

IMPROVING PROJECT COST MANAGEMENT PRACTICE AND PROFITABILITY OF DOMESTIC CONTRACTORS IN VADODARA

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Abstract: Poor cost performance in construction project is a common problem worldwide resulting in significant amount of cost overrun. Construction cost management is the most important function for project success and the construction project performance is generally expressed in terms of cost and its variance from the budget. However, it has not been effectively used due to the presence of a large quantity of data with many complex interrelationships. Construction firms, being project based organizations, have to develop their project management capacity in order to accomplish firm and project objectives successfully. In addition to the major cost management functions (which comprises estimating, tendering, budgeting and cost controlling practices), the study result made on contractors' performance with regard to winning contracts and securing adequate profit from contracted projects indicated that, the success rate for about 43% of contractors is below 50%. The major contributing factor for this are severe competition among contractors and high and/or low pricing. With regard to the profitability of contracted projects, 52% of contractors have secured a profit of less than half of the anticipated amount. Inadequate financial planning and lack of effective and efficient project cost management system are among the highest responsible factors for obtaining low profit. Thus, contractors need to focus on project cost management processes to improve the financial management capacity and the profitability of contractors'.

Index Terms: Construction cost management, cost estimating, tendering, budgeting, cost control

I. INTRODUCTION

Construction firms, being the key stakeholders of the construction industry, are the primary agents for meeting the demands made upon the industry. These firms, being project based organizations, they carry out the construction of public or private projects, which demand efficient management and coordination to make the best use of resources and ensure continuity of works and revenues. The problem of poor cost management and overrun in project cost is serious issue in both developed and developing countries. This needs serious attention for improving the construction cost performance as rarely projects are completed within budget [4]. Failure to manage these projects properly will lead them to economic failure or undermine their organizational capacity. Hence, contractors need to focus on projects portfolio management processes in fulfilling predetermined project objectives. Among these, project cost management process is the one and most essential and common issue in the entire construction industry, which is the subject of this research. However, construction cost management has become more complicated with the introduction of new procurement methods, technologies, resources and various professionals involved in a project [10]. Consequently, most domestic contractors are characterized by lack of appropriate financial management system; and failure to manage these projects will lead them to bankruptcy that undermines their organizational capacity. It is recognized that the number of failures of contractors in the construction industry is much higher than it should be. Thus, this research is carried out to investigate the current cost management practices of domestic construction firms, in order to identify the particular areas which need to be improved for achieving the predefined project objectives and their profitability.

Construction projects cost management is a process which complements the broad functions of estimating and tendering, scheduling, cost control and financial control [9]. Construction cost management is the entire process, which ensures that the contract amount is within the cost limit of client's approved budget [17]. The

cost performance of a project highly depends on cost variances, which is referred as any deviations in the budget or cost planned.

II. LITERATURE REVIEW

Construction projects management is a process which encompasses various sub processes and functions that are necessary for ensuring that these objectives are accomplished. Construction project management is the overall control of the managerial process which encompasses the planning, executing, and executing to optimize the three major attributes of the process, quality, schedule and cost, in addition to environmental safety [9]. The management of project is a special kind of management which holds certain basic features that differs it from general management or the management of steady state organisations which runs continuously.

A. Procurement and Contract Planning in Construction

The construction contract procurement includes the processes of issue of notice for tenders, pre-qualification of contractors, evaluation of bid on receipt and award of contract [15]. The most common and widely used procurement methods or pricing arrangements in the construction industry are competitive tendering and negotiated tendering [18]. Construction projects, whether small or large, cannot be executed with in-house resource unless the employer/client himself is a contractor [15]. A construction contract is a binding agreement, enforceable in law, containing the conditions under which is essentially designed to help achieve a quality construction project with in stipulated time and cost, while adhering to all the safety norms [14]. Among the various types of contracts evolved to suit the various situations, fixed price contract, cost-plus fee percentage contract, public private participation (PPP) infrastructure projects contract, and resource and service contract are the common types [15].

