JIMMA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

Jimma institute of Technology

Construction Engineering and Management Chair

Cost Management Practices of National Contractors Focused On Water Construction Projects

By

AMROT GOBENA

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Abstract

Cost management is a main stem of construction project management and the most important tool sought by contractors to maintain profit. This research reviews the theory of construction cost management and investigates cost management in term of its extent of application, human resource input, IT application, its performance and satisfaction of national contractors in Ethiopia. The result shows a not extensive application of cost management techniques/systems and human resource input. However, specific IT application is infancy and most importantly the contractors are not satisfied with the existing cost management techniques/systems. The results moreover indicated that most of the surveyed contractors are unable to obtain the profit they anticipate from their projects. 85% of the contractors have obtained below 75% of the amount they expected from most of the projects they have undertaken so far. Among these, 52% obtained less than 50% of the anticipated amount. The major contributing factors, in the order of their influence are inadequate resource/financial planning, delays of payment caused by owners and/or consultants and inaccuracy of the estimates prepared during the tendering stage and poor of cost controlling system at site management

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 markup amount or profit margin. 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 overhead 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, statuary 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 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.

Key words: *Project cost management, Profit margin, Cost controlling system, Information Technology Application, Cost Estimating methods and Budgeting.*

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Abbreviation

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

CHAPTER ONE
INTRODUCTION

General

The construction industry has a great impact on the economy of Developing countries [Leibing, 2001]. According to Chitkara, (2004), the construction industry in many developing countries, major construction activities account for about 80% of the total capital assets, 10 % of their GDP, and more than 50% of the wealth invested in fixed assets. In Ethiopia its percentage of GDP amounts to 3%, considerably lower than the sub-Saharan average of 6% [MoWUD, 2006] In Ethiopia, the construction industry is the highest recipient of government budget in terms of government development program. Consequently, most investments of the Government are being channeled to clean water access, irrigation and consume an average annual rate of nearly 24%, according to BIM Research Report.

Despite the construction industry's significant contribution to the economy of developing countries and the critical role it plays in that countries‟ development, the performance of the industry still remains generally low. As (Idoko, 2008)noted, **"**…many projects in developing countries encounter considerable time and cost overruns, fail to realize their intended benefit or even totally terminated and abandoned before or after their completion …" Moreover, the development of the construction industry in developing countries generally lags far behind from other industries in those countries and their counter parts in developed nations. Generally, as [(Ofori, 2006) & (Jekale, 2004)] concluded, "The construction industry in developing countries failed to meet expectations of governments, clients and society as a whole".

Similar to the case with other developing countries, the Ethiopian construction industry shares many of the problems and challenges the industry is facing in other developing countries, perhaps with greater severity. Given the critical role the construction industry plays in Ethiopia and other developing countries, and the poor level of performance of the industry in those countries, improving the performance of the industry ought to be a priority action. As contractors are one of the key players in the industry and the makers of the final product, any

development and improvement initiatives in the industry has to consider ways of improving the capacity and capability of the contractors.

Previous, research works by [(Adams, 1997), (Long, etal.2004) and others] have indicated poor managerial capability of contractors to be one of the critical problems of the construction industry in developing countries. Thus, improving the managerial capability of contractors need be one of the priority considerations for improvement of capability of contractors in developing countries. Researches by (Dlungwana & Rwelamila, 2004), and others have also strongly emphasized the importance of improving the management skills of contractors. As most of the works of contractors is managed as a project, improving the contractors‟ project Cost management capability can significantly contribute to the overall improvement of contractors‟ capability to deliver successful projects.

The construction industry is increasing in complexity and vigorous competition exists among national contractors in Ethiopia. National 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.

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 in line 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. Effective cost management is vital for

National contractors in order to manipulate the project resources and manage the project to meet the target goal: '**PROFIT**". 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 cost management skills.

Cost management is a major component of construction management and the most important tool sought by contractors in order to maintain the profit. "Profit" is vital in the business world. In order to survive in a competitive world, companies need to ensure the expected profit for each investment is obtained. Through the process of cost management, there can be a more realistic final cost and corrective actions can be adopted at right time.

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. Without cost management, a company may lose his financial control. Cost overrun or loss may be the ultimate result. Especially for complex large-scale projects with a tight program me, high uncertainty and unexpected factors can lead to cost overrun, such as additional cost for night work, changes in regulations, liquidation of a client and/or sub-contractor, etc., which have never been taken into account during cost planning.

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 there are numerous of books and journals related to construction cost management, cost planning and cost control. However, they mainly introduce the theory and techniques. Few of them further investigate the factors which exist in real world that cause failure of domestic contractors in project cost management. Previous studies conducted on the financial management practice of domestic contractors of public and private building works only. 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 water work contractors due to attention is not given to those contractors by previous studies and the government attention is now shifting towards contracting large hydropower's, irrigation and accessing clean water by investing up to 24% average annual rate according to BIM Research. Accordingly, it will investigate the existing practices on estimating, budgeting and cost controlling and identify shortcomings associated with each function, Assessing factors contributing to failure of contractors in cost management. By improving their practice, contractors can minimize cash flow problems, maximize profit and consequently fulfill firm and projectable actives. And, this is realized, to a satisfactory extent, through the implementation of an integrated cost management system, application of modern Information Technology 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.

1.2. The Research Problem.

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, asses the factors most significant for cost management, assessing the application of information technology system, 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.

1.3. The Research Objectives.

A) Main Objective

Main objectives of the research are 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.

B) Specific Objective

Based on the problem stated, the research is carried out in view of achieving the following four objectives:

1. To investigate project cost management practices of national contractors.
2. To identify shortcomings, drawbacks and limitations of the existing practice.
3. To assess the application of Information technology systems in the cost management practice of the national contractors
4. To forward recommendations and interventions to improve existing practice.

1.4. The Research Questions.

Within 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. How wide are the application of information technology specially software's?
4. What are and how wide are the impacts of the drawbacks and limitations?

1.5. The Study Scope

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 water work 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 water small spring projects to complex and heavy projects of hydro power, the scope of this research work is limited to and focused on water projects done by contractors class III and above only.

1.6. The Study Limitations

The need for limiting the research to Water work projects arises mainly due to three major reasons. The first reason is that previous works never give emphasis to water work contractors only focusing on private and public building contractors even though the current government investment is channeling to water work projects. The second reason tied to the work experience of the researcher on water work projects. The third reason is associated with the number of activities or work divisions involved in water work projects, which is much higher than those in building 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 in turn demands the employment of an efficient and effective cost management system.

CHAPTER TWO
LITRATURE REVIEW

In this chapter, a critical review of academic works regarding cost management are carried out in order to gain an overview of their inter-linkages and to provide a theoretical basis in refining the research methodology and finding analysis of the current study. The definition, principles, dimensions, institution and methods of measurement are examined.

2.1 Importance of Cost Management

Construction, one of the major industries, is vulnerable to all kind of internality and externality crash and which has been noted by most researchers implicitly for its dynamic and complicated nature. Within the theme of construction management, construction targets to achieve the goal of having the building completed on time, within budget and attainment of the highest quality. Time, cost and quality are located at each corner of a triangle, which means that each shares the importance toward the success of the project. The weighting of each may vary from project to project and depends on the client's brief. However, it seems that, usually, cost is the most concern of the promoter. Time, cost and quality management are the core elements of construction management. Construction cost management is one of the most important tools sought by main contractor.

