obtained below 75% of the amount assumed or planned during submission of tenders. Quite a significant proportion of these, 48%, secured less than 50% of the anticipated amount, from most of the projects they have completed.

Table 5.8 Ratio of actual profit to estimated profit

Ratio of profit obtained	Response distribution	
	Frequency	Percentage
100% or above	0	0
100 – 75	5	15
75 – 50	15	44
Below 50%	14	41

Several factors, with in and out of contractors’ control contribute to the inefficiency with respect to profit. In this study contractors were asked to rate the magnitude of influence of eleven factors on the level of profit obtained from projects, on a 5 point scale. Table 5.9 presents contractors' opinion. Price escalation is the first ranking factor in the order of influence, with an importance index of 90. Additional cost incurred due to the delays caused by owners and/or consultants is ranked second, with an importance index of 71.55.

Table 5.9 Mean Rank of factors responsible for low profit

S/N	Factors	Mean	Importance index	Rank
1	Poor definition of project scope(type, size, complexity) during tendering	1.28	32	11
2	Inaccuracy of tender estimates prepared during the tendering stage	2.68	67	5
3	Inadequate resource/ financial planning	2.81	70.3	3
4	Lack of project cost controlling system	2.73	68.3	4
5	Technical difficulties	1.66	41.38	9
6	Price Escalation	3.59	89.66	1
7	Work change orders	1.76	44.0	8
8	Problems related with contract document	2.21	55.25	7
9	Delays due to reasons related with clients and/or consultants	2.86	71.55	2
10	Deviations in labor productivity between assumed and actual	2.55	63.8	6
11	Weather conditions	1.55	38.79	10

In adequate resource and financial planning practice is the highest ranking factor, among the factors, which in most circumstances are with in contractors' control. On the overall it is ranked in third place with an importance index of 70.3. It is followed by nature/lack of cost controlling system at construction sites and inaccuracy of the tender estimates prepared during the tendering stage, with importance index values of 68.3 and 67 respectively. Deviation between estimated and actual labor productivity, which results owing to errors committed

during estimation (unrealistic productivity assumptions) or during construction due to failures in controlling productivity, is tied to 6th position with an importance index of 63.8. Problems associated with contract documents (insufficient drawings and specifications) have moderate impact on the level of profit. Work change orders, technical difficulties and weather conditions have insignificant effect on the level of profit from projects.

As discussed above, inadequate financial planning, lack of effective cost controlling system and inaccuracy of the estimates made at the tendering stage are identified as major causes of low profitability of projects, next to price escalation and additional expenses incurred due to delays. Among these top five factors, the first two in most circumstances, are beyond the control of the contractors and they can do little to avoid them or minimize their effect. But, the effect of the remaining factors can be minimized by employing an integrated cost management system which starts from the cost estimating stage and spans upto the completion stage.

The two issues discussed above, success in tenders and profitability of projects, are major concerns of a cost management system, from the point of view of contractors. Contractors' cost management system should comprise all the tasks or functions that are required to ensure that optimum volume of work or number of projects are acquired and that the project are generating sufficient profit. In this regard, the research has investigated contractors' tendering, cost estimating and controlling practices in view of identifying the factors responsible for the low performance on tenders and profit and other shortcomings associated with each function. As Kodikara and Mccaffer (1993) stated, estimating and tendering, planning and scheduling, cost and financial control taken together would form an integrated construction cost management system.

The next sections will present findings related with project tendering, budgeting and cost controlling practices.

5.4. Tendering/Pre-Contract Practices

5.4.1 Bidding Practices

In the bidding process, there are two important decisions that contractors have to make every time they receive an invitation for a quotation, whether to bid or not and the amount to bid. Both decisions are complex, because the consequences of each alternative are uncertain. Accordingly, their bidding process should complement all the tasks that enable systematic and effective selection of projects to tender for and submission of competent bid. Under certain circumstances, contractors may find it prudent to withdraw from bidding and save expenses of preparing a bid.

5.4.1.1 The Decision to Bid or Not to Bid

The decision on to bid or not, should follow evaluation of the several factors related with the internal and external environment of the firm. In the bidding process, for each potential contract, logical consideration must be given to several factors. In this study an assessment was made to investigate the importance of seven factors on contractors' decision to bid or not. Results are presented in Table 5.10. The highest ranking factor which governs the decision to submit or not a tender offer is size of the project under consideration. This follows evaluation of available company resources, as the requirement for resources increase proportionally with size of projects.

Location of the project is ranked in second position with an importance index value of 78.43. Location can be viewed from two perspectives, the first being the distance of the project from the head office and the second proximity/nearness of the project to other projects under construction or familiarity of the contractor with the location. If the new project is in an area where other company projects are being undertaken, this may be advantageous as a result of existing local knowledge and possible coordination and collaboration over resources. Also, contractors should make sure that the project is reached with available transportation facilities.

During the decision, an assessment should be made to discover that whether the addition of new project interface with current work loads. Volume and stage of works at hand, which are ranked third and fourth, are related to this and are closely linked with efficient and optimum

utilization of available company resources. The survey indicated that similarity of the project under consideration with previously undertaken projects has moderate influence on the decision of the contractors to bid or not. Availability of technical personnel, equipment and experienced sub-contractors to undertake special project requirements should also be investigated. But this factor, as shown in Table 5.10, has insignificant influence on contractors' decision.

Table 5.10 Mean rank of factors considered on the decision to bid or not

S/N	Factors	Mean	Importance index	Rank
1	Size of the project under consideration	2.56	85.29	1
2	Volume/monetary value of projects at hand	2.32	77.45	3
3	Stage of projects at hand	2.03	67.65	4
4	Location of project under consideration	2.35	78.43	2
5	Available company expertise and equipments	1.18	39.4	6
6	Similarity of projects with previous projects	1.47	49.02	5
7	Not to be idle	0.91	30.39	7

Other factors which need serious attention, but which are not considered by the contractors includes market condition (what other jobs are being bid at the same time), competition, current and projected economic conditions and their influence on labor and material price, owners' ability to pay for the completed works, degree of risk, type of contract, time span of proposed project, bonding capacity of the company and possibility of winning previously submitted offers.

The study indicated that, irrespective of the importance given to the above mentioned factors, the average number of tender offers made annually by majority of the contractors is high. As shown in Table 5.11, the average number of tender offers submitted annually by 56% of the surveyed contractors is between 16 and 30. This in other words means that these contractors submit a minimum of two tender offers per month.

Table 5.11 Average number of tender offers submitted annually

Range	Response distribution	
	Frequency	Percentage
5- 15	13	38
16 – 30	19	56
31 – 50	2	6
Above 50	0	0

5.4.1.2. The Decision on the Optimum Bid Amount

As indicated in section 5.1.2, national contractors' approach to the acquisition on award of contracts is competitive bidding. In the competitive bidding market contractors need to have bidding strategy which is directed towards the acquisition of sufficient volume of work at a sufficient profit level. As mentioned in section 5.3, the tenders' success rate for 80% of the contractors is below 50% and it is below 25% for 67%. Tough competition is the highest ranking factor responsible for the low tender success rate. This, indeed, is in agreement with the fact that competitive bidding involves decision making under uncertainty where one of the greatest source of the uncertainty is the unpredictable nature of competitors. Infact, each bid submitted for a particular job is determined by a large number of factors other than competition, including the estimate of the direct and indirect costs, the confidence that the contractor has in his estimate and the immediate and long range objectives of the contractor. Competition, being inherent characteristics of a tendering process, can not be eliminated. But, its effect can be minimized by formulating and employing a bidding strategy which considers the nature of competitors and nature of the project under consideration. Competitive bidding strategy helps to identify contractors' optimum mark up for each job to bid.

Formulation of a successful bidding strategy entails keeping results of previous bids. Contractors should maintain records of bidding activity in their market place so that an evaluation can be made each time a bid is to be submitted. Data to be used in analyzing the mark-up should be available from their own estimating records and tabulation or records of previous bid. Referring to these records, contractors can quickly determine the bidding patterns of their competitors. After deciding the mark-up or profit amount with the

consideration of different factors (project characteristics, financial goal, market conditions, etc) the amount can be optimized in view the expected competition (number of bidders). Moreover, the mark-up amount can further be optimized in view of size of the job. Yankoviak (1985) indicated that optimum mark-up for a project decreases as number of bidders and size of project increases.

5.4.2. Cost Estimating Practices

Once it is decided to bid, the tendering process is taken to the next stage. Cost estimating enable contractors to determine what their direct and overhead costs will be and to provide the bottom line below which it would not be economical to carry out the proposed work. The impact of inaccurate cost estimating is significant. Overestimation results in high tender prices which could lead to tender being unacceptable. On the other hand, underestimation lead to a situation where contractors incur losses or obtain a profit lowered than the expected amount, from awarded contracts. The accuracy and quality of the cost estimate prepared for a particular bid is affected by the estimating method employed, the identification and valuation of the various direct and indirect cost elements, information items and sources used, assessment and evaluation of risk, consideration of specific and contextual factors related to the project and so on. In this study an investigation was carried out on the entire cost estimating practices of contractors, in order to identify the factors responsible for inaccurate cost estimates. Results are presented in subsequent sections. As mentioned in section 5.3, inaccuracy of cost estimate is indicated by the contractors as one of the major factors responsible for low success rate of tender offers as well as for low profit from contracted projects.

5.4.2.1. Cost Estimating Methods

The study revealed the wide application of the standard or the detailed estimating technique, for preparing cost estimates. The standard estimating technique is a method in which the costs of construction (material, labor, equipment and sub contract costs) are established and to which an allowance for overhead costs, other indirect costs, risks and profit is added. As shown in Table 5.12, this technique is the sole technique used by all of the surveyed contractors for pricing tenders.

The application of different estimating methods can improve the quality and accuracy of an estimate. But, as shown in Table 5.12, no contractor uses probabilistic or statistical estimating method in addition to the standard estimating method. Akintoye and Fitzgerald (2000) have stressed the effect of the estimating method on the accuracy of an estimate. According to them, the standard estimating method is deterministic (single point number) in its nature and fails to cope with the realities of today’s world, which involves uncertainty due to the risk of overestimating or underestimating.

