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An Implementation of Material and Labour Management for Indian Contractors in Construction

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ABSTRACT

Effective construction resources management process is a key to success of aconstruction project. Nowadays, successful management of construction resources hasto be based on updated information and processed utilizing a well-designedconstruction resources management system. The aim of the thesis is to explore the local practice in construction resourcesmanagement to facilitate the management of construction resources mainlyinthebuilding construction. Construction resources management related literaturewasgenerally reviewed. A survey questionnaire supported was used to explore the local practiceinconstruction resources management. Twenty-three questionnaires were distributedtoconstruction companies. Thirteen questionnaires were received and analyzed. The study clarified that the availability of material at site was the mainsolution for many problems. The surveys also indicate that the stability of theworkwas one of the most important factors affecting on increasing productivity. The studyillustrated that the worker are not satisfied was one of the most important factors that may lead to affecting on reducing productivity. One of the main recommendations of this research is to encourage local contracting companies to have a construction resources management use it indetermining the required quantities of construction materials in order to get resourcesin time and required quantities, save time and minimize error.

1. INTRODUCTION

The construction industry plays a pivotal role in the economic development of nations, contributing significantly to GDP and employment. In India, the construction sector has grown exponentially in the past few decades, with rapid urbanization and a boom in infrastructure projects. However, despite this growth, the industry faces several challenges that impede its efficiency and sustainability. Among these, material and labor management are two of the most crucial factors influencing the success of construction projects. Effective management of materials and labor not only enhances productivity but also significantly reduces costs, minimizes delays, and improves overall project quality. This research aims to explore the implementation of material and labor management practices for Indian contractors and how these practices can improve the performance and outcomes of construction projects.

1.1. The Importance of Material and Labor Management

Material and labor management in construction refers to the strategic planning, control, and coordination of materials, manpower, and processes required to execute a construction project efficiently. Construction projects often involve large-scale operations with numerous moving parts, ranging from procurement and delivery of materials to labor scheduling and supervision. A lack of coordination in these areas leads to project delays, cost overruns, and poor quality outcomes, which are all too common in the Indian construction industry. Therefore, efficient management of materials and labor is essential to ensure that projects are completed on time, within budget, and to the desired quality standards. The significance of proper material management cannot be overstated. Materials in construction projects constitute a substantial portion of project costs, sometimes accounting for over 60% of the total budget. Managing these materials involves not only the timely procurement and supply but also the storage, inventory control, and utilization. Poor material management results in wastage, shortages, delays, and increased costs, all of which undermine project objectives. Effective material management systems are crucial for maintaining a steady flow of resources, ensuring quality, and avoiding project delays. Labor management, on the other hand, is equally vital for the smooth execution of construction projects. India, with its vast labor force, often faces challenges related to workforce productivity, skill levels, safety, and industrial relations. Ensuring the availability of skilled labor, proper deployment, training, and adequate compensation is essential for

maintaining productivity and avoiding disruptions on-site. Labor shortages, absenteeism, inadequate skill levels, and poor working conditions can severely hamper project progress. Therefore, effective labor management practices, including worker scheduling, training, welfare measures, and safety protocols, are necessary to optimize workforce utilization and minimize project delays.

1.2. Challenges in Material and Labor Management in India

The Indian construction industry faces unique challenges when it comes to material and labor management. Material procurement and logistics are often hindered by inadequate infrastructure, poor supply chain management, and lack of standardization. Additionally, the industry experiences frequent fluctuations in material prices, which can affect the project budget. Inefficient storage practices, wastage during handling and transportation, and the lack of modern technology in inventory management further complicate material management. Labor management in India is similarly fraught with difficulties. The Indian construction industry heavily relies on informal labor, with many workers employed on a temporary or casual basis. This makes labor planning and scheduling a complex task, as the workforce may be inconsistent and lack specialized skills. Moreover, there is a significant gap in the training and education of construction workers, which limits their productivity and increases the likelihood of errors. Social issues, such as labor strikes, disputes, and poor working conditions, also contribute to disruptions in the construction process. Furthermore, the lack of standardized labor practices, delayed payments, and the absence of formal contracts for many workers often leads to low morale and high turnover rates. This instability further exacerbates the challenges of labor management in construction projects.