Effective project management includes strategies, tactics, and tools for managing the design and construction delivery process and for controlling key factors to ensure the client receives a facility that matches scope and quality expectations, delivered on time and within budget. Successful project delivery requires implementation of management systems that will enable project delivery teams to control changes in the key of scope, costs, schedule, and quality. Project costs are measured and analyzed in many ways throughout a project, from planning and design to bidding, construction, turnover, and beyond. First costs, cost-benefit, and life-cycle cost are a few examples of how a project's cost effectiveness can be evaluated. However, the control of costs requires continual systematic cost management.

These cost management processes start with the establishment of budgets that align with scope and quality requirements and continue with milestone estimates, value engineering, and procurement strategies, and change order management through to claims avoidance and

negotiation. One of the most important challenges facing construction project managers today is controlling cost. The purpose of cost management must be devised to deliver the project successfully within budget.

2.2 Theory of Cost Management

2.2.1 Definition

Godey (1994) states that cost management differs from cost control in that it is a proactive process that focuses on the elimination of waste in business processes and procedures. Cost management, as much, is a strategic process that stresses the optimization of efficiency and focuses on the customer and on profitability. According to Hilton *et al.* (2000), Cost Management is "a philosophy", "an attitude" and "a set of techniques" to create more value at lower cost. Cost Management meets the need of both accurate costs and other relevant information for decision-making. Having accurate costs and creating more value at lower cost is vital in the world of survival of the fittest. Cost management is a philosophy of improvement because it promotes the idea of continually finding ways to help organization make the right decisions to create more customer value at lower cost. Cost management represents a proactive attitude that all the costs of products or services result from management decisions. In other words, costs do not just happen. Cost management is a set of reliable techniques. These techniques may be used individually to support a specific decision or together to support the overall management of the organization. A set of cost management techniques that function together to support the organization's goals and activities in called a cost management system.

12 Hilton *et al.* (2000) define that cost is a measure of the acquisition or consumption of a scare or constrained resource to achieve a specific outcome. They also state that Cost Management System is a set of cost-management techniques that function together to support the organization's goals and activities.

2.2.2 Mission and Vision

Cost management rejects the notion that "costs happen" and embraces the perspective that all costs can and should be managed to meet organizational goals. Cost management identifies and chooses among opportunities for improving organizational performance. Anticipating and managing the drivers of costs is even more effective. This approach to analyzing costs strives to

manage costs by modeling the impact of managers' decisions on cost drivers, costs, and profits.

2.2.3 Focus

The primary principle of cost management is that costs do not simply happen; they are the results of management decisions. To manage an enterprise effectively, identify strategic opportunities, and maintain a competitive advantage, cost management focuses on anticipating the impacts of alternate decisions.

2.2.4 Role

Cost management is philosophy of seeking increased customer value at reduced cost, an attitude that all costs are caused by management decisions, and a reliable set of techniques that increase value and reduce cost. Effective cost management allows managers to make critical decisions that affect the performance and success of the organization. Cost managers need broad knowledge of the organization's activities and how those activities interact to be able to provide information interpretations, and analyses of alternative courses of action that managers are contemplating. They also identify opportunities to improve operational efficiency.

2.3. Cost Management Techniques

Cost management systems from the perspective of a main contractor are composed of the following cost management techniques:- - Cost Planning and Control

- Estimating
- Budgeting
- Cash Flow Forecasting
- Financial Reporting and Cost Reporting
- Cost Code Systems
- Value Management
- Judgment

2.3.1 Cost Planning and Control

Dent (1974) states that cost planning in any real sense starts with a cost appraisal of the project in order to establish its overall cost limit, the total budget used at cost plan preparation stage for the purpose of fixing cost targets (totals for the cost analysis elements into which the project is sub-divided). Bathurst and Butler (1980) state that cost planning is the term used to describe any

system bringing cost advice to bear upon the design process. There are two methods of cost planning most commonly discussed and illustrated in technical journals - elemental cost planning and comparative cost planning. All forms of cost planning have three phases:.

Phase 1 – The estimate or establishing the target cost

Phase 2 – The cost plan

Phase 3 – the cost checking

Burgess (1982) defines that cost control is the management of expenditure and not historic accounting. It must be forward-looking. If carried out effectively, it enables a main contractor and his building team to predetermine and control the financial outcome of a building project. He also states that in this more complex, uncertain environment, control techniques today generally focus on all phases of the control cycle – from initial planning to progress monitoring and review – applied to the total project process. Pilcher (1985) defines cost control as the regulation, by executive action, of the cost of carrying out the various activities which go to make up a project or a contract. Halpin (1985) emphasizes that project cost control data are important not only to project management in decision-making processes, but also to the company's estimating and planning departments because these data provide feedback information essential for effective estimates and bids on new projects. Thus a project control system should both serve current project management efforts and provide the field performance data base for estimating future projects. American Society of Civil Engineers (1982) states that the control of costs is the life line of any competitive business; no business can survive without knowledge of costs and an intelligent control of costs. Of course, a contract may lose money for any one of a number of reasons, such as a poorly prepared bid, an insufficient knowledge of conditions, an increase in labor or material prices, or a poor selection of construction plant and equipment. Sometimes adverse weather and flood conditions contribute to losses, especially on heavy construction operation, but perhaps the most common form of loss us just plain inefficiency of management and supervision. By definition, if a payment is being made for the value of work done, then an accurate measurement of the work will have been made. At the same time, main contractor can see what his actual cost is and in theory, therefore, it should be

possible to determine profitability to date. In fact, of course, nothing can be further from the truth. A fully detailed measurement and valuation of work done is not always carried out each month, and the actual cost is never completely up to date. But this is an oversimplification.

2.3.2 Estimating

American Society of Civil Engineers (1982) states that estimating is the first phase of the construction cycle and followed by construction accounting and cost control. Accounts that must be set up to coincide with the estimate are, in turn, used for costing. Estimating, construction accounting and cost control thus form a continuous cycle. The foundation of a cost control system, therefore, is the bid estimate. Success in accurately assessing project performance during the execution of the work is largely dependent on integrity of the estimate. Burgess (1982) defines that the estimate is the probable cost to the contractor of carrying out the work detailed in the enquiry. According to the Code of Estimating Practice prepared by the Institute's Estimating Practice Committee (1983), estimating is defined as the technical process of predicting costs of construction. Halpin (1985) points out that estimate are prepared by referring to data on past projects of a similar nature and references containing data not available in company files. Burke (1992) defines that estimate is a quick method for pricing a project based on incomplete data. Schuette and Liska (1994) defines that estimating is the fundamental process of the construction industry that answers the question "How much is the project expected to cost?" The financial commitment to a construction project is very large, and inaccurate project estimates can have a detrimental effect on all parties. The process of estimating should be considered as a continual search after truth, and while this truth is unobtainable and the process can be based only on judgment of probabilities, it is important that the process should be carried out impartially and objectively. This is very difficult to achieve and the natural human reaction of an estimator, after failing to obtain a series of tenders, is to assume his pricing is too high and to lower it gradually. At the same time those responsible for finalizing the tender will probably be gradual lowering their margins. The combination of a difficult contract, tight estimating and low margins can, as many contractors have found, be disastrous. Estimating is to work from first principles by assessing the quantities of the various resources of labour, plant, materials and subcontractors, etc that will be required and the

duration of time involved, obtaining up-to-date quotations from suppliers and subcontractors and calculating and assessing the cost on an impartial and objective basis.