B. Construction Project Cost Management Process and its Elements

Project cost management, has a broader view of life-cycle costing, and incorporates the effect of project decisions on the cost of using, maintaining and supporting the product, service or results of the project. However, it is primarily concerned with the cost of resources needed to complete scheduled activities during the execution stage [16]. Project cost management is all about controlling cost of the resources needed to complete project activities [14]. The estimated or construction cost of carrying out the works of a construction project is composed of four categories comprising; direct costs, indirect costs, risk allowances and profit. Direct costs are those costs that can be correlated to specific activity or a work-item, which is being done or produced. All other costs that are incurred to accomplish an activity or the work-item but cannot be correlated directly fall in the category of indirect costs [15].

Project cost management includes the processes involved in planning, estimating, budgeting, financing, funding, managing and controlling costs so that the project can be completed within the approved budget [16]. But, it is identified that cost estimating, cost budgeting and cost controlling are the main and discrete processes of a cost management system. These processes are independent and do overlap. On the other hand, construction cost management deals with a broad range of functions such as estimating, scheduling, cost control, resource costing and financial control [8]. Based on these functions, [8] have developed an integrated cost management scheme, as shown below in figure 1.



Fig. 1. Data flow diagram for a cost management system [8].

Integrated cost management involves the main elements of planning, estimating and tendering, budgeting or the distribution of estimated cost and expected revenue, and controlling costs by comparing actual costs with the estimate.

Construction cost planning covers engineering practices that integrate estimating, planning judgment, costing techniques and accounting discipline for developing standard costs [15]. The project cost estimate is mainly concerned with developing an approximation of the cost of resources required to complete the planned project activities. Inaccurate estimation of costs can challenge contractors with regard to winning tenders and/or obtaining anticipated profit from contracted projects. Among the various types of cost estimating techniques, the most commonly used techniques identified by many textbooks and research papers are standard/detailed estimating, analogous estimating, parametric estimating, probabilistic / statistical estimating and other estimating techniques including cash flow forecasting, variance analysis, and earned value method, software packages and simple arithmetic formulas. A choice of the method of estimation to be used depends upon the nature of the project, the life-cycle phase, the purpose for which the estimate is required, the degree of accuracy desired and the estimating effort employed [14]. If the invitation to tender is given by client and accepted by the contractor, the contractor offer estimates to carry out the work and then the tendering process begins. The pricing of tender amount comprises a cost estimate for project activities and mark-up allowance for general overhead and profit [9].

Cost budgeting is the process of aggregating the estimated costs of individual activities or work packages to establish an authorized baseline [16]. Based on the baseline, cost controlling system should be capable of tracking and identifying activities which indicate substantial deviation from planned amounts so as to monitor the cost status of the project and manage changes to the cost baseline and taking remedial actions from changes to the cost baseline as applicable [15]. From numerous types of available cost control systems for construction projects, Earned Value control, Direct Cost Control, and the Budgetary Control systems are the most commonly used practices.

C. Project Work Breakdown and Coding Systems

The construction projects are best organized by tasks, best controlled by work packages, and best programmed for day work by using operational level which in turn are best planned and monitored by activities [15]. Project works are disaggregated/broken down in to manageable parts arranged in a hierarchical order till the desired level for the purpose of time and cost control. Four levels of project work breakdown are defined by [14], which arranged in descending, order are, sub-projects, work-packages, tasks and activities. Construction coding systems are adopted to provide a numbering system to replace verbal descriptions of items and it provides an identification of the description of the work in each WBS component. These codes reduce the length or complexity of the information to be recorded. The standardised cost structure that is used in each and every project has the key advantage that projects can be compared with each other and key performance indicators can be determined.

III. THE RESEARCH DESIGN AND METHODOLOGY

The study approach involves both literature search and the use of structured and unstructured questionnaires which was considered to be the most appropriate tool to reach the population of the study with limited time and to obtain as much information as possible by encouraging participants to give additional information/comments on the open spaces which are provided under each question in addition to structured type of questions. Accordingly, the survey were designed based on the variables extracted from the literatures and organized in four parts which include general questions related to the organizations' profile, and questions regarding the major project cost management functions on current practices which include the project tendering and procurement practices, project cost estimating practices, and cost controlling process and the project budget. The designed survey then distributed to 36 class C and above general and building construction firms contractors which were selected on the basis of purposive sampling from contractors' lists registered from 2014-2017 in Vadodara Municipal Corporation office. Out of the 36 contractors who have collected the questionnaire form, 33 of them has returned completed questionnaire and found suitable for analysis, representing a response rate of 91.7%. The data obtained from the survey was analysed using importance index of factors to rank them according to their importance, and frequency distributions were used to analyse

the result of some questions. The output of the analysed data is then presented using tables, graphs and simple percentage for further interpretation and discussion.

