RESEARCH PAPER | Technology & Innovation | Volume : 4 | Issue : 4 | Special Apr Issue 2014 | ISSN - 2249-555X


# Effective Utilization of Equipments and its Management in Construction Industry

KEYWORDS: Construction equipment, Construction management, cost management, Environmental conditions

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**ABSTRACT** *With the rapid economic development, accelerating the urbanization process, the construction industry as a pillar industry of national economy has been booming. The characteristics of equipment in Construction Projects differ with different regions. In addition, it is difficult for a new comer to identify selection of equipment based on environmental conditions. Selecting the right equipment for the project is inherently a multifaceted cost and benefit evaluation process that is further compounded by the complexity of today's building projects. A careful selection of the equipment size and number can result in substantial savings both in time and costs. The objective of this study is to identify the factors that influence the effective usage of equipment which can be achieved through attaining proper knowledge and sensibly implementing them to develop a more effective technique. Further, various tasks involved in the construction projects will also be assessed from the survey of sample respondents which constitutes engineers, contractors and supervisors within the State of Tamil Nadu and results are analyzed and interpreted using SPSS tool.*

## INTRODUCTION

### 1.1 INTRODUCTION

Selection of equipment for construction projects generally involves two classes of factors or considerations. The first class comprises tangible, quantitative, formal considerations. Typical factors of this class include technical specifications of the equipment, physical dimensions of the site and constructed facility, and cost calculations; they are hereby termed "hard" factors/considerations. The second class covers a large array of other factors, which are mostly intangible, qualitative, and informal in nature. Random examples include safety considerations, company policies regarding purchase/rental, market fluctuations, and environmental constraints. The purpose of this study is to evaluate the traffic flow of construction equipment and how it affects the efficiency of construction operations. A large construction project requires large quantities of construction equipment. This volume of equipment can result in a traffic jam within a construction site, thereby reducing the overall efficiency of construction operations.

### 1.2 STATEMENT OF THE PROBLEM

The complexity of today's building projects makes it harder to evaluate equipment alternatives and make the right selection from many alternatives. With the growing awareness of the role played by mechanization and industrialization in project execution, the decreasing availability of skilled manpower, tight budget and schedule constraints in a competitive construction environment, companies and project management teams often lack the tools to select the best combination of cranes, concrete pumps, forming systems, and other equipment suitable to meet project requirements.

Based on the related review of literature it can be inferred that a careful selection of the equipment, equipment size and number of equipments can result in substantial savings both in time and costs. This understanding permits the development of strategies, methods, and tools for better cost equipment management. Hence the present study brings to light an empirical research regarding proper selection of equipments, right utilization and its management and factors influencing them where fewer researches are undertaken till date.

### 1.3 OBJECTIVES

**The main objectives of the study are:**

- To offering suggestion for effective utilization of equipments and its management in construction industry.
- By giving a detailed account for selection of the right equipments suitable for the projects.
- Identifying the factor that influences the selection and effective utilisation of equipments.
- Analyzing the various tasks involved and difficulties faced by the respondents in the construction projects.

### 1.4 METHODOLOGY

This study is based on both primary and secondary data. Primary data would be collected by distributing questionnaires to sample respondents which include engineers, contractors and supervisors within the State of Tamil Nadu. Secondary data includes books written by different authors, reports of various committees and articles from standard books, newspapers, magazines and journals etc. A sample of 20 respondents is taken into account which constitutes engineers, contractors and supervisors engaged in construction projects within the State of Tamil Nadu. Statistical techniques namely chi-square test, regressions and correlation analysis, percentage analysis are applied for the study.