2.3.3 Budgeting

American Society of Civil Engineers (1982) defines that a budget is management's tool for planning, reporting, controlling costs and for cash forecasting. It is used to forecast the rate of expenditure and the anticipated income for the final aim of profit estimating. Hilton (2000) defines that a budget is a detailed plan, expressed in quantitative terms, that specifies how an organization will acquire and use resources during a particular period of time. The procedures used to develop a budget constitute a budgeting system. Budgeting systems have five primary purposes: planning, facilitating communication and coordination, allocating resources, managing financial and operational performance, and evaluating performance and providing incentives. Pilcher (1985) defines a budget is a statement of future activity, either intended or desirable, in either quantitative or financial terms, for a specified period of time. He has also pointed out the aim of budgetary control listed as following:-

- to set out, in quantitative terms, the objective of a firm, a department, a project, or some other subdivision of a business - to enable comparison to be made between alternative plans for achieving differing objectives, the subsequent analysis resulting in the choice of the most expedient and satisfactory plan making the best use of the resources which are available
- to facilitate the coordination of the activities of a number of different sections making up the whole of an organization, in order to make the most efficient use of limited resources, for example working capital. Subsequently, to allow measurement of the achievement against the standard set - to provide a plan as to the level of achievement which is feasible for the organization when actual performance is measured against the target set - to provide a plan against which the effects of action to correct adverse trends, or to take advantages of beneficial ones, can be measured both in performance and cost

2.3.4 Cash Flow Forecast

Cash is a major resource in construction and its use must be anticipated and managed. Burke (1982) notes that cash flow forecast is the models of the flow of money in the project. The time frame is in the monthly basis so as to coincide with the normal business accounting cycle. The

cast flow statement is the main item of a business plan, as it will show the bank manager or lender how much you need, when you need it and most importantly when you will pay it back.
20 Pilcher (1985) defines that movements of cash, either into or out of the project account, are referred to as cash flows. Income or receipts are known as positive cash flows and expenditure or payments are known as negative cash flows. Various payments and receipts occur during the course of a building contract. Main contractor is required to fund the cost of construction for a certain periods before receiving payment. Therefore it is considerable important to him when these periods expire and how much of his own finance will accordingly be required Hancock (1984). By definition, if a payment is being made for the value of work done, then an accurate measurement of the work will have been made. At the same time, the main contractor can see what his actual cost is and in theory, therefore, it should be possible to determine profitability to date. In fact, of course, nothing could be further from the truth. A fully detailed measurement and valuation of work done is not always carried out each month, and the actual cost is never completely up to date. But this is an oversimplification.

2.3.5 Financial Report and Cost Report

Burke (1982) notes that financial report and cost report is to record all the financial transactions, payments in and out, together with amounts owed and owing. This kind of information is essential for the top management in decision making and also for the financing of the project, as noted by Burgess (1982) that it is an obvious need of senior management to know the following:-

- financial performance to date anticipated financial performance of current year - anticipated financial performance at the end of the project Frisby (1990) also considers that a successful contractor has a solid financial plan, a good knowledge of costs, accurate and honest cost report, etc.

2.3.6 Cost Code System

Pilcher (1985) states that an adequate coding system simplifies the data-handling facility and also provides economy of storage in the case of a computer. A good and adequate system of coding is one that simplifies that task of referring to the items to be coded. The purpose of the cost code system is to enable huge of cost data to be identified and coded for the most efficient

application of cost management throughout the contract period. American Society of Civil Engineers (1982) states that cost coding in common use varies widely in type and scope. A simple decimal system, using only Arabic numerals in progressive order, is the most satisfactory for general use. Consideration has been given to its adaptability to computers, speed in writing or coding, ease in memorizing or grasping the significance of each account, and to a numerical control that minimizes errors and omissions in cost statements and reports. Joseph (1984) defines the objectives of cost code system as follows: -

- to provide traceable or reproducible information about the specific performance of a work activity
- to provide a mechanism to combine data via sorting capabilities on different characters of this cost code
- to provide a basis for parameter estimating - to provide the capabilities of performance value engineering analysis - to provide trades oriented sorting of cost

2.3.7 Value Management

. Characteristics of Value Management:-

- Systematic approach
- Multi-disciplined team-oriented process
- Stress on value and function
- concerned with both construction and life cycle costs

Green and Popper (1990) define that value management is the systematic application of recognized techniques which identify the function of a product or service, establish a monetary value for that function, and provide the necessary function reliably at the lowest overall cost. A very important point suggested by Fong *et al.* (1998) that value management focuses on value rather than cutting cost and it does not means to sacrifice the quality of building for the sake of reducing cost.

2.3.8 Judgment

Al-Tabtabai and Diekmann (1992) point out that a good price forecasting technique needs to include both historical trend based data and competent “judgments” based on construction experience and knowledge. Skitmore *et al* (1990) indicate that the exercise of judgment is the

responsibility of the expert construction professional involved in making the strategic cost forecast rather than the model itself. The view is supported by Fortune and Lees (1996) by their survey results established for which reinforced the view that none of the cost management techniques can be used without the application of judgment by the users. The relationship can be summarized as follows: [technique] + [judgment] = [advice]

2.4. The Construction Project Cost Management Process

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. the processes 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.

2.4.1 Classification of Construction Cost

By applications of cost management techniques, different types of the construction cost can be identified. Burke (1992) classifies the construction cost as the following categories:-

- **Direct Costs:** costs that can be specifically identified with the activity or project, eg. direct management cost, direct labor, direct material, direct plant, etc.

–**Indirect Costs**: costs that cannot be directly booked to an activity or project, together with costs that may be incurred whether the project is execute or not eg. Overhead, Medical Insurance Policy etc.

- **Labour Costs**: costs of project workforce, eg. Salary, overtime payment, etc.

- **Material and Equipment Costs**: costs of material, eg. Concrete, welding rod, wastage, etc costs relates to the equipment, eg. Office equipment's, site equipment, etc.

- Transportation Costs: costs of delivering goods to the site - Preliminary and General (P&G) Costs: costs that relate to the project as a whole and cannot be easily directly assigned to an activity, eg. Site supervision, insurance, scaffolding, removal of rubbish, etc.

Similarly, according to ASCE Manuals and Reports of Engineering Practice No. 65 prepared by

America American Society of Civil Engineers (1982), all construction cost fall into four main groups: -

- Direct labor, material and sub-contract costs
- Cost of plant and equipment required to perform the work, which include the depreciation and taxes of these assets
- costs incurred in operating and maintaining plant and equipment, which will include operating labor, fuel, lubricants, repair, labor and parts, maintenance, supplies, etc.
- Indirect costs of administrative and technical personnel, required to oversee and supervise the job, together with other similar expenses of an overall or general character.

Schuette and Liska (1994) classify the costs into direct or indirect costs more simply. Direct cost: are attributable to a specific task of the project. - Material - labor - plant and equipment - sub-contract costs Indirect cost: cannot be directly attributed to any specific task of the project. - general overhead (advertising, profit, taxes, insurance, etc.) - job overhead (salary, office expenses, etc)

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 overall 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.