IV. ANALYSIS AND DISCUSSION

Since the research is focused on building contractors in Vadodara, the survey result indicated that, the proportion of building projects for about 85% of the surveyed contractors, building projects has constituted more than 50% of their total work that the firms has undertaken over the past ten years. Among the surveyed contractors who procure projects through tendering, about 76% secured more than half of their work load through the competitive bidding, which involves severe/tough competition. The findings of the survey indicated that, majority of the contractors has been involved in projects in which the unit price /BOQ contract type followed fixed price type of construction contract with importance index value of 72.0 and 67.4 respectively. Another participants having a rank of third and fourth are familiar with the item/percentage rate and turnkey/BOT construction contracts, with importance index value 57.0 and 53.9 respectively. However, cost-plus-fee contract, PPP contract, and resource & service contract has not been exercised widely by domestic contractors to procure building construction projects.

A. Contractors Performance with regard to the Success Rate of Tender Offers and Profitability of Contracted Projects

The construction firms’ survival and growth is closely related with the acquisition of sufficient / optimum volume of work / number of projects and with generating sufficient amount of profit from the projects. In this regard, based on the assessment made to reveal the average number of tender offers made by the contractors annually with the associated rate of success, it is disclosed that the success rate for about 70% of contractors is below 75%, and 43% have a success rate lower than 50%. The major contributing factor for this, as indicated by contractors is tough/severe competition followed by high/low pricing, with importance index of 89.4 and 78 respectively, as shown below in figure 2.

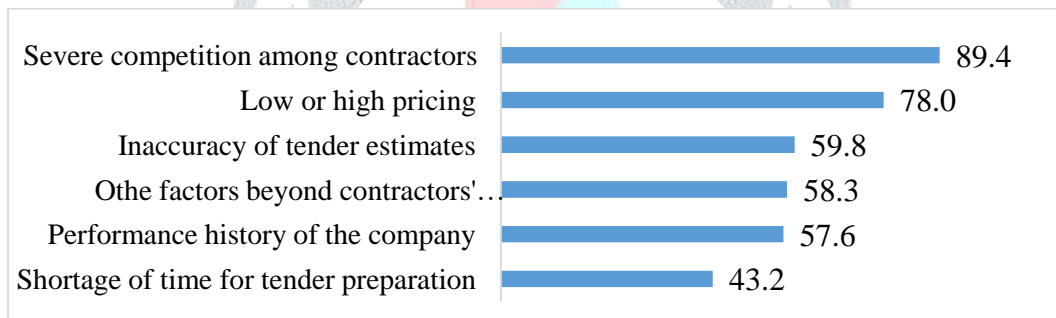


Fig. 2. Rank of factors responsible for low success rate of contractors’ tender offers.

Regarding contractors’ performance with respect to profit, the survey finding revealed that domestic contractors face serious challenges with regard to securing adequate profit amount from most of their projects. As shown in the figure 3, all of the surveyed contractors have obtained below 75% of the amount assumed/planned to obtain during tender submission. Among these, 52% of contractors have secured a profit below half of the anticipated amount from most of the projects they have undertaken.

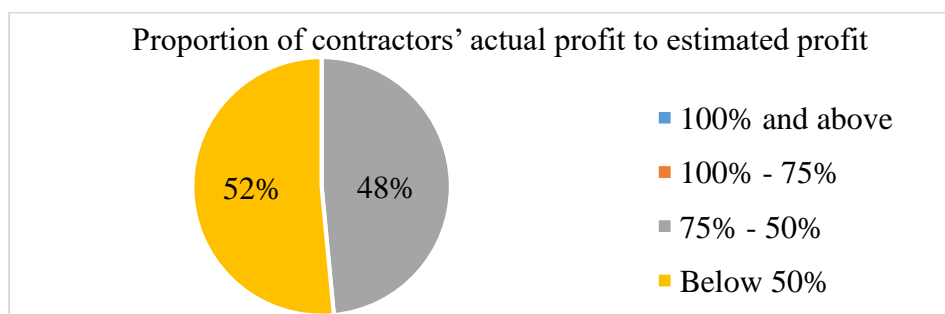


Fig. 3. Proportion of contractors’ actual profit to estimated profit.