## 2. ANALYSIS OF SURVEY DATA

### 2.1 Frequency Percentage of variables

Table 4.1 to table 4.5 illustrates the frequency percentage of the profile of the respondents, ie, designation of the respondents, type of the projects, Locality of construction, types of machines used in the construction field and experience of the respondents in the construction industry. They are as follows:

**Table 2.1: Frequency Percentage of Designation of the respondents**

| Designation of the respondents | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Engineer | 7 | 35.0 | 35.0 | 35.0 |
| Contractor | 6 | 30.0 | 30.0 | 65.0 |
| Supervisor | 5 | 25.0 | 25.0 | 90.0 |
| Equipment operator | 2 | 10.0 | 10.0 | 100.0 |
| Total | 20 | 100.0 | 100.0 | |

From the above table it could be inferred that Engineer constitute 35% of the total respondents followed by contractor

Volume : 4 | Issue : 4 | Special Apr Issue 2014 | ISSN - 2249-555X

of 30%, supervisor constituting 25% and Equipment operator to 10% of the total respondents

**Table 2.2: Frequency Percentage of Type of the Project**

| Type of the project | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Small project | 4 | 20.0 | 20.0 | 20.0 |
| Medium project | 9 | 45.0 | 45.0 | 65.0 |
| Large project | 7 | 35.0 | 35.0 | 100.0 |
| Total | 20 | 100.0 | 100.0 | |

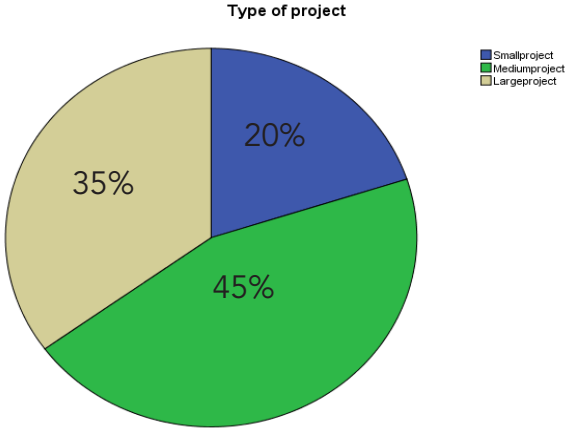
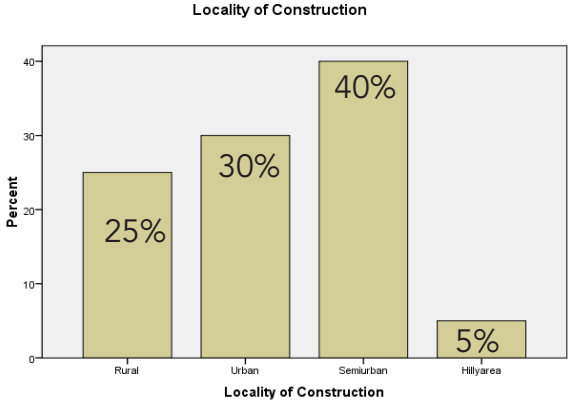



**Figure 2.2 Frequency Percentage of TYPE OF PROJECT**
The above table brings to light that majority of the projects carried are medium projects constituting to 45% followed by large projects of 35% and small projects are to the extent of 20% of the total respondents.

**Table 2.3: Frequency Percentage of Locality of the Project**

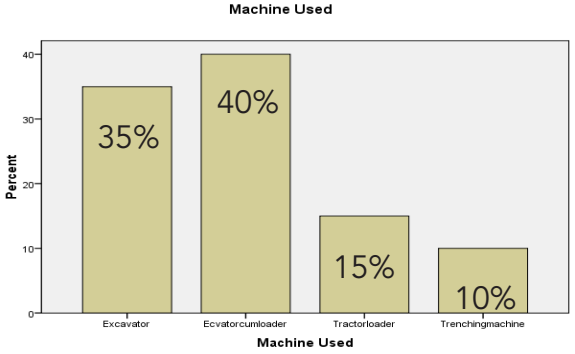
| Location of the project | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Rural | 5 | 25.0 | 25.0 | 25.0 |
| Urban | 6 | 30.0 | 30.0 | 55.0 |
| Semi urban | 8 | 40.0 | 40.0 | 95.0 |
| Hilly area | 1 | 5.0 | 5.0 | 100.0 |
| Total | 20 | 100.0 | 100.0 | |




**Frequency Percentage of LOCALITY OF THE PROJECT**
As regard to locality of the construction it could be observed that majority of the constructions are carried in semi- urban areas constituting 40% of the respondents followed by constructions undergone in urban areas of 30% and rural areas constituting to 25% of the total respondents.

