STUDY ON BUILDABILITY FACTORS AFFECTING FORMWORK LABOUR PRODUCTIVITY IN SOUTH INDIAN PROJECTS

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Abstract - *Buildability factor are highly influential in construction industry. These factors are the main reason for the profit and loss incurred in an ongoing project. If the productivity is too low then it will directly affect the buildability. In this study, the factor which affects the formwork labour productivity is taken into consideration. The factors are listed as questionnaires and are responded by experts. Clustering all the responses with the use of SPSS software and identifying which are the factors affecting the productivity more.*

*Key Words***:** *Formwork productivity, SPSS, Buildability*

1. INTRODUCTION

Construction is the world's largest and most challenging industry. In 2007, the Indian construction industry accounted for 10% of Gross Domestic Product (GDP) and employed over 10 Million, making the industry as one of the largest in the country. On the other hand, some experts indicated that a 10% increase in construction labor productivity would yield annual savings of about £1 Billion to the British economy. Buildability is one of the most important factors influencing labour productivity. Several factors affect labour productivity, but buildability is one of the most important. Buildability is as defined the Construction Industry Research and Information Association (CIRIA), is "the extent to which the design of a building facilitates ease of construction, subject to the overall requirements for the completed building" [Jaejun Kim et al. (2008)[5]]..

For the analysis of Productivity, the impact of the use of microcomputers and expert systems will enable the measurement, recording, analysis, prediction and dissemination of productivity data, as well as analysis and design, to be vastly improved. There should be a definite link between productivity and the analysis and design of formwork [John christian *et al.* (1988) [8]]. Reuse of timber might be a solution but there are several factors affecting the reuse of timber formwork. These include the materials used to fabricate the formwork (H1), workmen who work with the formwork (H2), design of the completed structure (H3), design, fabrication, and stripping of the form-work (H4), and site management issues (H5) [Ling and Leo (2000)[9]]. It is also stated that Development of the construction productivity estimation model using artificial neural network for finishing works for floors with marble. It was found that ANNs have the ability to predict the productivity for finishing works with a very good degree of accuracy of the coefficient of correlation (R) was 89.55%, and average accuracy percentage of 90.9% [Huda farhan ibraheem (2009)[4]]. It means that the any changing of Motivation factor would be most affect to Labour productivity than others. Therefore the project manager or construction manager who is handling the construction projects needs to pay attention on those factors, especially site management and labour motivation[Jagadeesh (2015)[6]].

Previous research in the area of productivity has proved to be inadequate for the following reasons, Research was concerned with the effect of a single factor on productivity without due consideration to other factors. The majority of research studied the effect of factors on the final cumulative productivity. The influence of factors on daily productivity was not investigation. No standardized data collection technique was used and data from different sites might have been collected differently.

II. METHODOLOGY

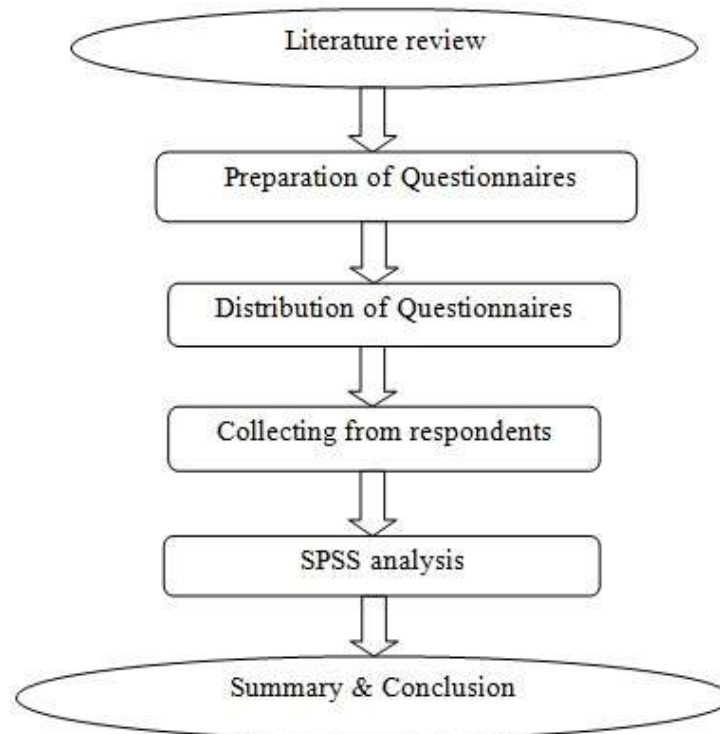The methodology is shown below in Fig.1.