Among the eleven factors which were asked to contractors to rate the magnitude of influence on the level of profit obtained from projects undertaken so far, inadequate financial planning (budgeting, financial plan,

cash flow forecast); escalation of materials, labour and sub-contractor prices; lack of effective and efficient project cost management system; the level of accuracy of cost estimates prepared during tendering; and delays that occurred due to design changes or other reasons are the top five ranking factors in order of influence, with the importance index of 81.8, 80.4, 76.1, 69.3, and 62.5 respectively. However, weather conditions have insignificant effect on the level of profits.

B. Pre-Contract (Tendering) Practices

Contractors' Bidding Practice:

Based on the assessment made to investigate the importance of seven critical factors on contractors' decision to bid or not, the highest ranking factors which governs the decision to submit or not a tender offer, are the project location, the project size, and the available company's expertise and equipment's with an importance index value of 81.8, 81.8 and 72.7 respectively. Market condition, competition, current and projected economic conditions, degree of risk, type of contract, time span of proposed project, bonding capacity of the company and possibility of winning previously submitted tender offers are among other factors which need serious attention by contractors. Most of domestic contractors' approach to the acquisition on award of contracts, as presented earlier is competitive bidding. In the competitive bidding market, contractors need to have bidding strategy which is directed towards the acquisition of sufficient volume of work at sufficient level. Formulation of a successful bidding strategy entails keeping results of previous bids. Contractors should maintain records of bidding activity in their market place so that an evaluation of mark-up can be made each time when a bid is to be submitted.

Contractors' Cost Estimating Practice:

The accuracy and quality of the cost estimate prepared for a particular bid can be affected by the employed estimating method, the identification and valuation of various direct and indirect cost elements, information items and sources used, risk assessment and its evaluation and so on.

The study revealed that standard / detailed estimating technique has a wide application for preparing cost estimates, representing about 82% of the surveyed contractors. But, according [9], the standard estimating is deterministic (single point estimate) in its nature and fails to cope with the realities of today's world, which involves uncertainty due to the risk of over or under estimating, it is recommended that contractors have to use the probabilistic estimating techniques which can 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 by incorporating the allowances for risks in a project tender. Among information items required for developing their cost estimating process, the materials' price is the most important information item for cost estimation with an importance index value 85.6, as this component constitutes large proportion of the total project cost and it is highly subjective to price fluctuation. According to the results of the survey, information on project size and location, labour price, and tender document are ranked from second to fourth respectively, with importance index values 83.3, 81.8, and 81.1. Furthermore, material cost is the most difficult cost component during estimation with importance index value of 87.9, as shown in figure 4. This is due to the fact that, it is highly subjective to price fluctuation. Among the various project cost components, site overhead costs and company overhead costs are the second and third most difficult items to estimate.

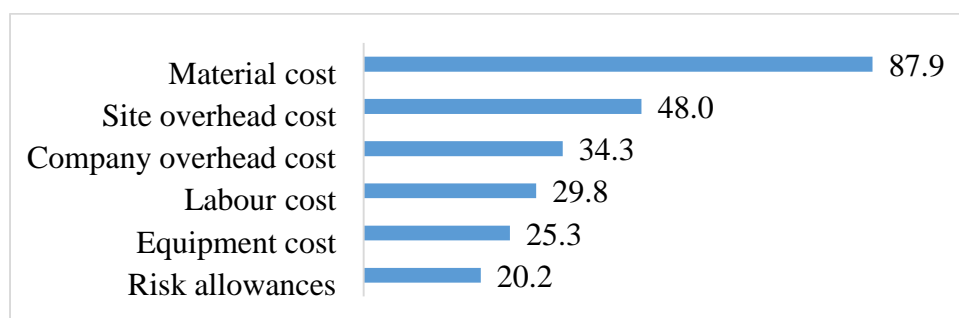


Fig. 4. Mean rank of project cost components difficult to estimate.