**2.4 FREQUENCY PERCENTAGE OF TYPE OF EQUIPMENT USED**

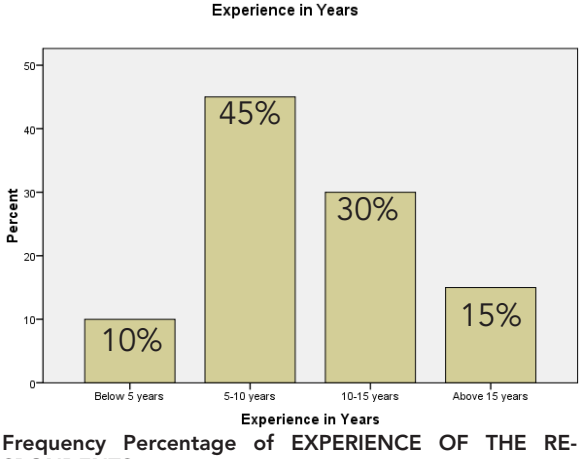
| Type of the Equipment | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Excavator | 7 | 35.0 | 35.0 | 35.0 |
| Excavator cum loader | 8 | 40.0 | 40.0 | 75.0 |
| Tractor loader | 3 | 15.0 | 15.0 | 90.0 |
| Trenching machine | 2 | 10.0 | 10.0 | 100.0 |
| Total | 20 | 100.0 | 100.0 | |




**Frequency Percentage of TYPE OF EQUIPMENT USED**
From the above table it could be highlighted that nearly 40% of the respondents use excavator cum loader for their construction work and 35% of them use excavator machines while only 15% of the respondents use tractor loader and 10% of them use trenching machines in their construction work.

**Table 2.5: Frequency Percentage of Years of Experience of the respondent**

| Experience of the respondents | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Below 5 years | 2 | 10.0 | 10.0 | 10.0 |
| 5-10 years | 9 | 45.0 | 45.0 | 55.0 |
| 10-15 years | 6 | 30.0 | 30.0 | 85.0 |
| Above 15 years | 3 | 15.0 | 15.0 | 100.0 |
| Total | 20 | 100.0 | 100.0 | |




**Frequency Percentage of EXPERIENCE OF THE RESPONDENTS**
As regards to the experience of the respondents in the field of construction industry nearly 45% of the respondents have 5-10 years of experience and respondents having experience of 10-15 years constitute to 30%. While only 15% and 10%

Volume : 4 | Issue : 4 | Special Apr Issue 2014 | ISSN - 2249-555X

of the respondents have experience of above 15 years and below 10 years respectively in the field of construction.

**B. Mean and Standard Deviation of Equipment utilization factors**

Descriptive analysis for equipment management factors like environmental factors, Contractor related factors, Cost factor, equipment related factors and safety factors were analyzed using descriptive statistics and the results are tabulated in table 4.6

**Table 2.6:Mean and Standard deviation of equipment management factors**

| Factors | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Environmental factors | 20 | 7 | 11 | 8.95 | 1.356 |
| Contractor related factors | 20 | 11 | 19 | 15.50 | 2.090 |
| Cost factor | 20 | 14 | 28 | 20.45 | 4.174 |
| Equipment related factor | 20 | 10 | 19 | 14.70 | 2.716 |
| Safety factor | 20 | 6 | 13 | 9.35 | 2.033 |
| Overall Equipment Management | 20 | 56 | 84 | 68.95 | 9.076 |

To analyze the effective utilization of equipment and its management, six major factors are taken into consideration. The above table vividly brings to light that cost factor whose mean value is 20.45 plays an effective role in influencing equipment management. While environment factors with 8.95 as mean value plays least role in influencing equipment management.