Fig. 1 Methodology of the Project

III. QUESTIONNAIRE SURVEY

The factors found in the literature were classified into four components and shown in the Table 3.1 also similar factors were unified under representative names.

Table 1 Sub critical factors influencing productivity

WC	WTC	WCC	WMC
Capability	Rework	Work space	Mgmt system
Responsibility	Work continuity	Prefabrication	Manager
Experience	Technology	Advance work	Planning
Health	Type of construction	Work method	Accidents
Education, Training	Skill level	Crew ability	Safety
Motivation-Attitude	Adaptability	Work difficulty	Scheduling

3.1 IDENTIFICATION OF CASE STUDY

Projects in and around South India has been taken for the STUDY. Studied all the available plans, estimates, schedules and work procedures in detail and collecting all the relevant data about the project. The real time execution of formwork has been taken into account and simultaneously compared with different projects in Chennai, Coimbatore, Salem, Hyderabad, Bangalore, Cochin, and Calicut.

3.2 RESPONDENTS

Totally 200 responds have been collected which includes 25 Administrative Personnel's, 60 Project Managers, 30 Planning Managers, 20 Quality Engineers, 60 Site Engineers and 5 Architect.

IV. RESULTS AND DISCUSSION

The data collected from the respondent are analysed using SPSS software. Based on the mean values the top 8 factors affecting labour productivity are identified. Table 4.1 shows the top factors affecting labour productivity.

Table 4.1 Critical factors affecting buildability and labour productivity

Factors	Mean
Lack of coordination between different parties involved	3.85
Lack of supervision	3.72
Use of scarce/ foreign materials	4.03
Equipment breakdown/ non availability	3.9
Riots/ death of famous personality	4.14
Budgetary limitations	4.50
Damage to material/ site due to act of nature	3.87
Cross referencing of drawings	4.03

The frequency bar chart from the SPSS analysis for some factors like Lack of coordination between different parties involved (Figure 4.1) it shows the frequency in statistical manner, also Use of scarce/ foreign materials (Figure 4.2) which shows its significance in buildability, then Budgetary limitations (Figure 4.3) having high dominance in buildability and labour productivity and Damage to material/ site due to act of nature (Figure 4.4) shows the perspective solutions from each respondents in each areas based upon their work.
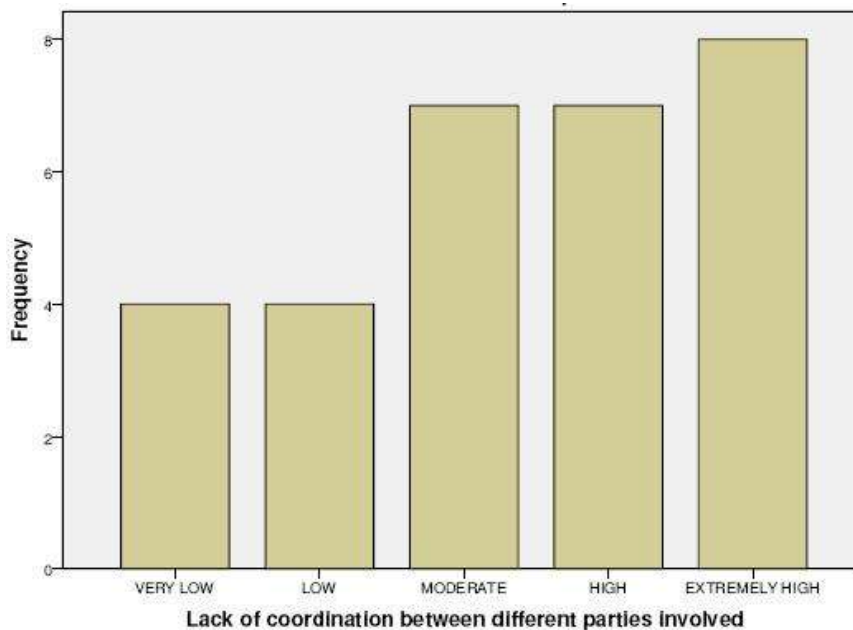