Inaccurate estimation of costs can challenge contractors with regard to winning tenders and/or obtaining anticipated profit from contracted projects. According to the survey result made to indicate the major causes

of the inaccuracy of cost estimates, insufficiency of information provided by drawings and specifications is the primary cause of inaccurate cost estimates with a severity index value 86.1. While lack of accurate data about resource's price and lack of accurate data regarding resource's consumption and productivity standards are the second and third responsible factors, with severity index value of 63.6 and 51.5 respectively. With regard to method of incorporating overhead costs in to the tender sum, the survey result revealed that 67% of contractors introduce allowances for overhead costs by making a list of overhead items together with relevant prices and distribute proportionately to the total sum of all project activities. Moreover, only 39% of contractors often incorporate allowances for risks in their tender estimate. However, failure to incorporate risk allowance in tenders is one of the responsible factor for inaccurate cost estimates. The construction contract types that are widely used by surveyed contractors are unit price /BOQ contract, fixed price, item/percentage rate, and turnkey/BOT construction contracts, as sown earlier. These contract types impose or transfer most of the risk consequences to the contractors. Hence, allowance for potential risks need to be incorporated in the estimates for such contracts, depending on the project characteristics, economic conditions, previous experiences and other factors. Also, since most of the contractors are involved in standard estimating technique which is deterministic (single point estimate) in its nature and fails to involve uncertainty due to the risk, use of the probabilistic/statistical estimating techniques is recommended which can assist contractors to verify the accuracy.

Contractors' Pricing Practice:

Because, contractors' have the objective to submit a bid with optimum mark-up that leads to win the award, a pricing stage should be prepared with a comfortable profit margin. Contractors allocate mark-up based on the final estimated project cost and the calculated overall proportion of the surveyed contractors' profit amount to their total project costs is 12%. The major factors considered by most of the surveyed contractors to decide the amount of profit margin to be introduced are, project characteristics (size, type, location and its complexity), market conditions, similarity with previous projects and expected competition with importance index value of 97, 79, 64, and 52 respectively. However, contractors do not give much attention to the amount of contract period, in fact the more the contract period involved, the higher the uncertainty of the occurrences of unforeseen events that may affect the accuracy of the estimate. Moreover, the experience gained from previous tenders plays a decisive role by providing a good deal of information on the competitors to formulate a successful bidding strategy, very few of the surveyed contractors take this factor in to consideration. Also, some contractors add a constant percentage of profit that does not change from project to project. Therefore, careful consideration should be given to the factors mentioned here and other possible factors while determining the mark-up amount involved in a project. Concerning the practice of inclosing estimate supporting details or cost break downs with the bid document, only 36% of the surveyed contractors support this practice, in fact, this practice is strongly recommended as it can serve as evidence in the situations when contractors claim for cost changes. With regard to the employment of software, 70% of the surveyed contractor's stated that, lack of skilled personnel is the main reason for not employing the software's, as shown in figure 5. Whereas, 64% of contractors have information but the software's are expensive for them and 45% of contractors are unfamiliar with the software's or do not have sufficient information about the software's.

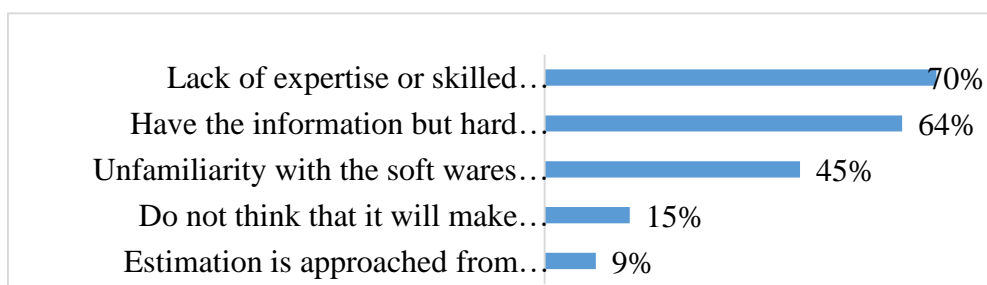


Fig. 5. Reasons for not using estimating software's.

