Factors Affecting The Cost Of Building Material In Construction Projects

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Abstract- In India, Construction Industry has a key role to play in both economic growth and poverty reduction. This industry consumes about 40 to 50% of the national five year plan outlay and contributes to nearly 20% of GDP. Continuous increases in the cost of materials and cost of labour have raised serious problems on the efficacy of works contracts. In India, the performance record in successful implementing of infrastructure projects in India has not been encouraging. Cost escalation is part and parcel of the construction projects in India. Hence, thus identification and evaluation of factors affecting cost escalation in building construction projects in India becomes necessary for undertaking a systematic study. The primary goal of the present questionnaire is to identify the most significant factors and factor categories affecting cost overruns and cost escalation in building construction projects and identify the type of problems posed by cost escalation payment in the building construction contracts in India.

INTRODUCTION

Materials management is the system for planning and controlling all of the efforts necessary to ensure that the correct quality and quantity of materials are properly specified in a timely manner, are obtained at a reasonable cost and most importantly are available at the point of use when required. Thus materials management is an important element in project management. The materials on a project can represent anything from 50% to 60% of the cost of the work, so minimizing procurement costs improves opportunities for reducing the overall project costs. Poor materials management can result in increased costs during construction. Efficient management of materials can result in substantial savings in project costs. If materials are purchased too early, capital may be held up and interest charges incurred on the excess inventory of materials. Materials may deteriorate during storage or get stolen unless special care is taken. Delays and extras expenses may be incurred if materials required for particular activities are unavailable. Ensuring a timely flow of materials is an important concern of material management.

OBJECTIVE AND SCOPE OF THE STUDY

The objective of the study is to identify the variables influencing material procurement and inventory which affects the construction time and causes cost overruns. The paper also aims at identifying the relative importance of the factors and to rank the factors according to their significance. The study provides recommendations for quality project delivery within stipulated time with proper material management system which helps timely project completion and cost savings.

LITERATURE REVIEW

Productivity in construction is often broadly defined as output per labour hour. Since labour constitutes a large part of the construction cost and the quantity of labour hours in performing a task in construction is more susceptible to the influence of management than are materials or capital, this productivity measure is often referred to as labour productivity. However, it is important to note that labour productivity is a measure of the overall effectiveness of an operating system in utilizing labour, equipment and capital to convert labor efforts into useful output, and is not a measure of the capabilities of labour alone.

Homyun Jang et al (2010) identified 25 critical variables and were grouped into 4 groups, namely work management, work technique, work characteristic and worker component.

Durdyev and Mbachu(2011) identified 56 variables affecting construction productivity, and categorized them in to 8 factors of internal group and external group.

Enshassi (2015) classifies factors affecting productivity in the construction projects into 10 groups, namely: factors associated with the internal workforce, factors associated with leadership, factors associated with work motivation factor associated with time, factors associated with materials and equipment, factors related to supervision, factors related to project characteristic, factors related to security, factors related to quality and external factors.
Soekiman et al (2014) identified 113 variables affecting construction labour productivity and these variables were grouped into 15 groups of factors according to their characteristics, namely: Design, execution plan, material, equipment, labor, health and safety, supervision, working time, project factor, quality, financial, leadership and coordination, organization, owner/consultant and external factor.

Nabil Ailabouni et al (2010) identified 32 significant variables affecting the productivity in the construction industry and these were grouped into 4 groups based on their characteristic, namely: environment factors, organizational factors, group dynamics and personal factors.

METHODOLOGY

In order to identify the most frequent categories affecting performance of construction projects and investigate the causes of material waste in construction projects the following methodology is adopted. A proper background study is done for the identification of critical factors which causes material mismanagement. A questionnaire is designed based on the data collected form literature.

MAJOR CATEGORIES IDENTIFIED RELATED TO MATERIAL MISMANAGEMENT

The factors that cause the cost overruns in building project are classified into 8 categories based on following issues:

- Design related issues: Improper study on material availability study and its source, inflated specification of item over specified codes, inadequate preconstruction survey on material.
- Client related issues: Poor cooperation of owner towards purchase, delay in supplier’s payment and claim.
- Contractor related issues: Improper supervision at site and control, insufficient material handling instructions, engaging inadequate skill on labour, improper construction methods, improper planning and errors during construction, fraudulent activities of subcontractors.
- Site related issues: Waste control during material usage, lack of site storage space, operation limitation within site, stealing on site, unforeseen site condition, existence of unnecessary material.
- Labour and equipment related issues: Obsolete or unsuitable construction equipment, improper handling of materials at site.
- Store related issues: Improper procurement policy, improper inventory control, problem on logistics of materials.
- External issues: Problem with neighbours, weather condition.

DESIGN OF QUESTIONNAIRE

The questionnaire was developed to identify the significance impact level of the factors that causes cost overruns in building construction projects from the specialist and experts in the construction industry. A preplanned survey was conducted through the questionnaire. The questionnaire was divided into two parts. The first part requested background information about the respondents. The second part of the questionnaire focused on causes of material mismanagement. Twenty six numbers of issues were selected initially for the proper assessment of most critical factors. The scale method of designing questionnaires was adopted that is five point scale which includes strongly disagree, disagree, agree, moderately agree, and strongly agree.

RESULTS AND DISCUSSIONS

After collection of sample, data analysis was conducted with research instruments such as the Statistical Package for Social Science (SPSS) software. The data from the questionnaires was fed into SPSS software version 20, and the results were analyzed to determine the major factors. The mean scores were calculated to rank mismanagement issues.