Table 5.12 Cost estimating techniques/methods

S/N	Estimating techniques	Response distribution	
		Frequency	Percentage
1	Standard/detailed estimating	34	100
2	Analogous estimating	-	-
3	Parametric estimating method	-	-
4	Probabilistic/statistical(Range estimating)	-	-

Curran (1990), suggested the use of range estimating by contractors as part of their estimating process, (cited by Akintoye and Fitzgerald, 2000). The range estimating approach can be described as a decision supporting technique, which is an adjunct to the standard or detailed estimating. Range estimating can provide information on the probability of cost over run, on how large the over run can be and on what to do to eliminate or reduce cost over run risk, including how much contingency to add to the estimate in order to reduce any residual risk to an acceptable level, (Akintoye and Fitzgerald, 2000). The parametric estimating method is also among the probabilistic/statistical estimating methods. Since it is useful to establish an order of magnitude project value and helpful when time is at premium, the method could assist contractors to verify the accuracy of their detailed cost estimate produced by the conventional methods and to determine the approximate value of the project, in order to make a decision on whether or not to tender for the project.

5.4.2.2. Information Items and Sources Needed For Preparing Estimates

Kamal M. (1994) stated that the preparation of a detailed estimate for a particular project using the standard estimating methods requires collecting, retrieving and manipulating massive amount of independent but related cost and non cost data and information in a time effective manner. Accordingly, major information items and sources that are required for developing cost estimates were identified from literature and contractors were asked to rate the magnitude of their importance on their estimating process.

As shown in Table 5.13, information on materials' price is the most important information item for cost estimation. This is due to the fact that, as indicated by the contractors, the material cost component constitutes large proportion of the total project cost and it is highly subjective to price fluctuation. Information on equipment cost, labor rate, equipment productivity and labor productivity standards are ranked from 2nd to 5th respectively, with importance index values of 83.08, 82.35, 78.68 and 76.34. Among the direct cost components, sub-contract costs receive relatively less importance during cost estimation. Further, the survey revealed that, information on overhead costs and potential risks finds modest attention from estimators.

According to the results of the survey, contractors assign relatively high importance or give much attention to the information items that are related to the estimation of direct cost components. Infact, the direct cost components constitute major proportion of the total project cost. However, the production of accurate cost estimates also requires the evaluation of numerous low visibility factors which can challenge and affect accuracy, in addition to the highly visible or direct cost elements. As Shash (1995) emphasized, estimating the highly visible cost elements, especially the direct costs and to a certain extent overhead costs, is scientifically structured and entails the application of basic mathematical operations. However, this is not enough to assume a reliable estimate. The estimator must assess and evaluate the effect of low visibility factors which are associated with project specific and/or contextual factors and the occurrence of some events during the construction period that might alter the estimated cost. Identification and evaluation of the effects of factors such as project location, project type, availability of skilled labor, statutory regulations and so on, is an important criterion that determines the quality of an estimate.

Table 5.13 Mean rank of information items and sources needed to prepare cost estimate

S/N	Information items	Mean	Importance index	Rank
	A) Cost related items			
1	Material prices	3.85	96.32	1
2	Labor rates	3.29	82.35	4
3	Equipment costs	3.32	83.09	3
4	Sub contract prices	2.59	64.71	11
5	Site overheads costs	2.85	71.32	9
6	Company overhead costs	2.85	71.32	9
	B) Project specific and contextual items			
7	Project location	3.0	75.0	8
8	Skilled labor availability	3.06	76.47	6
9	Statutory regulations	1.68	41.91	15
10	Risks	2.41	60.29	12
	C) Information Sources			
11	Historical data from previous works	2.27	53.23	14
12	Site visit	2.65	67.32	10
13	Tender document	3.5	87.50	2
14	Labor productivity standards	3.03	75.34	7
15	Equipment productivity standards	3.15	78.68	5
16	Construction method statements	2.31	55.2	13

The survey results indicated that, during preparing estimates, contractors allocate high importance to the location of the project and availability of skilled labor in the vicinity of the project. The location of the project is of paramount importance in the arrival of a cost estimate. There are several location parameters that should be incorporated in cost estimates. First, the distance between the project location and the location of the contractor head office contributes to the project costing. If the project is located in a city distant from the contractor office, the contractor is obliged to arrange all necessarily accommodations to his employees. Mobilization and demobilization costs will also increase as the distance increases. Also, if the

location is in an area where other contractors' projects are undertaken, it may lead to escalation of resources price due to shortage or competition. Another location parameter is the familiarity of the contractor with the location either in the past or currently. If the contractor has active projects with in. or around the location of the new project under consideration, a reduction of costs might be exercised as a result of low mobilization cost and effective coordination over resources. Information on applicable governmental or statutory regulations that might impose additional costs on the contracts, receive modest attention from the contractors.

Tender document is identified as the most important, among the various information sources that are needed for cost estimating, followed by site visit. Historical data from previously undertaken projects, as shown in Table 5.13, receives relatively low attention from the contractors and hence, is not an important source of information. But, recorded data on actual production costs and productivity standards from previously undertaken projects can provide fairly accurate and reliable cost related information for the estimation of costs for new project bids.

5.4.2.3. Estimation of the Direct Cost Components

Estimation of direct project costs, which constitutes the bulk of the estimation process, entails pricing of material, labor, equipment and subcontractor costs. The development of estimates for material, labor and equipment costs requires information regarding resources' costs and productivity standards. As shown in Table 5.13 information on material costs, equipment costs and labor rates are identified as the most important information items for developing estimates. Despite their high level of importance, currently there are no established systems which provide contractors up to date cost of resources. As shown on Table 5.14, lack of accurate data on resources prices is the second ranking responsible factor for inaccuracy of cost estimates. Along with the resource costs, information on resource consumption and productivity standards is required for developing cost estimates. Lack of accurate data regarding materials consumption standards, labor and equipment productivity standards is identified by the contractors, as the primary cause of inaccurate cost estimates, with a severity index of 95.2. This is due to the fact that the Ethiopian construction industry lacks standardized estimating manuals such as those published by R.S. Means in the United States,

which provide recent data on materials’ price and consumption standards, labor rates and productivity and equipment costs. The standards currently in use in Ethiopia, Construction Performance Standard developed by Ethiopian Building Construction Authority and the National Building code of Ethiopia prepared by MoWUD, are not up-to-date and are not in a suitable form for efficient or systematic use.

Table 5.14 Mean rank of sources of inaccurate cost/price estimates

SN	Potential causes	Ranking by contractors						I.I.	rank
		1 st	2 nd	3 rd	4 th	5 th			
1	Lack of accurate data about resources’ price	7	15	7	2	2		91.7	2
2	Lack of accurate data regarding material’s consumption standards, labor and equipment productivity standards.	15	6	5	6	2		95.2	1
3	Insufficiency of information provided by drawings, specifications etc	6	5	7	3	8		68.2	4
4	Estimation of overhead costs.	0	4	8	9	8		59.4	5
5	Difficulty in forecasting potential risks/unable to quantify them.	6	3	7	11	8		75.3	3

5.4.2.4 Estimation of Overhead Costs

Overhead (OH) costs are major components of projects’ construction price. These costs are those charges that can not be attributed exclusively to a single activity. As a significant portion of these costs (company OH) are not component of the actual construction work, but incurred by the contractor to support the work, they are difficult to estimate and incorporate in to a tender sum. 35% of the surveyed contractors identified OH costs as the most difficult item to estimate, among the various project cost components. OH costs, though they are claimed to be difficult to estimate, the survey also indicated that the effort by contractors to identify and incorporate them in a tender price is low.

Regarding the OH costs allocation method, the survey results revealed that 52% of the contractors introduce allowances for overhead costs by magnifying the total estimated direct cost or activity direct unit cost by an arbitrarily selected percent. The survey results further indicated that, the percent is decided based on intuition, experience and expected competition. In some cases it is included in the gross percentage which is added to account for profit and risk. The remaining 48% disclosed that they first identify relevant overhead cost items with the associated costs and then distribute the total sum to each project activity.

In construction cost estimation, overhead costs are classified into company/general OH and site/project OH. In this study participants were asked whether or not they are familiar with the classification and majority, 87%, stated that they are familiar. But only 48% of the contractors use the classification as a base for estimating the over head costs. As mentioned above, 52% add an allowance for the OH costs arbitrary, with out segregating the two. Site overhead and company overhead cost have many possible components that can be considered. Among the common site OH cost items, project staff costs, project office running expenses, transportation expenses and mobilization/demobilization costs are considered and estimated in detail, almost by all contractors who estimate OH costs in detail. However, expenses related to the specific project under consideration and which are associated with bonds, guaranties, insurance etc are considered by very few of them. Regarding, the proportion of site OH costs, as shown in Table 5.15, they represent between 11% and 15% of total project direct costs, for majority, 53%, of the contractors. The calculated overall percentage* is 14.23%. Wibshet (2007) reported that the ratio of site overhead costs range from 11.4 to 14.6%, of the direct project cost, 13% being the average ratio.

Table 5.15 Ratio of site overhead costs to total project direct cost

Percentage of site overhead costs		Response distribution	
Range	Mid – point	Frequency	Percentage
Below 5%	5	2	18
6% - 10%	8	11	32
11% - 15%	13	18	53
16% - 25%	20	3	9
Above 25%	25	0	0

Company OH, which is also called general administrative OH, includes all costs incurred by the contractor in maintaining the firm in business, but are not directly related to specific project. These costs, unless estimated properly, can challenge contractors. As Assaf (2001) stated, company OH is one of the main reasons why so many contractors are unable to realize profit or even to stay in business. The survey results indicated that the ratio of company OH cost to direct project cost for most of the surveyed contractors is high. As shown in Table 5.16, 87.5 % of the contractors have a ratio above 5%. The calculated overall percentage* is 11.22%. This figure is much higher than the ratio reported in the literature. Wibshet (2007) reported that, the current average ratio of company OH to the construction cost, in Ethiopia is 4.5 %.

Table 5.16 Ratio of company OH to total project direct cost

Percentage of company OH costs		Response distribution	
Range	Mid – point	Frequency	Percentage
Below 5%	5	4	12.5
6% - 10%	8	13	40.63
11% - 15%	13	10	31.25
16% - 25%	20	4	12.5
Above 25%	25	1	3.13

The major company OH cost items considered by the contractors are office running expenses, head office staff wages, office rent and/or building depreciation, office furniture and equipment and transportation expenses. Here also, expenses related with tenders, insurances, bonds, guaranties, bank interests do not receive attention from majority of the contractors.

In general, the results indicated the need for change in overhead cost estimating practices. Inaccurate estimation of these costs can challenge contractors with regard to winning tenders and/or obtaining anticipated profit from contracted projects. Over estimation of these costs may result in high tender prices which force contractors out of competition during bid. Under estimation on the other hand can hamper them from realizing sufficient profit.