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 programmer 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, (Tads', 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.

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.

2.4. 2.Elements of the Project Cost Management Process

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

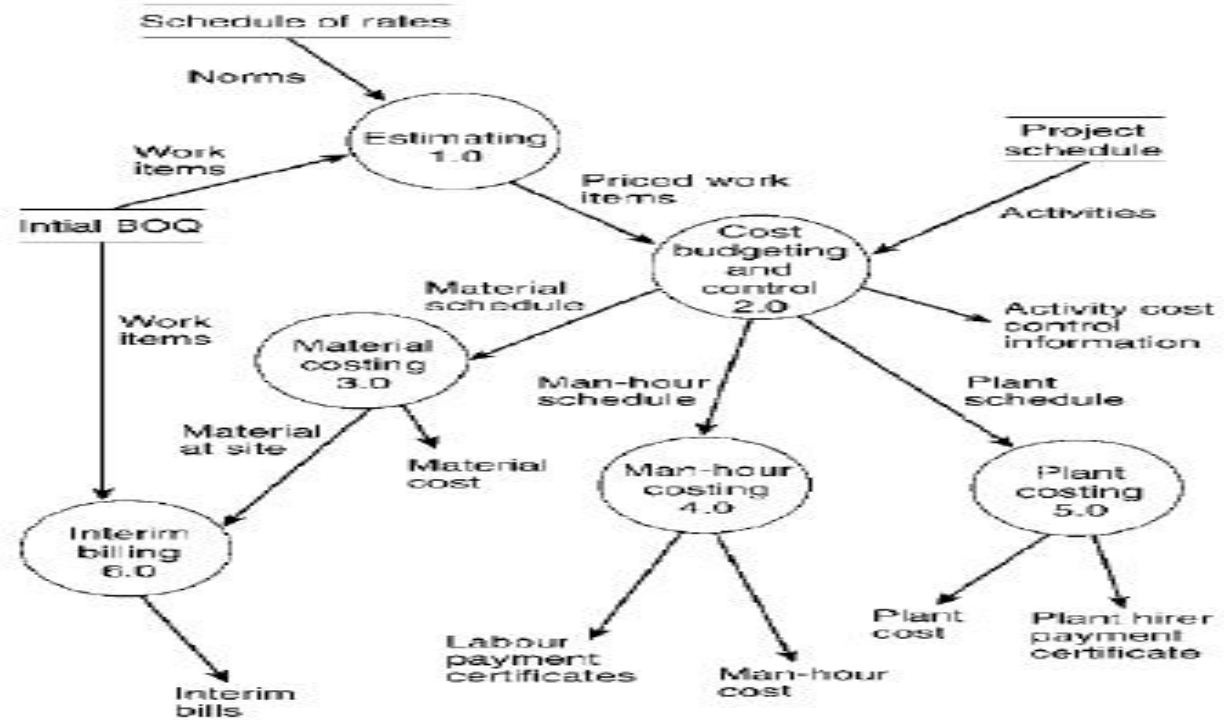

Figure 2.1 Data Flow diagram for a cost management system, Pereira and Imriyas, (2003)

Hennigan (2002) states that the basis for effective cost management is to understand cost structure and to analyze the costs flowing through that structure. Godey (1994) states that cost management are a strategic process that focuses on the customer and on profitability. The six steps to effective cost management are:

1. Understand what causes the cost and revenue structure of the business
2. Understand and reduce inter functional complexity
3. Provide the tools to manage costs
4. Involve employees in decisions
5. Increase effectiveness and continuously improve costs
6. Measure decisions against the strategic business plan

Understand what causes the cost and revenue structure of the business

This is the most critical item in cost management. Many contractors do not have accurate information on what their true costs are. A contractor must identify exactly where its revenue comes from and the specific costs that produce its revenue stream, and then its overhead costs and costs not directly liked to revenue generations.

Understand and reduce inter-functional complexity

In many contractor company, the way of many departments operate are influenced by other parts of the company. The complex cause-and-effect relationships must be sorted out. Reducing complexity means constantly questioning why work is done, and how it can be done more efficiently. A basic flow chart of the contractor's work flow can be very helpful in understanding how things actually get done. It will probably also show that there are a number of extra, unnecessary steps involved in construction processes. Look for ways to get the right information to those who need it as quickly as possible.

Provide the tools to manage costs

Provide the skills that will enable employees to better understand how to control costs, improve quality and productivity, and enhance performance. Most people want to do a good job. When a contractor invests in his employees by educating them, the employees will be better able to do a good job.

Involve employees in decisions

Employees will need to understand the contractor's objectives and have accurate cost information. Soliciting input from the employees will not only give management a better understanding, but it will give employees more inventive to become involved. Contractors that actively solicit suggestions from their employees will undoubtedly find better and more cost effective ways to do things. When someone works with it every day, they will have insight into the work and possibly how to do it better.

Increase effectiveness and continuously improve costs

Redefine the contractor's cost structure to select the costs that generate profit. Cost management must become standard operating procedure. Management and employees must be constantly identifying opportunities for eliminating or reducing unprofitable work. When a contractor only incurs costs that are specifically liked (with reasonable overhead) to revenues, they will be maximizing their profitability. A contractor may need to eliminates, of it may need to consolidate or even to consolidate or even expand departments based upon where their spending generates revenue.

Measure decisions against the strategic business plan

Every contractor needs to have a long-term business strategy. Cost management should be part of the strategy and be influenced by the strategy. Cost decisions should be measured against the contractor's strategy, rather than a current short-term situation.

2.4.2.1. 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 whereby 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 markup 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.