C. Project Cost Controlling and Monitoring Practices

As stated 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. However, the survey result indicated that the cost controlling system frequently focused on generating information regarding profitability and monitoring efficiency of resources' performance. But, the capability of cost controlling in providing early warning for uneconomical operations and providing feedback for the estimating process on actual production costs, have very little consideration by majority of the surveyed contractors as indicated in figure 6.

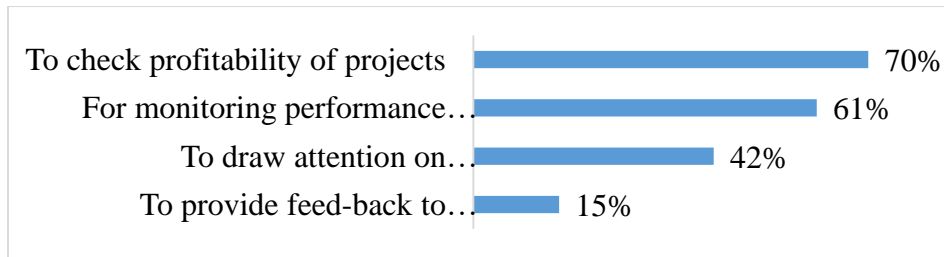


Fig. 6. Purpose of cost controlling system for contractors.

Most of the surveyed contractors prepare budget for their projects. Among these, all the contractors prepare cash outflow budget for material requirements as it represents the largest proportion. In the inflowing cash budget, all of the surveyed contractors prepare budgets for the stipulated revenues/payments from clients or owners. As advance payment is one account in a cash flow budget, which is collected usually before commencement of construction, 79% of them prepare an isolate expenditure schedule for the advance payment. Among these, 61% of them distribute the amount in to material, labour and other expenditures. All contractors claimed that they prepare budget for their projects, however, a small proportion of them use the budget for facilitating the cost controlling process. According to the survey result, earned value technique is employed by 61% of the surveyed contractors for facilitating the cost and time control. Moreover, comparison of payment received with total cost incurred is the second most practiced controlling procedure exercised by 48% of the surveyed contractors, and 24% of the contractors exercised direct cost variance analysis, figure 7.

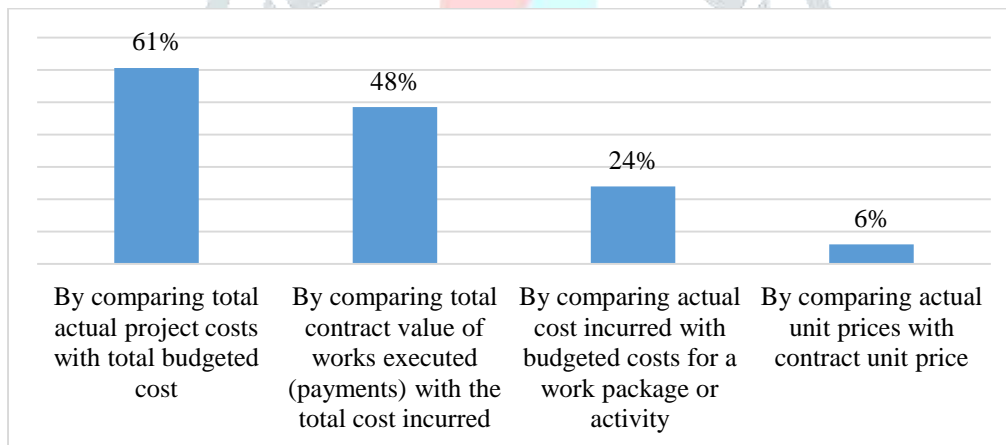


Fig. 7. Techniques used for controlling project costs.

In fact, frequent check enables early identification of problems to give timely corrective actions, only 42% of the surveyed contractor's checks every three month and many of the contractors do not check the profitability status of their project during execution.