*Overall ratio of OH to project direct cost = $\frac{\sum (\text{calculated mid point percentage} \times \text{Percentage})}{100}$

5.4.2.5. Allocation of Risk Allowances

The identification, evaluation and quantification of risks and uncertainties is a major factor which affects the quality and accuracy of estimated costs. The main reason why risk exists in construction projects is because tenders are submitted ahead of construction taking place. Construction may not start for some time after a bid is compiled and then it may continue for some years into the future. All of this delay increases the uncertainty of the project conditions and hence increases the risk. For 30% of the surveyed contractors, risk allowance is the most difficult cost element to estimate and incorporate, among the different project cost components. Moreover, failure to incorporate risk allowance in tenders, owing to difficulties in forecasting and quantifying potential risks is third ranking responsible factor for inaccurate estimates, Table 5.14.

As shown in Table 5.5 earlier, the construction contract types that are widely used in the Ethiopian construction industry are the BOQ and Lump sum contract type. These contract types, which are versions of the fixed price contact type, impose or transfer most of the risk consequences to contractors. Hence, allowance for potential risks need to be incorporated in the estimates for such contracts, depending on the project characteristics (location type, size, complexity etc), economic conditions, experience on similar work and other particular factors. Of the surveyed contractors, 38% incorporate allowance for risks in their final tender estimate. The common method used by these contractors, for incorporating the allowance is adjusting or increasing the profit margin. Economic risk, which is related to escalation of materials price, is the major risk item considered by these contractors.

But, there are also other risks that contractors need to assume during estimation. Managing the project so that the productivity of resources allowed for in the estimate is achieved, bad weather and the interference with production and schedule that it may cause, the availability of materials for incorporation in the work, delays due to industrial disputes, the financial stability of the client, the performance of equipment, site conditions particularly sub surface ones, and change of scope to contracts as a whole or partially, are the major among the various risk items that need to be considered during estimating. Regarding changes to scope of project, even if the additional cost of the changed works can be reimbursed, it is often difficult to substantiate and thus cover all the costs of delay and reprogramming. Inflation is

another source of risk to be taken into account at the tendering stage. For projects of an expected duration in excess of one year, the use of formula based on published cost index, to measure the additional inflation cost, is suggested.

Concerning the allocation method, many text books in the area suggested the use of intuition, judgment and experience to determine the allowance to be included in the tender. Tadesse (2006) on the other hand indicated that all risks, whether they are political, contractual, technical or economical, finally results in increasing the price of resources. Accordingly, he suggested the use of different factors for each cost component (direct and indirect cost components); the factors determined based on available published cost indices and assumptions. The use of probabilistic estimating methods, like the range estimating technique can assist the decision on the amount of allowance to be introduced to account risks.

5.4.3. Tender Pricing Practices

The final stage of the tendering process is the pricing stage, where contractors, based on the estimated costs, prepare the tender price or quotation to be submitted. A tender sum combines a cost estimate and mark-up, where mark-up comprises an amount for profit, and depending on the nature of the project and risk allocation method, an allowance for risks and uncertainties. At the pricing stage contractors' objective should be submission of a bid with optimum mark-up that win the award with a comfortable margin for profit.

The survey indicated that contractors allocate mark-up or profit amount based on the final estimated project cost which is comprised of the direct and estimated overhead costs. As shown on Table 5.17, the ratio of the profit amount to total project costs for 55% of the contractors is between 11-15%. 10% of the contractors add more than 15% of the project estimated cost as a profit. The calculated overall percentage is 11.44%, a figure higher than the 6-8%, recommended by the National Building Code of Ethiopia (1995).

The decision on the magnitude of mark-up or profit to be introduced should be based on the result of assessment and evaluation of several factors related to the inside and external environment of the firms.

Table 5.17 Ratio of profit margin to total project cost

Range	Response distribution	
	Frequency	Percentage
Below 3%	0	0
4% - 7%	3	10
8% - 10%	8	26
11% - 15%	17	54
Above 15%	3	10

Table 5.18 presents data concerning factors considered by the surveyed contractors, to arrive at the amount of profit margin to be introduced. As shown in the table, market condition and expected competition are factors that are considered by majority of the surveyed contractors. Consideration of market condition entails assessing the construction market or volume of work available for the contractors in the industry. Consideration of competition, on the other hand, involves assessment of the contractors involved in the bid, their number, their pricing or bidding trends and other related information regarding them, which leads to formulation of a successful bidding strategy. Bidding strategy, as discussed in section 3.3.1.1, is formulated based on company's history of success with a range of margins and competitors range. Experience from previous tenders plays decisive role in formulating a bidding strategy. Based on such bidding strategy, contractors can determine the severity of the competition and determine the most competitive profit margin for a particular bid. Despite the fact that most contractors stated that they consider competition, experience from previous tenders which can provide a good deal of information on the competitors is used only by 32 % of the contractors.

As shown in Table 5.18, project characteristics do not have much influence on the decision made by majority of the contractors. Only 41.2% of the surveyed contractors take into consideration the size, type, and location of the project, while determining the mark up amount for a particular project bid. This could be owing to that project characteristics are well assessed and their effect well evaluated, either during the decision to bid or during the cost estimation.

Similarity of the project with previously undertaken projects has an influence on the decision of 23% of the contractors. The effect of contract period or the estimated duration of the project should be evaluated, while determining the mark-up amount. It is obvious that the larger the contract period, the higher the uncertainty of the occurrences of unforeseen events that may affect the accuracy of the estimate. The survey results indicated that contractors do not give much attention to the contract period, while determining the mark up amount. Only 9% of the contractors consider the contract period. 17.6% of the contractors add a constant percentage that does not change from project to project irrespective of market conditions, severity of competition and the project characteristics.

Table 5.18 Factors considered during the decision on profit margin

SN	Factors	Response Frequency	
		Frequency	Percentage
1	Market conditions /trend	24	70.6
2	Competition	24	70.6
3	Project type, size, complexity, location, monetary value	14	41.2
4	Experience from previous tenders	11	32.3
5	Similarity of the project with previous projects	8	23.5
6	Risks expected	12	35.3
7	Need for work	5	14.7
8	Contract period	3	8.8
9	Company fixed or predetermined margin	6	17.6

Generally, in determining the mark up amount careful consideration should be given to the factors mentioned above and other factors including possibilities of major errors that may have been made in estimating direct costs, the cost of financing the contract working capital, present work load, availability of resources, the need to keep specialist resources fully and continuously employed and so on.

5.4.4. Other Practices Related With Cost Estimation

Tax allowances are among the indirect cost components of a project. Taxes, as they are due, should be considered during estimation. 94% of the surveyed contractors add an allowance for taxes in their tender price. Table 5.19 shows the methods used by those who incorporate tax allowance.

Table 5.19 Bases used to incorporate tax allowances

S/N	Methods	Response distribution	
		Frequency	Percentage
1	As an overhead cost	11	34.37
2	As percentage of envisaged profit amount	17	53.13
3	Assuming a fixed amount	4	12.50

This research has examined contractors' practices related with enclosing estimate supporting details (cost break downs) with the bid document, keeping records of the details of the estimates, and using standard or off the shelf estimating software for cost estimation. Moreover, an assessment was made to reveal whether the contractors have their own standard estimating formats.

As shown in Table 5.20, most of the contractors, 79%, do not enclose the details of the cost estimates (cost break downs) with the bid document. But, enclosing the details is strongly recommended as it can serve as evidence in situations when contractors claim for cost revision or cost compensation. Regarding the practice on keeping records of details of the final estimates, 82% of the surveyed contractors maintain the details in computerized data base. This helps to facilitate the cost controlling process later, during the construction stage. Of the surveyed contractors, 67% have their own estimating formats. However, the formats used by most of the contractors are basically similar and are mainly used to estimate direct unit costs only (Material, labor and equipment costs). Moreover they are not organized in a way which facilitates the budgeting and cost controlling processes. The formats can not provide information on total resource requirements and total estimated costs.

Table 5.20 Contractors' practice on four selected issues

No	Description	Yes		No	
		frequency	%	Frequency	%
1	Enclose estimate supporting details (cost break down) with bid document	7	21.21	26	78.78
2	Keep a record of details of estimate in a computer database or other means	27	81.82	6	18.18
3	Have standard estimating formats	22	66.67	11	33.33
4	Use standard or off the shelf estimating soft wares for cost estimation	5	15.15	28	84.85

The application of standard software for cost estimating and tender pricing is not popular among national contractors. The survey revealed that no contractor use standard cost estimating software, except one who uses "CON.MIS", locally prepared estimating software. Excel spread sheet is used by the firms, its purpose mainly being for arithmetic check. The contractors were asked to mention the reasons why they do not use estimating softwares. Accordingly, 38% stated that they are unfamiliar with the softwares or do not have sufficient information about the benefits, where as 8% are familiar but lack expertise or skilled personnel. 19% of the contractors have the information but hardwares and softwares are expensive for them. The remaining 35% do not think that softwares will make significant difference in the estimation process. But, using standard softwares give advantages in estimate accuracy, reliability, speed and man hour saving.

5.5. Project Cost Controlling & Monitoring Practices

Once construction commences, contractors' focus should be directed towards controlling each project activity or operation, so that they are carried out according to the estimated and/or budgeted costs. Moreover, the controlling method or system should be one which is capable of indicating activities or operations which suffer inefficiency (either due to low productivity or under pricing) and identifying the causes of the observed inefficiency. Among the participants of this study, 52% stated that they have a standard system for tracking, recording, controlling and monitoring project costs. But, lack of an efficient cost controlling system at

construction sites was ranked fourth, among the factors responsible for low profit from projects, with an importance index of 68.3, Table 5.9.

5.5.1. Scope and Purpose of Cost Controlling

The research revealed that the cost controlling by majority of the surveyed contractors is entirely focused on and limited to generating information regarding profitability only. However, the scope of a cost controlling system should be broader than this and encompass other related functions/purposes. As mentioned in the literature review section, an efficient cost controlling system should provide early warning of uneconomical operations, give information that can improve productivity of resources and update resource planning and costing norms. Moreover, it should be able to provide feed back to the estimation process on actual productivity standards and production costs and also enable understanding of time and cost behavior. According to the results of the survey, the cost controlling by majority of the contractors, do not take these functions into consideration, rather it is mainly focused on checking profit. Of the surveyed contractors, 38% disclosed that, their controlling system is capable of tracking and indicating activities which suffer inefficiency and identifying causes of the observed inefficiency. 31% of the contractors use the reports of the controlling system to monitor the performance of labor and equipment resources. Among the major functions of a cost controlling system one is providing feed back to the cost estimation process and establishing historical cost and productivity database, for pricing future tenders. 18% of the contractors have a system which takes this function into consideration.