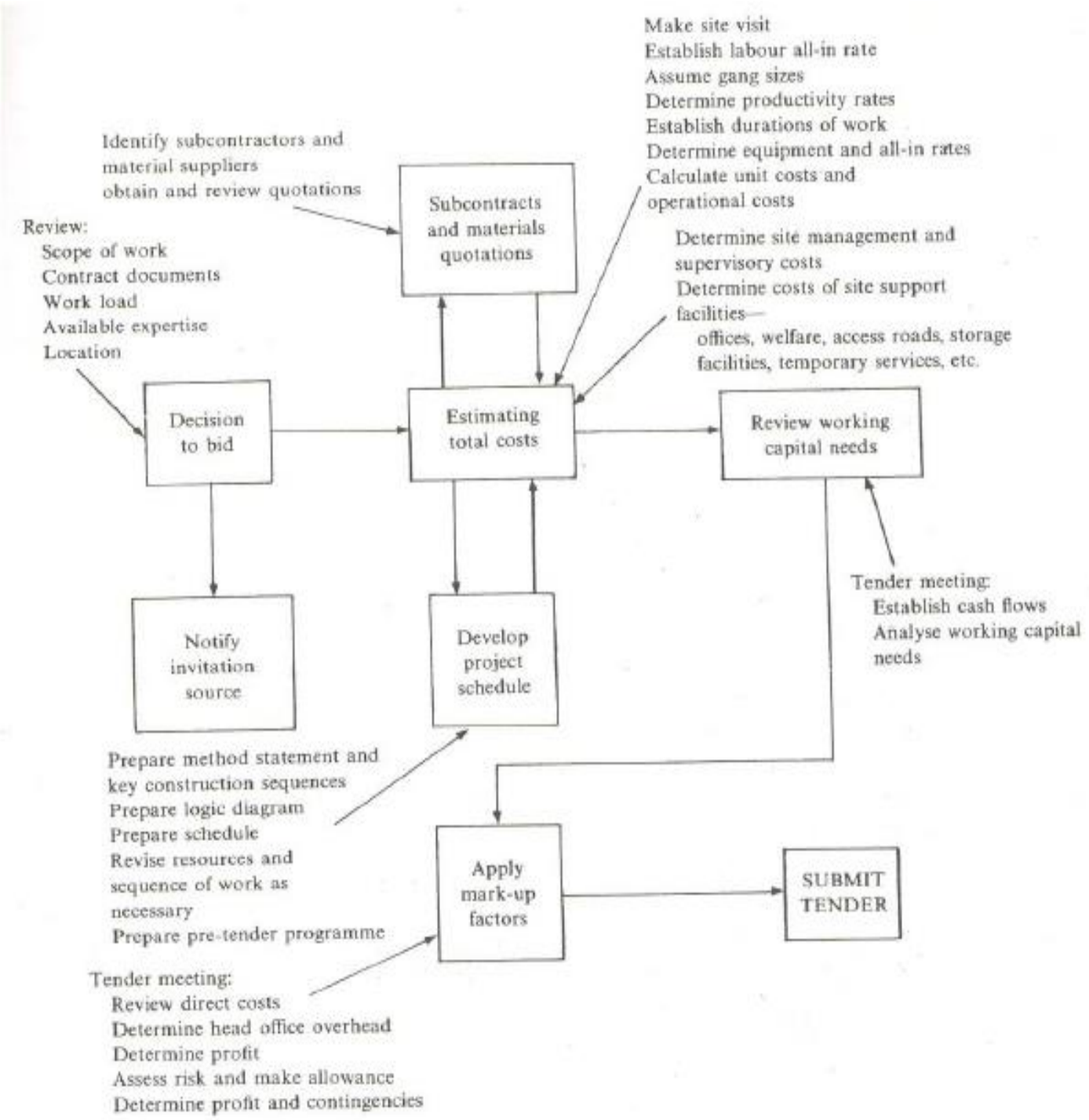

Figure 2.2 The tendering process, Plither 1992

2.4.2.2. 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 markup 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 markup 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.

2.4.2.3. 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.

2.4.2.3.1. 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 outcome 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, sometimes 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 description of the work in each WBS component.

e) Commercial data base

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

2.4.2.3.2. 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 plat, sub-contractors) are established and to which an 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 Akin toy 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 ad 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.

2.4.2.3.3. 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 relationships:

Direct cost = Direct material cost +Direct labor cost + Direct equipment utilization cost... [2.1]

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

Material unit cost=∑ (Material consumption quantity standard x Material's unit price)..... [2.2]

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.

Direct labor hourly cost=∑ (No of labor x Basic salary x Labor index x UF)..... [2.3]

Labor index is a multiplying factor of the basic salary which represents the additional benefits a worker gets such as overtime 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.

Direct labor unit cost=Direct labor hourly cost/ hourly crew productivity..... [2.4]

Direct labor unit cost= Direct Labor hourly cost x Worker's productivity standard..... [2.5]

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 output by a worker, executing a specific activity for one hour. (Example 3hr/m_2 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 equipment's, capacity and equipment utilization factor and the equipment hurly cost.

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

Direct equipment hourly cost=∑ (No of equipment x Hourly cost x UF)..... [2.6]

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

Equipment rate per hour= owing cost per hour + operating cost per hour..... [2.7]

Where, Owing cost = Depreciation

Operating cost = Fuel cost +Maintenance cost + Major repair cost + Operator's cost
+ Tire replacement cost (for rubber tired 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:

Direct Equipment cost per unit work= Direct equipment hourly cost/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 overhead 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 overhead costs=K1 x Direct unit cost..... [2.8]
  Where K1= Total site overhead cost/Total project direct cost
- Head office overhead costs=K2 x Direct unit cost..... [2.9]
  Where K2= Annual head office overhead costs/ Average annual direct cost turn over
- Indirect unit cost=Site overhead costs +Head office overhead costs..... [2.10]

2.4.2.4. 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.

2.4.3. 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, (Chaitra, 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 cannot take care of all eventualities and unforeseen circumstances.

2.4.3.1. 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 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 Roy Plither (1992), 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.

2.4.3.2. 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 overall 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 inflow as well as cash out flow. While the contractor's cash inflow 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 onetime costs and time related costs and then preparing monthly schedule of expenditures. The difference between cash inflow 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 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.

2.4.4. 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 enables contractors to strengthen the case for buildup of new rates.

2.4.4.1. 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
- 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.

2.4.4.2. 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).....[2.11]
- Work done value or quantity variance = Budgeted or forecast revenue – Contract value of
- work done.....[2.12]
- Price variance =Contract value of work done – Actual (approved) revenue.....[2.13]

2.4.4.3. Budgeted cost control

Budget relates costs with time progress. Control of budgeted cost involves evaluation of cost variances by comparing actual costs with budged costs to determine cost overrun / 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 2.3.

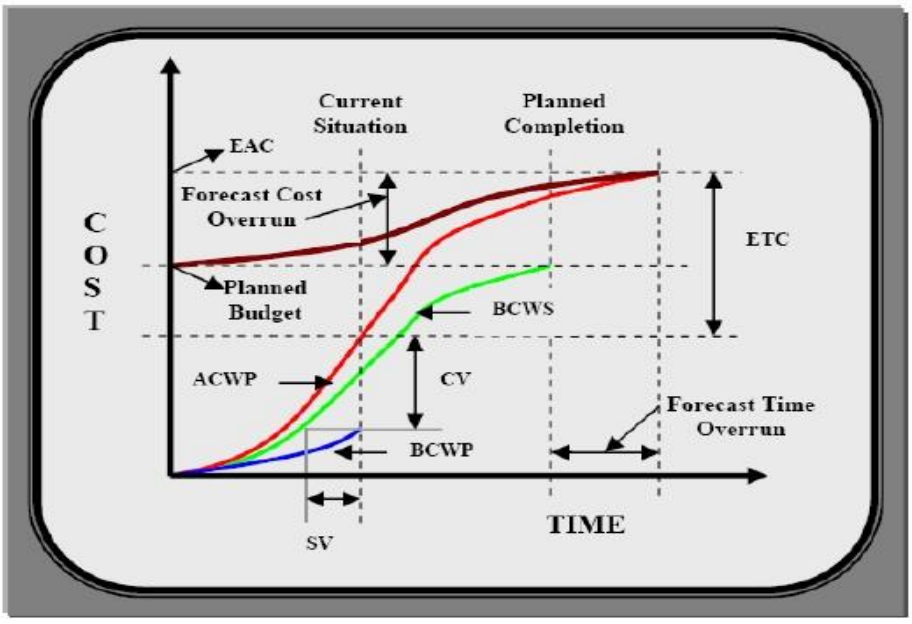

Figure 2.3 Cost and Schedule Variances, Source Wibshet, 2004

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……..... [2.14]

The cost variance at the end of the project will be the difference between the budgets 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 ……..... [2.15]

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.