1.3. Government Policies and Regulations

The Indian government has recognized the challenges faced by the construction industry and has implemented various policies to address these issues. Initiatives such as the "Make in India" campaign, "Atmanirbhar Bharat," and the "Pradhan Mantri Awas Yojana" (PMAY) have been launched to boost the construction sector by encouraging local manufacturing, improving housing infrastructure, and enhancing employment opportunities. Additionally, the government has introduced several labor laws and regulations to protect the rights of workers and improve working conditions. However, the implementation of these policies remains inconsistent across the country, and there is a lack of enforcement mechanisms, particularly in the informal sector. The Government of India has also established guidelines for the construction industry to improve safety standards and quality control. The Bureau of Indian Standards (BIS) plays a crucial role in setting quality standards for construction materials. However, adherence to these standards is often poor, and the industry lacks a robust mechanism for ensuring compliance. The absence of a well-defined framework for material and labor management has resulted in inefficiencies and poor project outcomes.

1.4. Global Practices and Their Relevance to India

Globally, many developed countries have adopted advanced techniques and tools to manage materials and labor moreeffectively. The use of Building Information Modeling (BIM), just-in-time (JIT) inventory systems, and automated project scheduling tools has transformed the way materials and labor are managed in construction projects. These practices have resulted in reduced material waste, optimized labor deployment, and better cost control. Countries like the United States, Japan, and Germany have demonstrated the effectiveness of these practices in improving construction efficiency. In India, there is a growing recognition of the need to adopt such practices, but the transition remains slow. While large contractors in metropolitan cities are increasingly incorporating modern technology in their projects, smaller contractors in rural and semi-urban areas continue to rely on traditional methods. The challenges of technology adoption, the high cost of advanced systems, and a lack of skilled workforce in these areas are significant barriers to progress. Therefore, it is crucial to evaluate how these global practices can be adapted to the Indian context, taking into account the country's unique socio-economic and cultural factors.

1.5. The Need for a Structured Approach to Material and Labor Management in India

Given the challenges faced by Indian contractors in material and labor management, there is a pressing need for a structured approach to improve the efficiency and effectiveness of these processes. The implementation of integrated management systems, better procurement strategies, and a more formalized labor workforce can help reduce the gaps and inefficiencies in current practices. Additionally, training and skill development programs for workers, the use of technology for better planning and execution, and the adoption of more stringent regulatory frameworks can play a significant role in improving material and labor management in construction. By focusing on both material and labor management, this research aims to provide insights into how Indian contractors can optimize their practices to achieve better project outcomes. The goal is to identify key factors that influence material and labor management in the Indian construction industry and propose practical solutions to address these challenges. The research will explore the role of technology, policy interventions, and industry practices in enhancing the efficiency of construction projects.

2. LITERATURE REVIEW

Neeraj et al. (2010) reported that approximately 42% of government-funded construction projects in India experience time overruns. In a prior study by one of the authors, a second-stage questionnaire survey was conducted to identify significant schedule performance factors. The analysis of the survey responses concluded that factors such as the competence of the project manager, monitoring and feedback from project participants, interaction with external project stakeholders, and effective coordination among all participants play a crucial role in project performance.

Heon (2011) highlighted that construction scheduling techniques often result in schedules that cause undesirable fluctuations in resource utilization levels, leading to peak resource demands that exceed available limits. Resource allocation models, or resource-constrained scheduling models, are designed to address these conflicts by rescheduling project activities while minimizing the extension of project duration.

Fan (2011) acknowledged that scheduling delays are a common issue in construction projects worldwide.

Hegazy and Menesi (2008) found that scheduling delays occurred in 70%, 40%, and 50% of government-contracted

construction projects in the United Kingdom, India, and the United Arab Emirates (UAE), respectively.

Anderson (2005) noted that research focused on engineering projects, typically large and complex, often offers more comprehensive insights into project management practices that can be applied to smaller projects as well.

Ibbs (2007) pointed out that project delays lead to both direct and indirect costs. Many previous studies have focused on construction projects in developed countries. In recent years, however, India's construction industry has seen a surge in major projects related to infrastructure development, including airport expansion, metro rail systems, and the power sector.

Love (2000) argued that field overhead costs require proper estimation, although they are generally less complicated than overhead charges for home and office spaces.

Saka and Mudi (2007) observed that most contractors in Nigerian construction companies sourced materials locally, rather than from suppliers, which may lead to inefficiencies in material procurement.