5.5.2. Cost Controlling Methodology

Any controlling process should follow the logical step which includes, defining the parameters to be controlled, establishing baselines for measuring performance, accounting performance which includes measuring, recording and reporting performances and deviations and monitoring performances. For cost controlling in construction projects, the budget forms the baseline for measuring and evaluating cost performances. The project budget is a major component of an efficient cost controlling system. Project cost control aims at controlling and monitoring changes to the budget. Control of budgeted cost involves evaluation of cost variances by comparing actual costs with budgeted costs, to determine cost over/under run.

In this study, 72% of the surveyed contractors stated that they prepare budget for their projects. Among these, 69% prepare budgets for both out flowing and inflowing cash, while the remaining 31% prepare inflowing cash budget only. The cash outflow budget of 65% of these contractors comprises material, labor and equipment requirements and associated costs. The cash outflow budget of the remaining contractors consist material requirements and costs only, mainly because the material component represent the largest proportion. Only 15% of the contractors incorporate overhead costs budget in the cash outflow budget. But, as indicated in section 5.4.2.4, these costs form more than 20% of the total construction costs in the projects undertaken by the contractors. Therefore, pertaining to their high proportion, they should get adequate and balanced attention from a cost controlling system. OH costs budget, which retains detailed description of each OH cost item with associated or estimated costs, is important for facilitating the controlling process.

The inflowing cash budget of all contractors is prepared based on the stipulated payments from clients or owners. No contractor includes revenue or income from other sources in the cash inflow budget. Advance payment, which is collected usually before commencement of construction, is one account in a cash inflow budget. It should be planned and utilized properly and effectively. 77% of the surveyed contractors prepare a separate expenditure schedule for the advance payment. The schedule shows cost accounts and cash amounts allocated to material, labor equipment and other expenses separately. The remaining contractors do not prepare program, rather simply distribute the amount uniformly through a certain period of time. Allocating of the sum in to different cost accounts is advantageous, as it forms a base line for controlling and monitoring expenses.

The budget, in addition to assigning financial targets and resource to each activity, it is important to forecast and determine the amount of cash or working capital that will be required over the various periods of a construction work. Since, considerable amount of money can be tied up in projects during construction, contractors need to maintain adequate cash reserve or working capital. The demand will be high, particularly when a high rate of working is achieved on contracts where clients do not meet valuations promptly. The forecast of money that will be received for works completed (cash inflow) should be compared with the estimated expenses for the works(cash outflow) and by taking the difference, contractors

can know how much money or working capital they have outstanding for any period of the contract. It will also indicate the time during the contract when the maximum amount of money will be outstanding. With number of projects operating at the same time, it will be important for contractors to forecast cash reserve, so that the outstanding capital is within the limits of the working capital of the company. The research findings indicated that only 20% of the contractors are accustomed to preparing working capital budget. Since, it is normally towards the end of a project that break even cost is achieved and consequently working capital is financed out of the surplus or the profit made, contractors need to have clear picture of the reserve or the capital to finance projects.

Budget and project cost control are inseparable. The primary purpose of having budget is establishing baseline for measuring, controlling and monitoring cost performance. Though 72% of the surveyed contractors claimed that they prepare budget for their projects, quite small portion of them use the budget for facilitating the cost controlling process. Analysis of the survey data revealed that only 35% of the contractors have a cost controlling system which is primarily based on budget.

One of the budget monitoring or cost performance measuring tools is the Earned Value Technique (EVT). This technique compares the cumulative value of the budgeted cost of work performed (earned) at the originally allocated budget amount, to both the budgeted cost of work scheduled (planned) and to the actual cost of work performed (actual). The technique has an advantage over the traditional cost controlling method, cost variance analysis, as it enables looking at the cost, schedule and work performance in a project, simultaneously. With the EVT, schedules are prepared and the costs are budgeted period by period for the whole project or work packages. As the project is executed, the work progress and the actual costs are tracked periodically and are compared to the planned schedules and budgets. The survey revealed that only 10% of the contractors employ this method for facilitating the cost control as well as time/schedule control.

The next stage of budgeted cost control is the direct cost variance analysis. Direct cost variance analysis is exercised by comparing the actual direct costs with the budgeted costs for a particular work package or activity and analyzing the reasons for variations. It aims at

improving productivity by minimizing the wastage of input resources and developing standards for costing future works. The methodology involves evaluation of materials price variance (which is composed of material usage variance and/or material price variance), labor cost variance (labor productivity variance and/or labor rate variance) and equipment cost variance (equipment productivity variance and/or equipment rate variance). This cost controlling methodology, as shown in Table 5.21, is pursued only by 16% of the surveyed contractors. 26% of the contractors use comparison of actual unit costs with contract unit prices. In situations where budgetary control or detailed cost controlling system is not available, such comparison on selected or particular work items of the project that seem to be vulnerable to inefficiency, can be an option.

Table 5.21 Methods used for controlling project costs

SN	Methods	Response distribution	
		Frequency	%
1	Comparing total contract value of works executed/payments with total cost incurred	22	71
2	Comparing total actual project costs with total budgeted project costs	3	10
3	Comparing actual costs with budgeted costs for a work package or activity	5	16
4	Comparing actual unit prices with contract u. price	8	26

Comparison of payment received with total expenditure is the common cost controlling procedure practiced by 71%, of the contractors and 74% among these, use this procedure only. This is a straight forward comparison between valuation figure and the total expenditure, giving a single figure of profit or loss. Besides, the method provides only an overview or a limited information on the overall cost status of a project. Infact, the test of profitability can help upper management levels, to decide whether or not a detailed investigation of costs is required. Rather, payment received can be compared with the

corresponding contract value of the works executed, to reveal whether there is a work done quantity variance or contract price variance.

The survey results, as shown in Table 5.22, indicated that national contractors are reluctant to perform periodic and frequent checks on the profitability status of their projects. 30.3% of the surveyed contractors do not check or make any assessment during the construction stage, to reveal whether the projects are making the expected profit or not. 12.12% stated that they perform checks yearly, normally at the end of the fiscal year. 6% of the contractors check every three month and 3% perform checks twice a year. 30% perform checks on monthly basis. In general, frequent check has an advantage as it enables early identification of problems and timely corrective interventions.

Table 5.22 Intervals for checking profit

Profit is checked every	Response distribution	
	Frequency	Percentage
Month	10	30.30
3 month	2	6.06
6 month	1	3.03
year	4	12.12
randomly	6	18.18
After completion of projects	10	30.30

5.5.3. Project Works Classification and Coding Systems

Project works break down system and project works coding system are major components of an efficient project cost control system. As Halphin and woodhead (1976) stated project works need to be disaggregated /broken down for the purpose of time and cost control. Each category of work or activity defined for a project would be identified by a pre-defined code specific to that activity. The work breakdown and coding give advantages in estimate preparation, cost control and assurance and data management. Ostwald (2001) stated that, codes are the glue between estimating, purchasing, scheduling and cost controlling and accounting. Accordingly, participants were asked to give their opinion on the importance of having project’s activity coding system, for facilitating the management of project costs. 94%

of the surveyed contractors argued on the importance of having a project works classification and coding system. But only 12% have or use a project works classification and coding systems. During the cost controlling process, while implementing a system of cost accounts, an appropriate numbering or coding system is essential to facilitate communication of information and proper aggregation of cost information. Particular cost accounts are used to indicate the expenditures associated with specific activities or work packages. Standard set of cost codes such as the MASTER FORMAT codes could be adopted to identify cost accounts along with project identifiers and extensions to indicate job specific needs.

5.5.4. The Control on Labor and Equipment costs

Activity's unit cost and/or total cost of a project is composed of the various direct and indirect cost components. These components receive different level of attention from a cost controlling system. Among these costs, material costs tend to be fairly predictable and sub contractor costs are defined at the time of bid and job buy out. Labor and equipment are however, difficult and constitute the greatest risk for large cost over runs and in many cases have the potential for bankrupting the project or even the company. This is because labor and equipment are the areas in which inefficient working, due to deviations between estimated and actual productivity, exist most of the time. In this regard, the participants were asked to give their opinion on which cost component should receive more attention from a cost controlling system. 70% argued that the material component should receive more attention, while 18% suggested that the equipment component should get more attention. The remaining 12% stated that labor should receive more attention.

Besides, the check on labor and equipment costs should be frequent, preferably on daily basis if possible, otherwise on weekly basis. As Pierce (2006) indicated the control on the material component is obviously necessary, but it is quite satisfactory to carry out checks at monthly intervals. Pierce stressed the need for frequent and periodic control on labor and equipment costs owing to their sensitivity to changes. He emphasized that these costs need to be checked at a minimum of weekly intervals. However, the survey results indicated that only 15% of the surveyed contractors perform checks on these items weekly and 39% check monthly. 43% check labor and equipment costs randomly, with no fixed schedule, Table 5.23.

Table 5.23 Intervals for checking labor and equipment costs

S/N	Frequency of checking	Response distribution	
		Frequency	Percentage
1	Weekly	5	15.15
2	Monthly	13	39.39
3	Quarterly	1	3.03
4	Randomly	14	42.42

Regarding the method used for accounting equipment costs, 41% of the surveyed contractors account equipment costs, by recording the operational expenses associated with a specific activity or work item and charging this cost to the activity. In this method owning costs are not considered. Another 37%, first establish company's hourly rate by considering both owning and operating costs, and then use this rate for computing the equipment cost associated with each activity, according to the time spent on the activity. 16% account equipment costs by charging the project for company equipment based on local market rate. Here, equipment costs associated with each activity are computed by applying market rates to the time spent on the activity. 6% of the surveyed contractors establish company hourly rate by considering owning costs only and add this hourly cost to the actual operational expenses incurred for the execution of the activity. Pierce (2006) suggested the use of the second method, i.e., establishing hourly rate by considering both owning and operational expenses and applying the rate to each activity based on the duration of the activity.

CHAPTER SIX

THE RESEARCH CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the conclusions and recommendations of the research which are based on the results of the data analysis and discussions made on the previous chapters.

6.1. Conclusions

As it is to be recalled, the major objectives of the research were to investigate the existing project cost management practice of national contractors, to identify problems or drawbacks associated with the practice and to forward recommendations which can assist in overcoming or minimizing the consequences of the problems. The need for undertaking a detailed investigation on the existing practice was mainly due to the fact that previous studies conducted on the area, apart from reporting the incompetence of the practice in general, have not pointed out particular areas which need interventions. In this research detailed assessments were made on the tendering, budgeting and cost controlling practices and, consequently, particular issues which demand improvement interventions were clearly pointed out. Moreover, contractors' performance with regard to winning bids and securing adequate profit from contracted projects were also explored. These two issues are crucial to contractors, for ensuring continuity and sustainability of business and even for ensuring their survival. The research's findings and conclusions made with respect to the above mentioned points and other related issues are summarized below. The thematic approach followed in the analysis and discussion part is also used for presenting the conclusions.