2.4.4.4. Direct Cost Variance Analysis

Direct cost control is exercised by comparing the actual directs 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. Likewise 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 output.

Materials cost variance = standard materials cost – Actual materials cost..... [2.16]

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..... [2.17]

Where,

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

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

b) Labor Cost Variance

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

Direct Labor cost variance = Standard materials cost – Actual labor cost..... [2.18]

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 output. The equipment variance analysis is

Equipment cost variance = Standard equipment cost – Actual equipment cost…..... [2.19]

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 time – Actual rate)

2.4.5. 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.

2.5. 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 forecasts. The activity's sale or contract price is used to determine the income and cash-flow forecasts. 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.

2.5.1. 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, without interference from 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 itself and can be performed without 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, cost able 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.

2.5.3. 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.

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 THREE
MATERIAL AND METHODOLOGY

3.1. Overview of the Research Process.

This research undertake as an applied research, which enables towards contributing knowledge towards solving a practical problem, the research started by investigating a practical problem.

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.

3.2. The Study Approach and the Research Instrument

The main purpose of this research was to assess whether and to what extent the processes, practices and tools under each of Project cost management knowledge areas are being applied by water work contractors in managing their construction projects. The motivation for the research has emanated mainly from observations and experience of the researcher serving as site engineer and resident engineer in water work construction projects and also to show the gab of the existing knowledge of cost management practices within the national water work contractors with the existing knowledge of cost management practices.

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, the following tasks were undertaken to develop the proposed gap:-

1. Literature review
    a. To identify knowledge areas to be included.
    b. To identify processes and practices effective in cost management knowledge area.
2. Questionnaire survey was selected as the research instrument owing to its suitability to the level of information required;-
    a. To identify the processes and practices followed by the national contractors currently.
    b. To determine the relative importance of the factors in the knowledge area with their relative weight to assess their impact on current cost management practices. **.**

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.

3.3 The Research Questionnaire Design

Scott (1961) states that "a high response rate to mailed surveys was achieved by keeping the questionnaire brief and the amount of work needed to be done by the respondent to a minimum". Therefore the length of the questionnaire should be to be limited to permit completion within a fifteen to twenty minute time period. A selection of the literature and practical issue on questionnaire design was reviewed to achieve this aim. The main objectives of this research are to investigate the extent of cost management technique adopted, its performance, and satisfaction and evaluate the factors influencing the contractors in the point of view of water projects in Ethiopia. Therefore the structured questionnaire was designed to suit the above research objectives.

Questionnaire is designed in three major parts focus on the required data. The first part comprises questions about the background of the contractors. The second part investigates the extent of the application of cost management techniques in the respondents' company and the effectiveness of those cost management techniques. The third part participants were asked regarding the success of profit and 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**.** And also participants asked to rate a list of hypothesized factors influencing cost management identified. The questionnaire form, which was accompanied by a covering letter, consisted three parts. The questionnaire was a mix of structured (closed) and unstructured (open) type of questions. Participants were encouraged to give additional information or Comments on the open spaces provided under each question.

3.4 The Research Sample Selection

The population of the study was limited to (WWC) contractors of class III and above and Water Work Construction Enterprises. This is mainly due to the fact that these contractors, most of the times, involve in multimillion projects which demand the implementation of an integrated and efficient cost management system and also the government is giving due concern to accessing

clean water, constructing large scale irrigation project and hydropower's. So, capacitating domestic water work contractors with effective cost management practices is a must. Participants of the research were selected from contractors' lists Gained from Ministry of Water, Energy and electricity and Ethiopian Contractors Association. The list published by Ministry contained name and address of 52 classes III and above construction firms As the research is focused on domestic water contractors, foreign contractors were excluded from the selection list. Moreover, contractors whose head office is located out of Addis Ababa were also excluded. Two contractors could not be reached. Accordingly, the questionnaire was delivered to the remaining 36 contractors in person. Of the 36 class III and contractors who have collected the questionnaire form, 34 contractors have returned completed questionnaire the research sample did not include below Class III ,is mainly due to the project they handling is not complex and difficult as of class III and above . Furthermore, the findings and recommendations for Class III and above will also work for those classes.

3.5 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, (1= Not significant 2 = slight significant, 3 = significant, 4 = very significant and 5= extremely significant). 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.. The Relative Importance Index (RII) is calculated with the following formula:-

$$RII = \frac{\sum W}{A*N} \quad ; \text{ Where:}$$

$$W = 1 * n_1 + 2 * n_2 + 3 * n_3 + 4 * n_4 + 5 * n_5$$

W = weighting given to each factor by respondents ranging from 1- 5.

n_1, n_2, n_3, n_4 and n_5 = number of respondents for very low , low , medium, high , very high involvement respondents respectively.

A= is the highest weight (i.e. 4 in this case), and

N =is the total number of respondents

RII value had a range between $0<RII \leq 1$.

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CHAPTER FOUR
ANALYSIS AND DISCUSSIONS

4.1. Respondents Background

Most of the respondents are senior management grade and the right professions responsible for construction cost management, thus the data obtained are confident to represent the survey population. Contractors are asked to assign whom responsible for construction cost management to reply this questionnaire. It is reasonable that the result in Table 4.1. Shows 38% of respondents are Contract Administrator / Quantity surveyor. The others are project Director / General Manager / owners, 24%, Project Manager / Engineer / Site Agent, 29% and Accountant 9 %. Table 4.1 Statistic of Respondents Profession.

Profession	No.	Percentage
Project Director/General Manager	8	24%
Contract Manager/ Contract Administrator	13	38%
Project manager / Engineer/Site Agent	10	29%
Accountant	3	9%
Total:	34	100%

4.2 Experience of respondents.

There are more than half of the respondents with experience more than 5 years in construction field. As shown in Table 4.2, 44% of respondents have 5-10 years' experience, 18% of respondents have 0-5 years, 26% of the respondents have 11-15 years' experience and 12% of the respondents have 16-20 years' experience. The result reveals that the respondents are experienced enough and the information given was valuable for this research. The more experience of the respondents, the more confident and reliable of the data obtained.

Table 4.2 Statistic of Respondents Experience

Years of Experience	No.	Percentage
Less than 5 years	6	18%
5 – 10 years	15	44%
11 – 15 years	9	26%
16 – 20 years	4	12%

4.4. Application of Cost Management Techniques/Systems

This research intended to investigate the application of cost management techniques/systems in the contractors of water work contractors of in Ethiopia. The statistics are listed in the Table 4.3. Overall, Table 4.3, Only 4 of respondents does not use any techniques and rely on judgment with experience and intuition only. Most of the respondents use tender budgeting, working budgeting/on-going job budgeting, and financial report & cost report for construction cost management. Only 2 of the respondents use cash flow forecasting. None of the respondents use value management cost coding and cost planning and control. For the case of water work contractors, do not use any specific techniques and only by judgment with experience and intuition only 35%. But few contractors with annual contract amount of more than 100 million birr and water work enterprises uses working budgeting which occupies 26% use financial reporting and cost reporting 21%, use tender budgeting 12% and cash flow forecasting 6%. The results are within the expectation of this research that the contractors with less than 100million birr annual contract amount don't have resource to do the reporting, monitoring and documentation works and highly relies on the judgment with experience and intuition. Generally water work contactors weather those have annual contract amount more than 100million birr nor less than 100 million birr use full techniques of cost management such as cost coding, value management and cost planning and control.