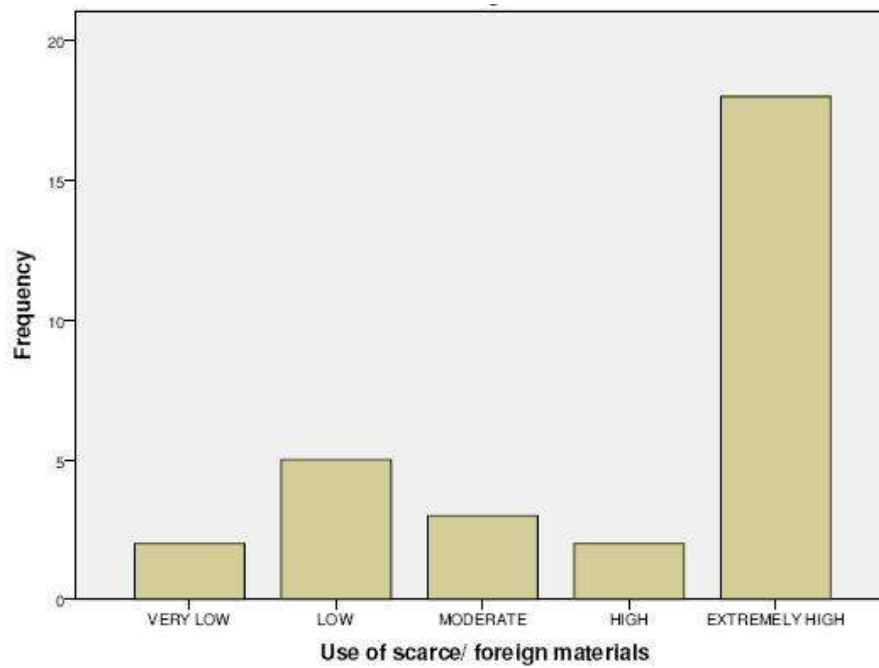**Fig 4.1 Lack of co ordination between different parties involved vs frequency**