6.1.1. Performance in Bids and Profitability of Projects.

a) Tender Offers' Success Rate. The research revealed that the rate of success of tender offers for majority of the contractors is very low. The research findings indicated that the rate is below 50% for 80% of the contractors. 67%, among these, have a success rate below 25%. Tough competition and low balling/pricing are identified as the top two major causes for the low success rate, followed by inaccuracy of the estimates made during the tendering stage. Performance of contractors on previous projects has insignificant impact on the success rate. The average number of tender offers submitted, annually, by majority of the contractors is high when compared or viewed from the point of view of the failure rate. The results indicated that 56% of the contractors submit as high as 30 offers and another 6% as

high as 50 offers annually. The results indicate the need for allocating proper attention to the tendering process, as such high number of offers with the accompanying failure rates will definitely result in high company overhead costs. Each bid for a project involves expenses related with bonds, man-hour, stationery, communication and so on. The aggregate effect of such expenses, with the above mentioned rate of failures, has the potential to bring financial troubles to the firms. On the other hand, competition, being inherent characteristics of the construction projects procurement process, can not be avoided. However, its effect can be minimized by formulating and employing a successful bidding strategy.

b) Profitability of Contracted Projects: The results revealed that most contractors are unable to obtain the profit which they expect from their projects, most of the times. 86% of the surveyed contractors obtained below 75% of the amount planned or assumed during tender submission. Among these, 48% have obtained below half of the amount anticipated, from most of the projects they have undertaken so far. According to the results of this study, the major factor that affects profitability of projects is price escalation followed by expenses incurred due to delays caused by reasons related to clients and/or consultants. Inadequate financial planning practice is identified as the third responsible factor for low profit from projects. Lack of an efficient cost controlling system at construction sites and inaccuracy of the estimates prepared during tender submission are tied to fourth and fifth in the order of importance of factors responsible for low profit.

6.1.2. Tendering Practices

I. The Bidding Process

The decision on to bid or not to bid: National contractors' approach to the acquisition on award of contracts is competitive bidding. Careful analysis is required of all factors which will enable submission of a bid with proper allowance for profit. Size and location of the project under consideration are the highest ranking factors that influence the decision of contractors, whether to bid or not. Present work load (stage of projects at hand) is also considered by the contractors during the decision. Factors like market conditions, degree of expected competition, current and projected economic conditions, contract period, owners' characteristics, bonding capacity, availability of expertise and equipment are among the factors which are not considered by majority of the contractors.

II. The Cost Estimating Process

Cost estimation is carried out by the contractors mainly for preparing tender offers upon invitations from clients. Estimation of the direct cost components is carried out in a detailed manner by most of the contractors, while the estimation of indirect costs exhibit significant variation among the contractors. The current practices related with cost estimating and factors which affect the quality, reliability and accuracy of the estimates prepared during the tendering stage, are summarized below.

a) Estimating Methods: The survey revealed the sole application of the traditional or standard estimating method for pricing construction contracts. This is mainly because; most construction contracts currently in use in Ethiopia are the BOQ/ad measurement contract types, where unit prices are quoted for each activity listed in the BOQ, whose quantity is placed aside. As the outputs of this system are deterministic (single value number), it often fails to consider and incorporate the effects of risks and uncertainties, which can affect the accuracy of the estimate negatively. No contractor uses other estimating methods primarily or in addition to the standard estimating method. However, the application of statistical and/or probabilistic estimating techniques, such as the range estimating technique, can improve the quality and accuracy of the estimates prepared by the standard method.

b) Information items and sources used for preparing estimates: The application of the standard or detailed estimating method for pricing contracts is very popular among the contractors. The preparation of such detailed estimate requires collecting, retrieving and manipulating massive amount of data on resources' cost, consumption and productivity standards and other qualitative items. The survey indicated that contractors focus mainly on information related to the direct cost components and give inadequate consideration to the indirect cost components and qualitative information items which can seriously affect the accuracy of the estimates or which can improve accuracy, if considered carefully and properly. The most important information items needed by the contractor for the cost estimation, in order of their importance are material prices, equipment costs, labor rates, equipment productivity standards, skilled labor availability and labor productivity standards. Information on potential risks, taxes, over head costs, sub contract costs, applicable governmental/statuary regulations and construction method statements receive inadequate

attention from the contractors, during estimation. Among the information sources, tender document is the major source, for most contractors followed by site visits. Historical data from previous projects is not a major source of information for majority of the contractors.

c) Estimation of Direct Costs: The development of estimates for material, labor and equipment costs requires information regarding their cost and productivity standards. Lack of accurate and reliable data on resources' price and labor and equipment productivity standards are identified by the surveyed contractors, as the top two factors responsible for inaccuracy of cost estimates. This is mainly owing to the fact that the Ethiopian construction industry lacks up-to-date estimating manuals, such as those published by R.S. means in the United States, which provides latest and integrated data on labor and equipment costs with the relevant productivity standards, and material consumption standards. Those, currently in use, fail to consider the dynamic nature of labor and the changes associated with productivity. Besides, they are not prepared in a suitable manner for efficient use. Historical data or records from previous projects, which could avoid or minimize such problems, are not also widely used.

d) Over head Costs: Results of the survey indicated that the ratio of OH costs to total project direct costs, on the average, is about 25%. Despite their significant proportion, large portion of the surveyed contractors do not estimate these costs systematically or in a detailed manner. Only 48% of the contractors estimate OH costs in detail, i.e., by segregating the OH cost items into site and company OH costs, identifying and costing them accordingly. The remaining contractors add a fixed percent of the total direct cost, on the estimated cost to account for these costs. The percent is selected arbitrarily based on experience, intuition and need for work. This practice is one of the major causes of inaccurate estimates.

The site OH costs items considered by majority of the contractors who estimate OH costs in detail are project office furniture, office running expenses and camp facilities, project staff costs, transportation costs and mobilization/demobilization costs. Tender and contract expenses like bonds, guaranties and insurance receive little attention. For the surveyed contractors, the overall or average ratio of site OH costs to total project cost is 14.23%. Assaf (1999) reported that the ratio of site OH for contractors operating in Saudi Arabia ranges between 11-20%, 14.9% being the average. Assaf further indicated that the average ratio or

the range is within acceptable level when compared with the data in literatures. Regarding company OH costs, the survey results indicated that the average company OH costs ratio is much higher than the reported ratio in Ethiopia (4.5%). 87.5% of the contractors have a ratio above 5% and the calculated overall ratio is 11.22%. This figure is much higher than the 6-8%, which is recommended by international practices, (Means Estimating Hand book, 1990). In an environment of tough competition and declining profit, contractors should attempt to control or reduce such costs to remain competitive and profitable. The company OH cost items considered by majority of the contractors are office running expenses, head office staff wages, office rent, furniture and equipment costs and transportation expenses. Expenses related with bonds, guaranties, insurance, bank interests, which are incurred for maintaining the firm in business, do not receive adequate attention from contractors, during the estimation of company OH.

e) Risk allowances: Majority of the surveyed contractors do not incorporate allowances for risk in their tender price, mainly due to difficulties in identifying, forecasting and quantifying potential risks. Only 38% of the contractors introduce allowance for risks in their final tender price. Failure to identify and incorporate risk allowance is placed in third place, among the factors responsible for inaccuracy of cost estimates. 30% of the contractors stated that risk allowance is the most difficult item to estimate, among the various components of project cost. Despite this fact, the effort by the contractors to gather information on possible risks and uncertainties is low. It is on 12th position, on the list of information items needed for preparing cost estimates. The common method employed by these contractors for incorporating risk allowance is adjusting or increasing the mark-up or profit margin. Economic risk which is associated with escalation of materials price is the major risk item considered by these contractors.

III. The Pricing Process

a) Mark-up or Profit margin: The survey indicated that contractors add mark-up based on the final estimated costs. The ratio of profit to the total project cost, for 55% of the surveyed contractors is between 11 – 15%. The calculated overall ratio, 11.4%, is higher than the 6-8% recommended by the National Building Code of Ethiopia, but fairly reasonable when compared with the 8-15% recommended in many text books, (Reed Construction Data, 2004).

Even though, low pricing is claimed to be crucial factor for low success rate of tender offers by the contractors, yet a significant portion of them introduce high profit margins.

b) Allocation Bases: The amount of mark-up to be applied should be based on the assessment and consideration of several factors. The survey indicated that, in deciding their profit margin, 70% of the contractors assess the market trend and expected competition. 41.2% stated that they consider project specific and contextual characteristics, which include project size, type, location and complexity, in deciding the profit margin. Project type and complexity are decisive parameters for selecting construction methods, which in turn affect the accuracy of the estimate and the profit margin to be added. Project size is also important parameter for determining the optimum mark-up amount, as optimum mark up decreases when project size increases. For 38% of the contractors expected risk influence the amount of profit margin to be introduced. 17% add a fixed percentage that does not change from project to project, irrespective of market conditions, competition and project characteristics. Though, most of the contractors stated that they assess expected competition in determining the profit margin, experience from previous tenders which can provide useful information on the nature of competition, is used only by 32% of the contractors. Recording bidding patterns of competitors on bids is important for formulating bidding strategy, which enable contractors determine the severity of competition in future bids and select the most competitive margin for a particular bid. Contract period which has high impact on the out come of projects is considered by only 9% of the contractors. But, the effect of contract period need to be considered because, the larger the contract period, the higher the uncertainly of the occurrence of unforeseen events that may affect the project.

IV. Other Related Practices

a) The application of estimating softwares which can give advantages in speed, man hour saving, reliability and accuracy of estimates is very limited. The survey indicated that no contractor, except one, use estimating softwares for facilitating the estimation process. Unfamiliarity with the softwares or insufficient information about their benefits is indicated as the major cause by 39% of the contractors. 19.2% stated that they do not use the soft wares because they are expensive. 34.6% do not think that softwares make significant difference in

the estimation process. But, using such softwares will obviously make differences with regard to producing accurate and reliable estimates and with regard to saving man hours.

b) 67% of the contractors use their own estimating formats which are developed from Excel spreadsheet. However, the formats are mainly used to compute activities' direct unit costs and do not integrate the estimating process with the budgeting and cost controlling processes. The formats fail to reflect total resource requirements and associated costs, which are basis for the project budget.

c) 79% of the surveyed contractors do not enclose the details of the cost estimates (cost break downs) with the bidding document, which can provide reliable evidences in situations when contractors file claims for cost revision or compensation.