**Analysis of variance between cost factor and types of machine used**

Analysis of Variance is used to test whether there is significant difference between cost factor and types of machines used in the construction industry as elicited in Table 4.7. The hypothesis is illustrated as under:

Ho: There is no significant difference between cost factor and types of machine used

Ha: There is significant difference between cost factor and types of machine used

**Table 2.7 Analysis of variance between cost factor and types of machine used**

| Types of Machine used | Mean | SD | F value | P value |
|---|---|---|---|---|
| Excavator | 24.43 | 2.573 | 13.012 | .001* |
| Excavator cum loader | 17.50 | 1.414 | | |
| Tractor loader | 17.00 | 3.000 | | |
| Trenching machine | 23.50 | 4.950 | | |
| Total | 20.45 | 4.174 | | |

**Note: * denote level of significance at 5%**

From the above table it is inferred that p value is less than 0.05 hence the null hypothesis is rejected at 5% level of significance. Hence we can conclude that there is significant difference between cost factor and types of machines used. That is the types of machines used in the construction industry have great impact in cost determination aspects. Apart from this while comparing the mean of the various types of machines used with cost related factor, excavator influences more on cost related factors with highest mean score of 24.43 and the least influencing variable on cost factor is tractor loader with 17.00 as mean score.

**A. Correlation Analysis**

Correlation is the relation between two or more paired variables or two or more set of data. The degree of relationship is measured and represented by the co-efficient of correlation. This co-efficient is identified by the letter 'r'. The value of correlation lies between -1 to +1

**To test whether there is correlation co-efficient among all the factors in relation to equipment management**

In order to analyze whether there is significant relationship among all the factors related overall equipment management and its utilization such as environmental factors, Contractor related factors, Cost factor, equipment related factors and safety factors correlation analysis was adopted. The hypothesis is framed as under:

Ho: There is no relationship between environmental factors, Contractor related factors, Cost factor, equipment related factors and safety factors.

Ha: There is no relationship between environmental factors, Contractor related factors, Cost factor, equipment related factors and safety factors.

**Table: 2.8: Correlation among all factors in relation to equipments**

| Type of the Factors | Environmental factors | Cost factor | Contractor related factors | Equipment related factor | Safety factor |
|---|---|---|---|---|---|
| Environmental factors | 1.00 | -.042 | 0.084 | .153 | .369 |
| Cost factor | - | 1.000 | .0324 | .760** | .514* |
| Contractor related factors | - | - | 1.000 | .222 | .601** |
| Equipment related factor | - | - | - | 1.000 | |
| Safety factor | - | - | - | - | 1.000 |

**Note: **. Correlation is significant at the 0.01 level (2-tailed).**

***. Correlation is significant at the 0.05 level (2-tailed).**

From the above table of content it could be observed that the correlation co-efficient between cost factor and equipment related factor is 0.760, which indicates 76% positive correlation at 1% level of significance. Similarly the correlation co-efficient between contractor related factor and safety factors is 0.601 which indicates 60.1% positive correlation at 1% level of significance. As related to cost factor and safety factor 51.40% positive correlation at 5% level of significance.

Volume : 4 | Issue : 4 | Special Apr Issue 2014 | ISSN - 2249-555X

But as regard to environmental factor and cost factor there is a negative correlation of 4.2 %. For other related factors there exists some level of positive correlation at least level.

## CONCLUSION

The study reveals that the types of machines used in the construction industry have a significant influence in the construction industry. As the cost of the equipment plays a major role, the construction industry based on the size of the projects .ie. small, medium or large scale projects utilize the types of equipment based on their need. From the study it could be ascertained that excavator are highly used large scale projects due to its cost effectiveness and trenching machines are deployed in medium and small scale projects. However optimism among construction equipment distributers remains high. Rental fleet growth is anticipated to play an increasingly important role in the business model of distributers who can't afford to own equipment.

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