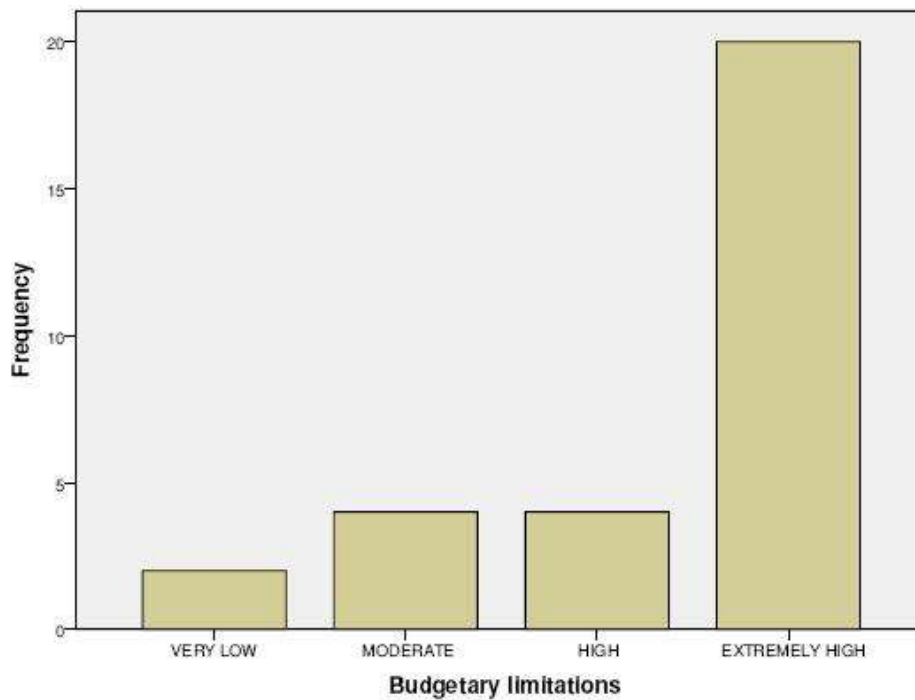**Fig 4.2 Use of scarce/ foreign materials vs frequency**

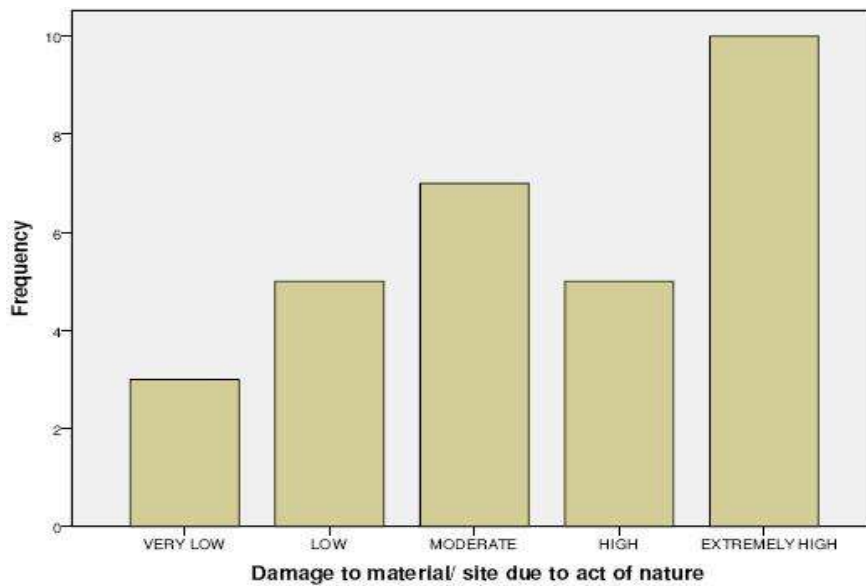**Fig 4.3 Budgetary limitations vs frequency**

Fig 4.4 Damage to material/ site due to act of nature vs frequency

V. CONCLUSIONS

From data analysis the critical factors affecting formwork labour productivity are found out

1. Lack of coordination between different parties involved

2. Lack of supervision

3. Use of scarce/ foreign materials

4. Equipment breakdown/ non availability

5. Riots/ death of famous personality

6. Damage to material/ site due to act of nature

7. Budgetary limitations

8. Cross referencing of drawings

      Labour are the important resources required for successful completion of a project, so they should be given proper importance. The various strategies to improve labour productivity are suggested they are as follows

1. Proper communication should be ensured between labours and management

2. Clear and detailed instructions must be given to avoid confusion

3. Proper training must be given to all the laborers according to the type of work they are involved

4. Supervisors with good managerial skills should be employed

5. Proper safety training and precautions must be taken at the site to avoid accidents

6. Labours should be treated in a friendly manner so they can tell their problems regarding work and others

7. Proper schedule must be prepared and it should be communicated to all the persons working in a particular project.

The organization should follow these strategies in order to improve formwork labour productivity.

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