6.1.3. Cost Controlling Practices

a) Scope and Purpose of Cost Controlling: An efficient project cost control system is one which generates information that can improve the productivity of resources, track and identify activities that suffer inefficiency and which provides feedback to subsequent estimating, apart from indicating profitability only. The survey results indicated that cost controlling, by most of the contractors, is mainly aimed at checking the overall profitability of projects. And, this is done simply by comparing contract value of works executed (payment received) with total costs incurred. But the result, apart from providing a very general and brief indication on the overall financial status of the project, is not capable of indicating operations suffering inefficiency and the associated causes of inefficiency. Moreover, the cost controlling by majority of the contractors is not linked with the cost estimation process and fails to provide feedback for the valuation or pricing of subsequent bids. Among the major purposes of a cost controlling system one is providing feedback to the estimation process. This is facilitated by establishing a database or cost records which retains actual production costs and productivity standards.

b) Profitability Tests: The research indicated that many contractors are reluctant to perform periodic and frequent assessments on their projects to check profitability of the projects. 30% of the contractors do not carry out, even, a single check during the course of

construction, and wait till the completion of projects to discover whether the projects made profit or not.

c) The Project Budget: Project cost control and budget are inseparable. The cost control should aim at controlling and monitoring changes to the budget. Though, 73% of the contractors stated that they prepare budget for their projects, only 35% use the budget for facilitating the cost controlling process. The primary purpose of a budget is forming baseline against which actual costs or expenses and performances are compared. The cost controlling system, based on the baseline, should be capable of tracking and identifying activities which indicate substantial deviation from budgeted amounts. Budgets for OH costs and working capital are not popular among the contractors. Only 15% prepare budget for OH costs and 20% for working capital.

d) Project works Classification and Coding Systems: The research revealed the very limited use or application of the project works classification or break down system and project works coding system for facilitating the project cost management process. Though, 94% of the respondents argued that they are important, only 12% have a cost control system which is based on these two systems. However, the works break down and coding systems give advantages in estimate preparation, scheduling, cost control and assurance and data management.

e) Cost Controlling Details: Contractors' cost controlling system allocates much attention to the material cost component. 86% stated that the material cost component should get more attention owing to its high proportion and sensitivity to price changes. But, labor and equipment costs being the components where inefficiency is encountered most of the time, the system should focus more on these items. Moreover, OH costs, as they constitute significant proportion of total project costs, should receive balanced attention from the system.

6.2. Recommendations

This section presents the research's practical recommendations that are targeted at minimizing the consequences of the challenges and problems, which contractors face with regard to

managing project costs. Lack of an efficient cost management system or inefficiency of the prevailing practice is one of the major factors, which undermine contractors' overall capacity and consequently, hamper them from fulfilling predetermined performance criteria which are stipulated in terms of budgeted cost, completion time, quality and stakeholders' satisfaction. Improving contractors' cost management capacity helps them to assume a better financial position, which in turn enables them to achieve firm and project objectives. The recommendations forwarded by this research are from two perspectives, from the point of view of contractors' internal environment or the process view and from the view of the external environment which primarily encompasses the various stakeholders.

6.2.1. The Process View / Expectations from Contractors.

As discussed in the literature review part, an efficient cost management system for construction projects should comprise and integrate the functions of tendering, budgeting and cost controlling. Adequate and balanced consideration should be allocated to these functions. If costs are not estimated accurately during the tendering stage, no matter how efficient the cost control is, projects will not result in satisfactory performance with regard to profit. Also, if costs are not properly budgeted and controlled/monitored during the construction stage, however accurate the estimates are, the financial outcome can be disastrous to the contractors. Therefore, contractors need to be aware and considerate of all the processes. The research's recommendations which can improve the existing cost management practice are presented below.

a) The decision to bid or not: The decision to be made by contractors when invited to submit a tender offer should follow a detailed examination of all the factors related to the internal and external environment of the firm. National contractors, apart from the project characteristics (size and location) and organizational capacity (present work load) which receives fairly good attention, should also consider other factors. These include market conditions (volume of construction in the market), current and projected economic conditions and their influence on labor and materials price, time span of proposed project, engineer's estimate, owner or client's characteristics and ability to pay, their bond capacity (bid bond) and possibility of winning submitted tenders whose results are yet unknown, if several bids are submitted in a short period of time.

b) Bidding strategy: As revealed by the results of this survey, contractors' approach to the award of contracts is predominantly the competitive open tendering. In such competitive situations, contractors need to have a bidding strategy which is directed towards the acquisition of sufficient volume of business at a sufficient profit level. The bidding strategy should be formulated based on the bidding patterns of competitors and their own bidding history. The competitive bidding strategy should help to identify the optimum mark-up for each job to be bid. Contractors should maintain records of bidding activity in their market place, so that an evaluation can be made each time a bid is to be submitted. The records help to quickly determine the bidding patterns of competitors.

c) On-site production costs and productivity data base: lack of accurate and reliable data on materials' consumption standards and labor and equipment productivity is the highest ranked factor for inaccuracy of cost estimates prepared during the tendering stage. Contractors are advised to maintain records of actual data on material consumptions and resources' productivity from their projects, to minimize the effect of lack of estimating standards. The survey showed the very limited application of information from previous projects on estimating new contracts. Contractors are advised to use the "labor hours per unit of work executed" approach rather than using the "birr per unit of work" for collecting and recording data regarding labor and equipment costs and productivities. This is mainly due to inflation which makes the later less reliable owing to frequent changes. The labor hours per unit of work approach has proven in practice to be easier to use and more accurate in estimating, planning and controlling costs.

d) Accurate estimation of over head costs: The survey revealed that, over head costs on the projects executed by the surveyed contractors, constituted more than 25% of the total construction costs. Significant portion of the surveyed contractors do not estimate OH costs in detail, rather, they incorporate an allowance arbitrarily, to account these costs. However, these costs need to be identified, quantified and estimated item by item during the cost estimating stage. As the ratio of company OH costs to total project costs is very high, contractors should control and minimize these costs, in order to be competitive and profitable. Besides, consideration should be given to expenses related with bank interests, bonds, guaranties and insurance while estimating OH costs.

e) Evaluation of low visibility factors: As important as the estimation of the direct costs and OH costs is the evaluation of information items which can affect the quality and accuracy of the estimate. The effect of project location, the availability of skilled labor in the vicinity of project, governmental regulations and weather conditions should be considered and accounted. Potential risks which can emanate from the nature of the project under consideration or its surrounding, economic conditions, and political situations should be assessed, forecasted, quantified and incorporated in to the tender sum to the extent possible.

f) Employing decision-supporting estimating techniques: It is highly recommended that contractors use other estimating techniques in addition to the standard estimating technique. Standard estimating method is deterministic in its nature and hardly considers uncertainties due to the risk of overestimating or under estimating. Contractors can use the range estimating technique as part of their estimating process. The range estimating can be used as a decision support technique, as it could provide information on the probability of cost over run, on how large the over run can be and on what to do to eliminate or reduce cost over run, including how much contingency to add to the estimate. Parametric estimating, on the other hand, can be used to establish an order of magnitude project value and can be useful when time is at premium. More over, it can assist contractors to verify the accuracy of their detailed cost estimates, which are produced by the standard method and to determine the approximate value of a project in order to make decision on whether or not to tender for a project.

g) The decision on mark-up/profit amount: The mark-up amount applied to the estimated costs, by the contractors is higher than the range recommended by national codes. By implementing an effective and efficient project cost controlling system at construction sites, contractors can lower their profit margin and submit more competitive bids. In determining the mark-up amount or the profit margin, contractors should give logical and careful consideration to several internal and external factors. Accordingly, national contractors, apart from competition and market conditions, should consider and evaluate the effects of factors like project scope, size, complexity, location, monetary value, similarity of the project with previous projects, contract period, history of the client

or the owner and other particular issues, before deciding the level of mark-up. Experience gained from previous successful or unsuccessful tenders can provide important information for the decision on profit margin. Moreover, their bidding strategy should help to identify the optimum mark up for each job to bid.

h) Estimating formats: The estimating formats should be integrated with those used for budgeting and cost controlling purposes. The formats, apart from unit costs, should also indicate the overall cost and quantity of resources to be employed which are necessary for preparing the project budget. Contractors, to the extent possible, need to use standard or off the shelf estimating softwares, as they give advantage in speed, accuracy and reliability of the estimate and man hour saving. Besides, it is highly recommended that contractors keep records of the details of the estimates prepared during the tendering stage, as they can serve as baselines for the cost controlling process. Also, it is advantages to enclose the details of the cost estimates with the bid document, for substantiating cost compensation claims during the course of construction.

i) Scope of cost controlling system: The scope of contractors' cost controlling system should go beyond checking profitability of project and cover check on efficiency of resources, which is carried out against the standards of the output rates that were used during the estimation. The check or test of profitability can be used as an aid for the decision on whether to carryout a detailed investigation of costs or not. The system should be able to identify activities which are being carried out uneconomically and indicate the causes, whether they are due to in efficiency or deviation from estimated productivity or due to under pricing or due to wastage. Besides, the cost controlling system should be able to provide feedback to the cost estimating process. It should provide data for valuation or pricing of successive bids. The maintenance of proper cost records enables the contractors to build up new rates for subsequent tenders. Moreover, the cost controlling by contractors should give more attention to the labor and equipment components of the project cost. This is because they constituent the greatest risk for large cost overruns, which occur as a result of inefficiency or deviations from assumed productivity standards. These costs need to check at a maximum of weekly intervals, so that early interventions can be taken when deviations arise.

j) Construction budget: Contractors must be accustomed to the preparation of a budget which retains information on material quantities, labor and equipment inputs with the associated cost amounts, for each type of activity or group of activities (work package). The budget should form the baseline for the cost controlling process, against which actual expenses are compared. With this information, actual material usage, labor and equipment employed can be compared to the expected requirements. This helps to identify cost overruns or savings on particular activity or work package and reveal whether they are due to changes in unit prices, labor or equipment productivity or in the amount of material consumed. For the cost controlling and monitoring purpose the original detailed cost estimate should be converted to a project budget. During the course of a project expenses or costs incurred will be recorded in specific job cost accounts associated with each activity or work package and be compared with the original cost estimates in each category. In addition to cost amounts, information on material quantities and labor inputs with in each job account should also be retained in the project budget. With this information, actual materials usage and labor employed can be compared to the expected requirements. Contractors need to prepare budget, not only for the direct cost components, but also for OH costs and for the project's working capital.

k) Project works classification and coding systems: It is highly recommended that contractors use project works breakdown or classification system for facilitating the cost controlling process and the cost management process, in general. Construction projects are best managed by work packages which in turn are best planned and monitored by activities. The breakdown levels should be applied to a project depending on the nature and complexity of the project, the project work plan and the expected degree of control. Also, each level or category of work or activity defined for a project should be recognized by a pre-defined code specific to it. The work breakdown and coding give advantages in estimate preparation and cost controlling.