Table 4.3 Statistic of Adopted Cost Management Techniques/Systems

Type of Cost Management Techniques/Systems	No	%
Tender Budgeting	4	12%
Working Budgeting / On-going Job Budgeting	9	26%
Cash Flow Forecasting	2	6%
Financial Report & Cost Report	7	21%
Cost Code System	–	–
Value Management	–	–
Cost planning and control	–	–
No Specific technique, by Judgment with Experience and Intuition only	12	35%

* Note: % of frequency of the techniques/systems selected to the no. of respondents

4.5 Human Resource Input for Cost Management

Overall, most of the samples have less than three staffs being responsible for cost management and there is no one for application of cost management techniques with in the contractors. Even those persons are responsible to financial report and cost report the financial part only and one or two persons for contract administration only. Referring the results shown in Table 4.4 the human resources input for cost management are 6% for more than 6 staffs, 18% for 3–6 staffs and 76% for less than 3 staffs.

Table 4.4 Statistic of Human Resource Input – Overall Response

Staffs responsible for cost management	No.	Percentage
Less than 3 staffs	26	76%
3 to 6 staffs	6	18%
More than 6 staffs	2	6%

4.6 Application of Information Technology

The survey reveals that application of information technology in construction cost management is still in infancy stage it is better to say not in use even. Advance information technology has still not yet been fully understood by our contractors. Overall result of the Table 4.5 and Fig. 5.8 show that only 35% of the contractors use Email, 47% of them has some kind of specific use of Microsoft Access and 17% of them doesn't use any information technology system. The software such excel is generally used by all of them. For those contractors in use of email is email opened as for the company purpose only. Most of contractor doesn't has even company email, they use email of general manager or the owner of company personal email. None of the contractors use special software used for construction cost management, Electronic Tendering and Electronic Document System. The result sounds reasonable and reliable as more resources and incentives to apply new information technology are needed for the water work contractors in Ethiopia.

Table 4.5 Statistic of Application of Information Technology

Type of Cost Management Techniques/Systems	No	%
Electronic Tendering	-	_
Electronic Document System	-	_
E-mail	12	35%
Microsoft Access	16	47%
Tailor-made computer software; (QSM, Ripac, Atles & CCS, etc)	_	-
None	6	17%

4.7. Factors Influencing Contractors' profit making

Construction firms' survival and growth is closely linked with the acquisition of sufficient or optimum volume of work or number of projects. As contractors said most of the around 97% obtain work through open or closed tendering. The others ensure work through negotiation and tendering. Hence, the performance of contractors is dependent on their performance in bids or tenders. On the other hand, the continuity of their firms 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.

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 4.6, indicted that 85% of the surveyed contractors have obtained below 50% of the amount assumed or planned during submission of tenders., Forty Eight (48%), secured 75- 50% of the anticipated amount, from most of the projects they have completed and only 9% of the surveyed contractors gain 100-75% those are contractors which handles large projects.

Table 4.6. Ratio of actual profit to estimated profit

Ratio of profit obtained	Response distribution	
	Frequency	Percentage
100% or above	0	0
100 – 75%	3	9%
75 – 50%	12	35%
Below 50%	19	56%

Several factors as mentioned in table 4.7, with in and out of contractors' control contribute to the inefficiency with respect to profit. In this study I tried to classify factors as cost management factors and project factor. Contractors were asked to rate the magnitude of influence of those factors on the level of profit obtained from projects, on a 5 point scale. Table 4.7 presents Table presents contractors' opinion. In adequate Resource/financial planning is the first ranking factor in the order of influence, with an importance index of 0.91. Additional cost incurred due to the delays caused by owners and/or consultants is ranked second, with an importance index of 0.88.

Table 4.7 Rank of factors responsible for low profit

S/N	Factors	Importance index	Rank
	Cost management Factors		
1	Inadequate resource/ financial planning	0.91	1
2	Delays of payments due clients and/or consultants	0.88	2
3	Inaccuracy of tender estimates prepared during the tendering stage	0.77	3
4	poor cost control of site management	0.72	4
5	Problems related procurement method	0.68	5
6	Deviations in labor productivity between assumed and actual	0.63	6
7	Poor definition of project scope(type, size, complexity) during tendering	0.57	7
8	Lack of resource and manpower for cost management	0.55	8
	Project Related Factors		
9	Price Escalation	0.49	9
10	lack of experience of project type	0.42	10
11	poor relationship with sub-contractor	0.38	11
12	buildability: change of construction method	0.35	12
13	Technical difficulties	0.32	13
14	Weather conditions	0.29	14

In Inaccuracy of tender estimates prepared during the tendering stage practice is also 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 0.77. It is followed by poor cost control of site management system at construction sites and Problems related procurement method, with importance index values of 0.72 and 0.68 respectively. Deviations in labor productivity between assumed and actual is on six positions with an importance index of 0.63. lack of resource and manpower for cost management has moderate impact on the level of profit. Price Escalation, technical difficulties, poor relationship with sub-contractor, lack of experience of project type, buildability: change of construction method and weather conditions have insignificant effect on the level of profit from projects.

As discussed above from the result of table 4.7, inadequate financial planning, and poor cost control of site management system at construction and 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 project.. Among these top five factors from table 4.7, the second and fifth, 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 upon the completion stage.

As discussed above, success in tender 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.

4.8. Tendering/Pre-Contract Practices

4.8.1. 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 4.3, 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.

4.8.1.1. 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 4.8, 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 4.8, 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 4.8 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 overrun can be and on what to do to eliminate or reduce cost overrun 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.

4.8.1.1.1 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. 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 4.9, 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 Water code of Ethiopia prepared by MoWUD, are not up-to-date and are not in a suitable form for efficient or systematic use.

Table 4.9 Mean rank of sources of inaccurate cost/price estimates

SN	Potential causes	Ranking by contractors						I.I.	rank
		1St	2nd	3rd	4th	5Th			
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

4.8.1.1.2 Estimation of Overhead Costs

Overhead (OH) costs are major components of projects' construction price. These costs are those charges that cannot 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 overhead costs. As mentioned above, 52%add an allowance for the OH costs arbitrary, without 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 4.10, 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 4.10 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	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

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 4.15, 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 4.11. Ratio of company OH to total project direct cost

Percentage of company OH 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

***Overall ratio of OH to project direct cost = Σ (calculated mid-point percentage X Percentage) 100**

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

4.8.1.1.3. Allocation of Risk Allowances

The identification, evaluation and quantification of risks and uncertainties are 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 4.9 .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.

4.8.2. 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 4.16, the ratio of the profit amount to total project costs for 54% of the contractors is between 10-15%. 13% of the contractors add more than 15% of the project estimated cost as a profit. The calculated overall percentage is 15.44%, a figure higher than the 10%-15%,

recommended by Ethiopian Building Construction Authority and the National Water code MoWUD. 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 4.12 Ratio of profit margin to total project cost

Range	Response distribution	
	Frequency	Percentage
Below 7%	0	0
8% - 10%	3	10
10% - 15%	17	54
15% - 20%	13	26
Above 20%	3	10

Table 4.13 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 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 contactors.

As shown in Table 4.13, 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 4.13 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.