The steps undergone for this analysis are given below

Step 1: Statistical analysis done for each attribute.
Step 2: Bar graph showing mean values were found out.
Step 3: Based on high mean, the ranking of issues found out.

A. Design Related Factors

It is important to understand that projects are never completed without alterations to the starting documentation. More changes mean more expenses, especially as the project progresses. These problems will eventually cause construction cost overruns.
The results indicate that most of the respondents strongly agree the improper material availability study and its source responsible for cost overrun in construction projects and moderately agree the remaining factors increase the cost. The result of ranking factors indicate that improper study on material availability and its source has the highest in the ranking of design related factor analysis, inflated specification of item ranked the second among the factors outlined above, inadequate preconstruction survey that occupied third position in the above ranking material mismanagement factors of cost overrun in construction projects.

B. Client Related Factors

According to the contractors surveyed, delayed payments would affect their project’s cash flow as a result of delayed income. For example postponing payment to subcontractors & suppliers, delay in supply of materials, etc., These multiple problems will eventually cause construction delays and cost overruns.

The results indicate that most of the respondents are moderately agreed that payment delay to suppliers factor will significantly increase the cost and the result of ranking factors indicate that payment delay to suppliers factor is responsible for cost overrun in construction projects and disagree the poor cooperation of owner factor increases the cost, the result of ranking factors indicate that payment delay to suppliers has the highest in the ranking of client related factor analysis.

C. Contractor Related Factors

According to the project managers interviewed, defective works were caused by unskilled labor, lack of supervision, incorrect construction methods and unordered sequences of work. These defective works required extra budgets to complete or repair them. Clearly this factor would cause construction cost overrun.
D. Site Related Factors

A major risk in civil engineering project is that the construction may encounter physical conditions on the project site which were unexpected and unforeseeable at the time of making the decision to build the project and which may delay work or cause increased cost. Building construction industry reflects various problems ranging from delays in project execution/delivery, to cost and time overrun as a result of wastages on sites, theft and displacement of materials on sites.

![Chart showing site factors]

The results indicate that most of the respondents are moderately agree that all site factors except lack of site storage space is responsible for cost overrun in building construction projects. The result of ranking factors indicate that unforeseen site condition has the highest in the ranking of site related factor analysis, waste control ranked the second among the issues outlined above, existence of unnecessary material that occupied third position, operation limitation within the site and pilferage both are occupied fourth position, lack of storage space lie at fifth position.

E. Labor and Equipment Related Factors

Unsuitable construction equipment affects the productivity which causes delay in project and resulting in cost overrun. The results indicate that most of the respondents are moderately agree that these two labour and equipment factors are responsible for cost overrun in building construction projects, the result of ranking factors indicate that obsolete or unsuitable equipment has the highest in the ranking of labour and equipment related factor analysis, improper material handling ranked the second the above ranking material mismanagement factors of the cost overrun in construction projects.

![Chart showing labor and equipment factors]

The results indicate that most of the respondents are agreed that above said two external factors will significantly increase the cost and the results indicate most of the respondents moderately agree that these two external factors are responsible for cost overrun in building construction projects, the result of ranking factors indicate that problem with neighbors has the highest in the ranking of external factor analysis, weather condition ranked the second.

G. External Factors

Most of the projects surveyed were in the early stages and this means that the works being undertaken were foundation work or construction of the building structure. Such activities would undoubtedly be affected by rain. Project managers whose buildings included basements said that their basements were flooded and they needed extra time and equipment to dewater them. Most of the concreting works for the structures were also affected by heavy rain and occasionally, concreting was postponed. Another impact of weather was that rivers with sand quarries were flooded and affecting the availability of sand.

![Chart showing external factors]
second the above ranking material mismanagement factors of the cost overrun in construction projects.

H. Market Condition Factors

Increased price was recognized as the top critical risk factor affecting both project time and cost. On the projects surveyed, the prices of steel, cement and timber had increased dramatically over a few years. As indicated, most of the activities were affected by these unwelcome effects.

The results indicates that most of the respondents are strongly agree price fluctuation of materials is responsible for cost overrun in construction projects at the same time they moderately agree that scarcity of materials in market increases the cost., the result of ranking factors indicate that price fluctuation of materials has the highest in the ranking of market condition related factor analysis, scarcity of materials in market ranked the second the above ranking material mismanagement factors of the cost overrun in construction projects.

I. Overall Material Mismanagement Factors

Many researchers have discovered reasons for the disparity between the tender sum and the final cost of construction cost. The following were identified as the factors that influence cost overruns. Such as design related factors, client related factors, contractor related factors, site related factors, labour and equipment related factors, store related factors, external factors, market condition related factors. The results indicates that most of the respondents are strongly agree the design related factor is responsible for cost overrun in building construction projects at the same time they moderately agree that remaining factors increases the cost, the result of ranking factors indicate that design related factors has the highest in the ranking of factor analysis, market condition related factors ranked the second among the factors outline above, store related factors that occupied third position, contractor related factors that occupied fourth position, external factors occupied fifth position labour and equipment related factors occupied sixth position, site related factors occupied seventh position, client related factors are lie at eighth rank in the above ranking material mismanagement issues of the cost overrun in construction projects.

CONCLUSION

Based on the analysis, obtained conclusions are given below

- Identifying variables influencing construction time and cost overruns shows that, design issues, client issues, contractor issues, site issues, labour and equipment issues, store issues, external issues, market condition issues are responsible for cost overrun of building construction projects are described.
- Rank of the top factors of each scenario is listed by means of questionnaire survey. The results obtained from the ranking analysis shows that the followings, design issues, market condition issues as the major significant factors that causes the cost overruns in construction projects in India.

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