Tools for Measuring Construction Material Management Practices and Determining Labor Productivity in Multi-Storey Building Projects for Amravati City

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ABSTRACT— Labor Productivity is a very important element in the process of construction project management especially with regard to the estimation of the duration of the construction activities. Planning, monitoring and evaluating materials management practices is also important for enhancing construction productivity. This study describes method in which we developed a tool for scoring materials management practices for building projects and, on that basis building a tool for predicting productivity of labor. The research was carried out in two phases. During Phase I, in-depth interviews were conducted virtually with some experts (civil professionals) and specific materials management practices were identified. During Phase II, questionnaires were used to collect quantitative data from contractors. Based on the analysis, tools for measuring and planning the materials management practices were developed. Based on the results and values obtained the productivity of the labor for such were predicted and thus results are shown in graphical pattern.

This research contributes to the body of knowledge by developing construction materials management practices measuring, planning, monitoring, and evaluating tools in the context of building projects.
Keywords—Regression models, Materials Management, Management practices, Labor Productivity

I. INTRODUCTION

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 for the excess inventory of materials. Materials may deteriorate during storage or get stolen unless special care is taken. Delays and extra expenses may be incurred if materials required for particular activities are unavailable.

Effective construction materials management process is a key to success of a construction project. Costs for materials handling, may range from 30-80% of total construction costs. Therefore, there is a need for efficient material management in order to control, productivity and costs in construction projects.

Construction is one of the country's biggest ventures of the world and has been assuming a critical part in financial improvement, and additionally in lessening unemployment. Profitability is one of the essential viewpoints for the organizations in the development business. Change in the efficiency of the development business is accordingly of basic significance thinking about its huge commitment to the Gross Domestic Product.

The construction company with the most efficient operations has a greater chance to make more money and deliver faster construction project to the project owner. Improving labor productivity can alleviate the shortage of skilled craft-workers, enhance the working conditions, and enhance the overall quality of a product. For every project, productivity, cost, quality and time have been the main concern.

II. METHODOLOGY

This research adopted exploratory sequential mixed-methods research design, which involves the collection and analysis of the quantitative and qualitative data in two phases (Creswell 2013). Therefore, this study was carried out, first, by collecting and analyzing qualitative data which were obtained from interviews during Phase I. On the basis of the qualitative data, appropriate materials management practices were identified, and their levels of implementations were refined to suit the building construction projects. To investigate the relationship between productivity and the practices, assign the weights to the materials management practices, validate the materials management practices' scoring tool for building projects, and develop as well as validate the productivity predicting tools, the quantitative data were collected and analyzed during Phase II. During Phase I, the participants interviewed were 22 professionals having work experience in the construction of multistory buildings in the Amravati city, Maharashtra, India. The expert's have 2-10 years experience. Their positions include construction manager, general manager, project manager, project engineer, project coordinator, site engineer, architect and contract administrator. The employees who were responsible for the construction of multistory building projects by these companies were then contacted. Site managers, project managers, and project coordinators were the respondents. The questionnaire consists of three parts. In the first part, the respondents were asked to provide information on a specific building project which they have completed within the last 5 years. The information includes project cost and project time among other things. In the second part of the questionnaire, the respondents were requested to rate the relative importance of the materials management practices which were identified during the first phase of the research. A scale of 1–5 is recommended to get better validity and reliability (Lozano et al. 2008; Jamieson 2004). Accordingly, to rate the

practices, this research used a scale of 1 for not important; 2 for slightly important, 3 for somewhat important, 4 for very important, and 5 for extremely important. On that basis, a new instrument (un-weighted scoring tool) was developed and validated through interviews with local experts during Phase I of the study. The clarity, language, format, and the contents of the levels of the practices have been discussed during the validation process of the questionnaire.

Fig.2 shows the procedures used in preparing the un-weighted and weighted scoring tools. First, the qualitative data were analyzed, and materials management practices which are suitable to enhance productivity in building projects were identified. Then the levels of implementation for the identified practices were prepared based on the existing tools developed by the Construction Industry Institute for industrial and infrastructure projects. Thus, the practice and its levels of implementation were excluded. Consequently, the un- weighted scoring tools were prepared and validated by conducting interviews with local experts during Phase I of the study.

$$RII = \frac{5(n5) + 4(n4) + 3(n3) + 2(n2) + n1}{5(n1 + n2 + n3 + n4 + n5)} \quad (1)$$

Where $n1$ = number of respondents who selected not important; $n2$ = number of respondents who selected slightly important;
$n3$ = number of respondents who selected somewhat important; $n4$ = number of respondents who selected very important;
And $n5$ = number of respondents who selected extremely important.

Using above formula RII for all the practices is calculated from the values and data collected from the responses.

The weights obtained using this equation was proportionally distributed among the five levels of the practices, and the weighted scoring tool was developed. During Stage II of the quantitative data analysis, the data collected from the building construction projects were transformed into equivalent scores using the weighted scoring tools, and projects scores were computed. The analysis was then conducted to validate the weighted scoring tools.

To prepare the weighted scoring tools, the weight of each practice is proportionally distributed among the five levels of implementation of a particular practice. The following formula is developed to compute the weight proportions of the practices.

$$\text{Level }(N + 1) = \text{Level } N + RII/5$$

III. FINDINGS AND DISCUSSIONS

Materials Management Practices for Improving Labor Productivity of the Building Construction Projects: Interview results will be

summarized in Table. The practices which were not considered suitable for improving the productivity of the multi-storey building construction projects by all interviewees were rejected. Accordingly, on-site materials tracking technology, procurement team, and post receipt preservation and maintenance were not found to be significant to enhance productivity in multi-storey building projects. However, six materials management practices which can increase the productivity of multi- storey building construction projects were identified. These practices comprise long-lead materials identification, procurement plans for materials, materials delivery schedule, material inspection process, materials inspection team, and materials status database.

IV. RESULT

By using the values which we have got in table, we have plotted the bar chart which shows the values of all the material management practices score in single chart and thus from that chart we came up for the conclusion of the work.
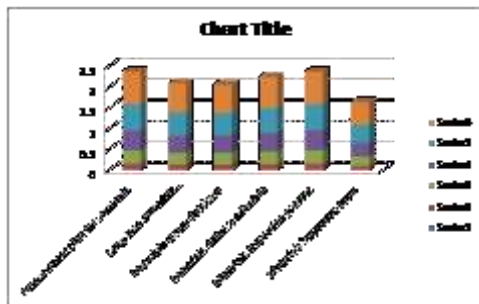
V.CONCLUSION

From the above methodology it is concluded that there are many methods of increasing productivity in construction industry. By proper use of construction management practices productivity as well as proper use of labor force can be easily done and managed. There is enormous study on the methods which improve the productivity which consists of material tracking, healthy and safe working condition and effective management systems.

By applying proper score and weighted tools for construction management practices we have predicted the labor productivity on the construction site in our project. From the above study we can conclude that from all the 6 material management practices the best practice or highly accepted practice that is adopted are procurement plan for materials andmaterial inspection process in the specific area where this research is carried out.

VI. FUTURE SCOPE
- Find inter-relationships between the identified practices and labor productivity.
- This inter-relationship can be used to develop service culture and improve service quality of an organization.

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