4.8.3. 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. 96% of the surveyed contractors add an allowance for taxes in their tender price. Table 4.15 shows the methods used by those who incorporate tax allowance.

Table 4.14 Bases used to incorporate tax allowances

No	Methods	Response distribution	
		Frequency	Percentage
1	As an overhead cost	11	38
2	As percentage of envisaged profit amount	17	56
3	Assuming a fixed amount	4	12

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 4.15, 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 cannot provide information on total resource requirements and total estimated costs.

Table 4.15 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 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 software's. Accordingly, they are unfamiliar with the software's or do not have sufficient information about the benefits. But, using standard software's give advantages in estimate accuracy, reliability, speed and man hour saving.

4.9. 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 underpricing) 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, poor 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 4.8.

4.9.1. 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 feedback 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.

4.9.2. 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 4.8.1.1.2 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 4.16, 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 4.16 Methods used for controlling project costs

S/N	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 unit 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. Infect, 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 4.19, 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 4.17 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

4.9.3. 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 4.18.

Table 4.18 Intervals for checking labor and equipment costs

S/N	Frequency of checking		
		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 FIVE
CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

In general from the result of this research, the application of cost management techniques used by national contractors in Ethiopia are limited to the cost planning, cost control, and financial report & cost report. The cost code system and value management is not adopted. Most contractors relied considerably on their judgment by intuition and experience only. For the human resource input, almost 90% the respondents had less than three staff working for cost management of the project. Regarding application of information technology (IT), it can be concluded that IT application in construction cost management used by national contractor in Ethiopia is still in its infancy. Only typical spreadsheet "Excel" is widely used.

The surveyed contractors obtained below 75% of profit amount planned or assumed during tender submission. Among these, 52% have obtained below half of the amount anticipated, from most of the projects they have undertaken so far. Accordingly, the major factor that affects profitability of projects are:- In adequate Resource/financial planning ranked first , the delays of payments caused by owners and/or consultants rank second , In Inaccuracy of tender estimates prepared during the tendering stage ranked three , Poor cost control of site management system at construction sites ranked four and Problems related procurement method are ranked five.

The survey revealed that the failures in accurate cost estimations arise due to the estimation method in use is standard estimating methods only, Lack of accurate and reliable data on resources' price and labor and equipment productivity standards cost estimates and while estimation of indirect costs deviation from the standards or margins set by Ethiopian Building Construction Authority and the National Water code MoWUD.. The survey results also 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.

5.2. 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. Application of cost management techniques in national contractors is not extensive and satisfactory. Therefore, applying the integrated cost management techniques which includes all techniques is highly recommended for efficient cost management. More over the application of Information Technology (IT) is infancy is limited to excel sheet only. The adaptation of software's such as Microsoft project, primavera and Tailor-made computer software; (QSM, Ripac, Atles & CCS, etc is important in this IT ear.

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 and/or Parametric estimating can be used as a decision support techniques , as those techniques provide information on the probability of cost over run, on how large the overrun can be and on what to do to eliminate or reduce cost overrun, including how much contingency to add to the estimate. Moreover, those techniques help in checking the estimated costs by the standard estimating techniques.

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 revealed that 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.

The profit mark-up amount applied to the estimated costs, by the contractors is higher than the range recommended by national codes. 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. Moreover, their bidding strategy should help to identify the optimum mark up for each job to bid.

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 carry out 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.

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 within 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.

5.3. Recommendations for Further Works

This research has identified the extent of the cost management practice and its effectiveness in

the national water work contractors. Factors influencing contractors profit is also identified. Moreover, has forwarded (qualitative) theoretical interventions and recommendations that can improve the practice and result in improved out comes 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..

- Improving Cost management practices of client and consults
- Developing contextual project works coding system and Value Management.
- Developing computerized estimating techniques.
- Assessing the current procurement method
- Introducing the information technology during tendering, cost controlling and documentations of contractors
- Developing system for controlling labor productivity and cost for construction projects.

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Appendix

Questionnaire

Name: Amrot Gobena

Course: MSc in Construction Engineering and Management

Institute of Technology, Jimma University This questionnaire is for my academic research and the topic is **"Cost management practice of national water work contractors in Ethiopia"**. The aim of this research is to investigate the current cost management techniques adopted by construction contractors and the factors lowered profitability of contractors in the water project the handle. All the data collected will be served for academic purpose exclusively and treated in strict confidential. Please kindly complete it and return to me by the attached envelope.. Your help is earnestly solicited.

Part I Background Information (Please tick the appropriate box by choosing ONE of the following)

1. Please select the profession that you are engaged:

	Project Director/General Manager/Owners
	Contract Manager/ Contract Administrator
	Project Manager/ Engineer/Site Agent
	Accountant
	Others, please specify _____

2. How many years of experience that you are in construction industry?

Less than 5 years		16 – 20 years
5 – 10 years		Over 20 years
11 – 15 years		

3. Please choose the approximate contract sum of the projects which currently undertaken by your company.

	Less than 100 million
	More than 20 million

Part II

Cost Management Techniques / Systems (Please tick the appropriate box)

4. Please select the kind of cost management technique / system which you currently adopt. (You may select more than ONE answer.)

	Cost Planning and controlling
	Tender Budgeting
	Working Budgeting / On-going Job Budgeting
	Cash Flow Forecasting
	Financial Report & Cost Report
	Cost Code System
	Value Management
	No Specific technique, by Judgment with Experience and Intuition only

5. How many staffs are responsible for cost management and for the application of cost management technique / system of a project normally?

	Less than 3 staffs
	3 to 6 staffs
	More than 6 staffs

6. What kinds of Information Technology assist in cost management of your company? (You may select more than ONE answer.)

	Electronic Tendering
	Electronic Document System
	E-mail
	Microsoft Access
	Tailor-made computer software; QSM, Ripac, Atles & CCS, etc
	None Others

PART III

7. 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)

8. 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

9.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
- 100% - 75%
- 75% - 50%
- Below 50%

b. 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

Cost management Factors

Lack of resource and manpower for cost management

Problems related procurement method

Delays of payments due clients and/or consultants

Deviations in labor productivity between assumed and actual

Poor cost control of site management

Inaccuracy of tender estimates prepared during the tendering stage

Inadequate resource/ financial planning

Price Escalation

Project Factors

Poor definition of project scope(type, size, complexity) during tendering

Technical difficulties

poor relationship with sub-contractor

lack of experience of project type

buildability: change of construction method

Weather conditions

10. 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

11. 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

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

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

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

c. 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%
- 5% - 10%
- 10% - 15%
- 15% - 25%
- above 25%
- do not know exactly

d. 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%
- 5% - 10%
- 10% - 15%
- 15% - 25%
- above 25%
- do not know exactly

13. 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.

14. 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

15. 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

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

- Yes
- No

If you have, please attach a copy.

17. 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_____

_____

18. 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
  - Labor requirement and cost
  - Equipment requirement and cost
  - Overhead costs
  - Sub contract prices
  - Risk allowances
- Cash in flows
  - Revenues /payments
  - Other incomes or financing schemes
- Working capital
  - Cash reserve

19. 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

20. 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 feedback to the estimation process
- To check profitability of project
- For monitoring efficiency or performance of resources /labor, equipment/

22. 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

23. 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.