6.2.2. Stakeholders' view / Expectations from stakeholders

The construction industry is characterized by the strong and multi directional relationships and interactions that exist among the various stakeholders. Hence, interventions or measures from the contractors' side only, can not result in improved outcomes, unless backed by pertinent or

counter measures from the other stakeholders. The major steps to be taken or expectations from stakeholders are summarized as follows:-

I. Consultants

- a) Consultants should be able to prepare adequate, complete and comprehensive tendering or contract documents, which include drawings, specifications and contract conditions. Insufficiency or incompleteness of these documents is identified as contributing factor for inaccuracy of cost estimates made during tendering and for low profit from contracted projects.
- b) Delay caused by reasons related with consultants and/or owners is the 2nd ranking factor, among the numerous factors responsible for low profit. Therefore, consultants should be able to provide responses, to enquiries raised by the contractors, especially to those pertaining to technical matters, as early as possible. Moreover, they should administer contracts according to the conditions of contract and make decisions with out favoring owners.
- c) Engineer's estimates to need to be carried out carefully and properly, as they can serve as reliable references for comparing bid offers and for formulating bidding strategies for contractors.

II) Project Owners

- a) Before awarding contracts to contractors, owners should give adequate and balanced weight to the performance of the contractors on past projects. This include evaluation of their performance with respect to accomplishing projects with the predetermined cost, time, quality and other project specific requirements. On the other hand, low balling or pricing is found to be the 2nd major factor responsible for low tender success rate of contractors. Form observations, projects which were contracted to contractors offering extremely low prices, suffered significant time and cost overruns and poor workmanship. Therefore, owners should award contracts on the basis of not only financial aspects but also critical evaluation of technical matters and performance history on previous projects. Awarding contracts by negotiation can also be a solution.
- b) Delay caused by owners is indicated, by the contractors, as major contributing factor to low profit from projects. Therefore, owners to the extent possible should facilitate or provide timely responses to contractors' inquiries with regard to payment or any other matter.

III) Government

a) Escalation of resources price is the highest ranking and the most crucial factor responsible for low profit from projects. Currently, compensation for price escalation is limited to very few items, and even escalations related to fuel, are not compensated properly, owing to difficulties in implementation. Hence, the government should act promptly to address this problem, otherwise in due course, it will undermine the capacity of national contractors irreversibly.

b) Lack of reliable and up-to-date cost estimating manuals which comprise information and data on resources price, materials consumption standards, labor and equipment productivity standards is a major cause of inaccurate cost estimates. Therefore, the government should work jointly with consultants, contractors, universities and professionals to prepare and revise such standards periodically.

c) Qualified contractors for award of contracts should not be selected on the basis of least bidder only. Additional evaluating and selecting criteria should be incorporated to the rules and regulations currently in use.

IV) Professionals

❖ Professionals should acquaint themselves with recent cost management theories and techniques (estimating techniques, formulation of bidding strategy, risk allocation, cost controlling methods and so on) which are available in many text books, instead of practicing with the rule of thumb.

6.3. Recommendations for Further Works

This research has identified major shortcomings of the national contractors' practice, with regard to competitive tender price estimating, budgeting and cost controlling. The research moreover, has forwarded (qualitative) theoretical interventions and recommendations that can improve the practice and result in improved outcomes from projects. However, the issues covered by the research are so vast that it became difficult to present all relevant interventions in a comprehensive and exhaustive manner. Therefore, the following points are recommended to be assessed in detail, as they can be focal points for further research, to improve the cost management practice of contractors.

- ❖ The application of various estimating techniques or introducing probabilistic/statistical estimating methods to the construction industry of Ethiopia.
- ❖ Developing and introducing contextual project works breakdown or classification system for facilitating project cost controlling and management system.
- ❖ Developing contextual project works coding system.
- ❖ Developing computerized cost and productivity standards library.
- ❖ Developing a system or estimating manual which integrate resources costs, codes and resources productivity standards, for facilitating project cost management system.
- ❖ Developing system for controlling labor productivity and cost for construction projects.

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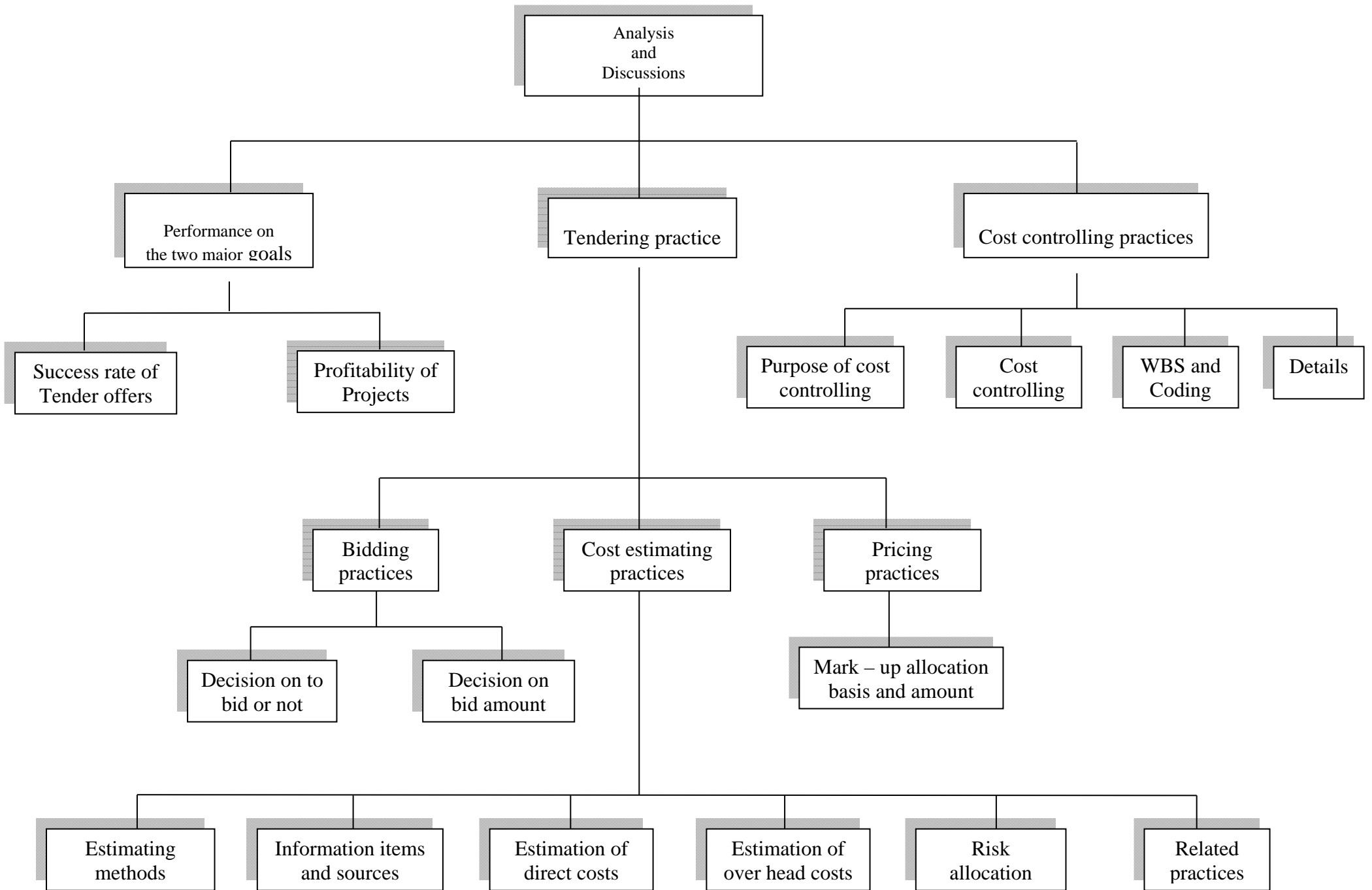


Figure 5.1. Schematic view of the analysis process

APPENDIX

Questionnaire survey

This questionnaire survey is part of the research conducted for fulfilling the requirement of Msc Degree in Construction Technology and Management at AAU.

The Research Problem

The need for improving the existing project cost management practices of national contractors: focused on building construction projects.

The Research Background

The motivation for this research has emanated mainly from personal experience and observations and from the findings of the few studies which were conducted for assessing the financial management practice of domestic contractors. The studies have indicated that most contractors face challenges with regard to managing the different costs involved in projects. Thus, this study is aimed at contributing knowledge towards improving the cost management capacity of contractors.

The Research Objectives

- ❖ To investigate project cost management practices of domestic contractors.
- ❖ To identify short comings, drawbacks and limitations of the practices
- ❖ To develop interventions to improve project cost management capacity.

Regarding confidentiality, any data or information provided in this survey, is solely used for Academic purpose of the research under consideration.

If you have questions or seek clarifications, please contact me on **0911 42 47 34**.

I thank you in advance, for your invaluable cooperation.

PART I. General information

1. a. Name of company (Optional) _____

b. Category and class of company _____

2. Average annual turnover amount in birr, over the past ten years.

3. Proportion of building projects, among all projects undertaken over the past ten years?

Under 25%

50% - 75%

25% - 50%

75% - 100%

4. a. Through which project procurement method, does your company obtain works, most of the time?

Through Negotiation

through Tendering

b. Please give a fair indication of the proportion of projects procured through competitive bidding.

Under 25%

50% - 75%

25% - 50%

75% - 100%

c. Which type of contract do you encounter often? Prioritize them by numbering, if you encountered more than one?

Lump sum contracts

Admeasurements / BOQ / Unit Price contracts

Schedule / Output / Item of rates

Cost reimbursement contracts

Hybrid contracts

PART II .Project Tendering

5. a. Which of the factors listed below, are considered as important factors by your company, when deciding to submit a tender offer for a project? Rate level of importance of the factors by assigning

3 = Very important 2 = Important 1 = fairly important 0 = Not important

- Size of the project
- Volume of work at hand (monetary value of projects)
- Stage of projects at hand (active projects and projects near completion)
- Location of the project under consideration
- Available company's expertise and equipments
- Similarity of the project with previously undertaken projects
- Not to be idle / not to make resources idle

If others, mention and rate please _____

b. On average, how many tender offers does your company submit annually?

- Below 15 30 – 50
- 16 - 30 Above 50

c. Give a fair measure of rate of success of the tender offers.

- Below 25% 50% - 75%
- 25% - 50% 75% - 100%

d. If your success rate is low, say below 25%, what do your think are the major reasons? Assign level of influence for those listed below, and identify, if there are others.