D. Project Works Classification and Coding System

Based on the assessment made on the importance of having project's activity coding system for facilitating effective management of costs in a project, 76% of them argued that having a project works classification and coding system is very important, and the remaining 24% argued on the importance of having project works break down and coding systems. However, only 30% of contractors use a project works classification and coding systems. Thus, contractors could adopt standard set of cost codes to identify cost accounts along with project identifiers and extensions to indicate the specific needs for the job.

The need for frequent and periodic control (preferably on daily basis if possible) on labor and equipment costs are essential. However, the survey result indicated that, 42% of contractor's checks weekly, 40% monthly. Whereas, the remaining contractors checks in a random manner. In response to the question on

contractors' method of accounting equipment costs, varied responses were received. 79% of the surveyed contractors account equipment costs by recording the operating expenses associated with a specific work item and charging this cost to the activity. In fact, establishing company's hourly rate by considering both owning and operating costs first for computing the equipment costs associated with each activity according to activity duration is highly recommended to account equipment costs, only 9% of the surveyed contractors use this method to account equipment costs.

V. CONCLUSION

The research indicated that the success rate for majority of the contractors' tender offers is low. The success rate for about 81% of contractors is below 75%, among these 54% of them has a success rate lower than 50%. The major contributing factor for this are severe competition among contractors, high and/or low pricing, and inaccurate estimate during tendering. However, domestic contractors need to consider several factors associated with the internal and external environment of the firm, which enables the contractor to submit a bid with proper allowances for profit. Most contractors are unable to obtain the profit which they expect from most of their contracted projects. Among these, 52% of them secured a profit of less than half of the anticipated amount. Inadequate financial planning is the highest ranking factor for obtaining low profit.

The standard / detailed estimating technique has a wide application for preparing cost estimates by majority of the domestic contractors, which is deterministic (single point estimate) in its nature and fails to consider risks and uncertainties which can have a negative influence for the quality/accuracy of cost estimates. However, the application of probabilistic and/or statistical estimating techniques, can improve the quality and accuracy of cost estimate by providing cost information. Insufficiency of information provided by contract documents, lack of accurate data about resource's price, and lack of accurate data regarding resource's consumption and productivity standards are the highest responsible factors for inaccurate cost estimates. These can challenge contractors with regard to winning tenders and/or obtaining anticipated profit from contracted projects. In this regard, contractors are recommended to maintain records of actual data on material, labor and equipment costs and to employ decision supporting estimating techniques from their projects so as to minimize the effect of lack of estimating standards and to improve the quality and accuracy of cost estimate by providing cost information. Moreover, contractors are advised to use labor hour per unit of work approach rather than rupees per unit of work for collecting and recording data, which makes contractors less reliable owing to frequent changes mainly due to inflation. 61% of contractors did not incorporate allowances for risks. Since, the unit price construction contract type is widely used by majority of contractors and these contract type impose/transfer most of the risk consequences to the contractors, contractors need to incorporate allowance for potential risks in the estimates for such contracts. 64% of the contractors do not enclosing the details of cost estimates, in fact, this practice can serve as evidence when contractors claim for cost changes.

Lack of skilled personnel and expensiveness of the software's are the main reasons for not employing the software's. But, the application of standard estimating software's can give advantages of speed, accuracy, reliability and saves man hours.

Majority of the contractors use the cost controlling system for generating information regarding profitability and efficiency of resources' performance, even though, an efficient cost controlling system is capable to provide early warning of uneconomical operations and identifying and tracking the causes of the observed inefficiency by generating feedback to the estimation process. Even though, majority the contractors prepare budget, a small proportion of them use the budget for facilitating the cost controlling process. However, contractors need to prepare budget for all direct and indirect cost components, for project working capital, and for advance payment as well. The implementation of project WBS and coding systems are highly recommended by contractors as they are essential for facilitating the cost controlling process and cost management process as well.

Labor, equipment and overhead costs are the areas in which inefficient working due to estimated and actual productivity exist, contractors should give balanced attention on these items as they constitute significant proportion of total project costs. Frequent and periodic control on labor and equipment costs should be employed. Furthermore, concerning accounting equipment costs, establishing and utilizing company's hourly

rate by considering both owning and operating costs is highly recommended but, very few contractors use this method to account equipment costs.

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