4 = Very high 3 = High 2 = Medium 1 = Low 0= Very low

- Severe competition among contractors
- Low pricing
- Inaccuracy of the estimates
- Shortage of time
- Performance history of your company on previous projects
- Other factors beyond your control

If others, please mention and rate them _____

6. Among the factors listed below, select those which in your opinion are responsible for inaccuracy (over or under estimation) of tender estimates. Prioritize by numbering

- Lack of accurate data about resource's price (Material, labor etc)
- Lack of accurate data regarding material's consumption standards, labor productivity standards, equipment productivity standards
- Insufficiency of information provided by drawings and specifications
- Difficulty in estimating overhead costs
- Unable to forecast potential risks (unable to quantify them)

If others, please mention _____

7. a. What percentage of the construction cost, do you often introduce as a profit margin?

- Below 3% 4%-7% 8%-10% 11%-15% Above 15%

b. Which factor/s is/are considered as most important while determining a profit margin?

- Need for work
- Risk
- Market trends
- An assessment of the expected competition
- Similarity with previous projects
- Experience gained from attempted but unsuccessful tenders
- Project type, size, location, complexity etc...
- Company's predetermined/fixed margin
- Contract period/project duration

If others _____

8.a. On average terms, what proportion of the expected profit amount, did you obtained from the projects you have completed so far?

- 100% or above of what expected 75% - 50%
- 100% - 75% Below 50%

d. If you do not obtain the profit you expected most of the time (say, you obtain below 50%), then what are the major factors or reasons, in your opinion? Assign a level of importance or level of influence for those factors listed below, by giving

4 = Very high 3 = high 2 = Medium 1 = low 0 = very low

- Project scope / type of work
- Level of accuracy of the estimates prepared during the tendering
- Inadequate financial planning (Budgeting, financial plan, cash flow fore cast)
- Lack of effective and efficient project cost management system
- Technical difficulties (construction methods)
- Escalation of materials, labor and sub contractor prices
- Work change orders / variation orders
- Problems related with contract document /Drawings, specifications, conditions of contracts/
- Delays due to design changes or other reasons related with the client and / or consultant
- Significant deviation in labor productivity between standard (assumed) and actual
- Weather conditions

If others, please mention and rate them _____

PART III- Project Cost Estimating

9. For what purposes do you often make cost estimation? Select and prioritize them by numbering

- To prepare tender price for client
- To select projects to tender for
- To control or monitor project execution
- To schedule projects

10. Which estimating technique/s is/are widely used in your company?

- Standard estimating procedure / detailed estimating
- Analogous estimating / Estimates based on past projects or projects at hand
- Parametric estimating
- Probabilistic / statistical estimating methods

If others, mention please _____

11. a. Among the **components of project cost**, which one, in your opinion, is difficult to estimate? Prioritize by numbering.

- Material Labor Equipment Site over heads
- Company overheads Risk allowances Taxes

Please give a brief explanation of your reason. _____

b. Among the cost components listed in 11.a, which one receives more attention, during estimation? _____

Why? _____

c. Among the following information items and sources, which one are considered by your company during tender preparation and what level of importance is assigned to them.

Item No	Information item	Importance level				
		V. high	High	Medium	Low	V. low
1	Tendering documents					
2	Material prices					
3	Labor rates					
4	Labor productivity standards					
5	Equipment costs					
6	Equipment productivity standard					
7	Site overhead costs					
8	Company overhead costs					
9	Risks					
10	Project location					
11	Skilled labor availability					
12	Historical data of similar works					
13	Site visits					
14	Construction method statements					
15	Statuary regulations					
16	Sub contractor prices					

d. While carrying out detailed estimates, what is your source of information for material consumption standards and price, labor and equipment rates, labor and equipment productivity standards?

Market assessment

- Published standards (e.g. Construction Performance Standard developed by the Ethiopian Building Construction Authority)
- Data collected from previous projects
- Guess

If other, mention please _____

e. If you accustomed to consulting published estimating standards, have you ever attempted to compare the data with actual data collected from construction sites?

- Yes
- No

If you have done, have you come across with major deviations in materials quantity, labor productivity rates etc...? _____

12. a. What method/s do you often employ to incorporate overhead costs in to a tender sum?

Make a list of overhead items together with relevant prices and distribute the total sum to all project activities.

Identify overhead costs associated with each project activity or group of related activities and assign the cost to the relevant activity/s (Activity Based Costing)

- Incorporate them as an arbitrarily selected percentage of the total direct costs

If other method/s please specify _____

b. For the projects, you've undertaken so far, what proportion /percentage of total project direct cost do overhead costs represent?

- Below 5%
- 10% - 15%
- above 25%
- 5% - 10%
- 15% - 25%

c. In general, for the purpose of cost estimation, indirect costs/overheads are classified in to site overheads and company or general overheads. Do you acknowledge this classification scheme? If you do, which of the following site overhead items are considered by your company, during tender price estimating?

- Project office furniture, equipments and other camp facilities,
- Project office running expenses-Electric, water, telephone, internet

- Project staff costs- PM, Construction and office engineers, Adm. and Finance etc...
- Transportation and travel expenses- Site vehicles
- Mobilization and demobilization costs- Transportation, dismantling and reinstalling costs
- Tender and contract expenses- Bonds, Guaranties, insurances
- Expertise service costs
- Workshops, garages and warehouses
- Permits and statutory fees
- Depreciation
- Detour and access roads

If other items, please specify_____

d. For the projects, you've undertaken so far, what proportion /percentage of the total project direct costs do site overhead costs represent on average?

- Below 5%
- 10% - 15%
- above 25%
- 5% - 10%
- 15% - 25%
- do not know exactly

e. Which of the following company/general overhead items are considered by your company, during tender price estimating?

- Building, furniture and equipments as depreciation/ Head office rent
- Office running expenses-Electric, water, telephone, internet
- Head office staff costs- GM, Construction, Adm. and finance and other office expenses
- Transportation and travel expenses
- Sundry expenses- donations, receptions, advertising
- Tender expenses/pre paid items but not successful- Bonds, Guaranties, insurance charges
- Expertise service costs such as the services of external auditors, lawyers, management consultants and external trainings,

- Work shops, garages and warehouses

If other items, please specify_____

f. For the projects, you've undertaken so far, what proportion /percentage of the total project direct cost do company or general overhead costs represent on average?

- Below 5%
- 10% - 15%
- above 25%
- 5% - 10%
- 15% - 25%
- do not know exactly

14. a. Do you often incorporate allowances for risks, in your tender prices?

- Yes No

b. If you do, please give a list of the risk items and method used for incorporating them.

15. How do you incorporate, taxes payable for the government, in the tender sum?

- As indirect or overhead costs
- As a percentage of the envisaged profit amount (e.g. 30% of the expected profit amount, for income tax)
- Assuming a fixed amount and distributing it as a percentage of the project cost
- It is not considered

16. a. Do you often attach or enclose estimate supporting details (cost break downs) with the bid document?

- Yes No

b. Do you often maintain or keep records of the details of estimates, in a computer database/cost library or other means?

- Yes No

17. Does your company have its own standard estimating formats?

- Yes No

If you have, please attach a copy.

18. a. Do you employ estimating soft wares for preparing estimates?

- Yes No

b. If you do, please list their name and state, in brief, the advantages you have gained.

c. If you don't, what are the reasons? Select from those listed and add if there are others.

- Unfamiliarity with the soft wares or insufficient information about their benefits
- Have the information but hard ware and soft wares are expensive
- Lack of expertise or skilled personnel
- Do not think that it will make significant difference

Estimation is approached from intuitive view point

If others _____

PART V- The Cost Controlling process and Project Budget

19. a. Do you prepare budget (resource and/or financial budget) for projects?

Yes

No

b. If you do, what details does it comprise? Select.

❖ Cash outflow budget

Materials quantity and cost

Overhead costs

Labor requirement and cost

Sub contract prices

Equipment requirement and cost

Risk allowances

❖ Cash in flows

Revenues /payments

Other incomes or financing schemes

❖ Working capital

Cash reserve

20. a. Do you prepare an expenditure schedule / budget for the advance payment, which you collect, normally before commencement of project works?

Yes

No

b. If you do, how do you disburse it?

Disburse it in to material, labor and other expenditures

Uniformly distribute it over a certain period of time

If other _____

21. How frequently do you check the profitability of a project?

Monthly

Quarterly

Twice a year

yearly

Randomly

After completion of the project

22. a. Do you have a standard system for accounting (tracking, recording and controlling) project costs/expenses?

Yes

No

b. If you have, give a brief description of the system together with, the inputs and the out puts of the system _____

c. Your cost control system, for what other purposes is it used?

To draw attention to operations which are uneconomical

To provide feed back to the estimation process

To check profitability of project

For monitoring efficiency or performance of resources /labor, equipment/

23. How do you account or track costs/expenses during the cost controlling or what method do you employ, for checking the profitability of a project?

By comparing total contract value of works executed (payments) with total costs incurred.

By comparing total actual project costs with total budgeted project cost

Phase by phase (E.g. after completing foundation work or after completing structural work)

Activity wise (E.g. after completing footing concrete or completing HCB work)

By comparing actual unit prices with contract unit price

24. a. In your opinion, which component of a project cost should receive more attention, by controlling and/or reporting system?

Material

Labor

Equipment

overhead

Why? _____

b. How frequently is, a check on labor and equipment costs, performed in your projects?

Weekly

Monthly

Quarterly

Randomly

The check is not time based, it is activity based

c. How do you account equipment costs?

By recording the operating expenses associated with a specific work item and charging this cost to the specific work

By establishing company's hourly rate, (considering owning costs /depreciation/ and operating costs) and using this rate for computing activity's equipment cost according to the duration.

By charging the project for company equipment, based on local market rate i.e. considering the equipment as hired and computing equipment costs based on local market rate.

Mention, if other please_____

25. a. How do you rate the importance of having project works break down and coding system for facilitating effective management of projects, including cost estimating, budgeting and controlling?

Very important Important Not so important Not important

b. Do you have a coding system for classifying and identifying the different activities and associated costs, involved in a project?

Yes No

c. If you have your own break down and coding system or use other standard systems, please give a brief description of the system (methodology of classification and list of work divisions).

SIGNED DECLARATION SHEET

Submitted by

_____	_____	_____
Student	Signature	Date

Approved by

1. _____	_____	_____
Advisor	Signature	Date

2. _____	_____	_____
Chairman, Dept's Graduate Committee	Signature	Date

3. _____	_____	_____
Chairman, Faculty's Graduate Committee	Signature	Date

4. _____	_____	_____
Dean, Graduate School	Signature	Date

DECLARATION

This thesis is my original work, and has not been presented for a degree in any other university and that all sources of material used for the thesis have been dually acknowledged.

Candidate

Name _____

Signature _____