Hisham (2010) emphasized the importance of proper planning and execution of material procurement and storage on construction sites to prevent the negative impacts of material shortages or excessive material inventory. Inefficiencies in material supply and flow were often cited as major causes of productivity losses and financial setbacks. Efficient planning of procurement and storage can significantly enhance productivity and profitability. Ignoring the critical interdependencies between procurement and site-space availability can result in material shortages, poor storage practices, unsafe site layouts, and productivity losses. Jang et al. (2007) underscored the need for research into modeling these critical interdependencies. The paper aims to present the development of a construction logistics planning (CLP) model that integrates and optimizes material procurement and storage decisions.

Said et al. (2011) echoed the importance of careful material procurement and storage planning to avoid the detrimental effects of material shortages or excess inventory on construction sites.

Guo (2011) noted that the successful implementation of Lean Construction Management (LCM) in construction projects is heavily reliant on a visual communication and collaboration platform. An effective information-sharing system is essential for implementing LCM, as it facilitates the gathering of project information across various stakeholders.

Orabi et al. (2010) discussed a model designed to allocate limited reconstruction resources to competing recovery projects, aiming to generate a recovery schedule for damaged civil infrastructure systems.

Bhargava et al. (2010) stated that cost and time overruns in highway projects are critical issues globally, negatively impacting project delivery, public relations, and disrupting highway programs. These challenges are exacerbated by overlapping activities and poor management of information transfer between activities.

3. OBJECTIVES OF STUDY

- Evaluate the local practices of construction resource management incontracting companies in India.
- Find out the benefits of using construction resources management inconstruction industry.

4. METHODOLOGY

4.1. Field Survey

Questionnaires are distribution to respondents of different construction companies and are explained with the research concepts. Out of 23 people13respondents filled the questionnaire and returned them back. Questionnaire data analysis is carried out in next step. Figure 1 illustrates the methodology flowchart.

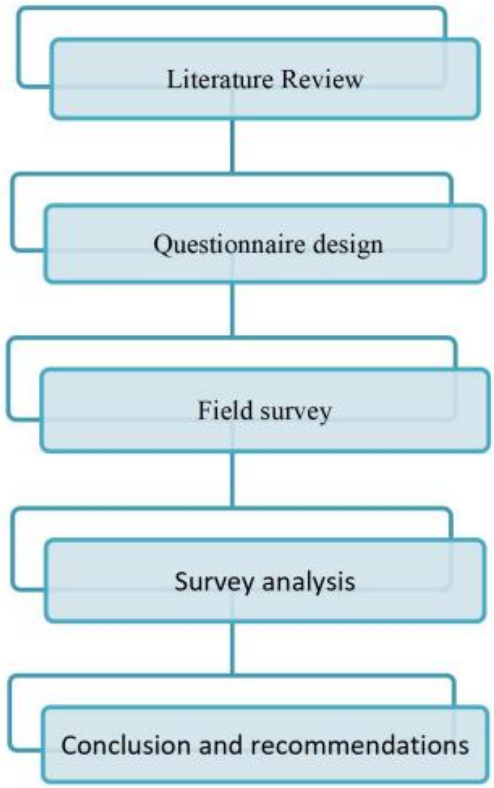

Figure 1. Methodology of flow chart

4.2. Data Analysis

In order to be able to select the appropriate method of analysis, the level ofmeasurement must be understood. For each type of measurement, there is anappropriate methods that can be applied and not others. In this research, the analysisisdone base don Likert's scale. The numbers assigned to the important (1, 2, 3, 4, 5) donot indicate that the interval between scales are equal, nor do they indicate absolutequantities. They are merely numerical labels. Based on Likert scale we havethefollowing (Cheung et al., 2004; Iyer and Jha, 2005; Ugwu and Haupt, 2007):

Very high important 5
High important 4
Medium important 3
Low important 2
Very low important 1

The relative importance index is computed as (Cheung et al., 2004; Iyer andJha, 2005; Ugwu and Haupt, 2007):

RI I = W/ (A× N)
Where:
W is the weight given to each factor by the respondents and ranges from1to5

A = the highest weight = 5
N = the total number of respondents

The criteria in questionnaire are quantified based on the RI I value obtainedusinglimits. The relative importance index (RI I) value is classified as follows:

- 0.9 ≤ RI I ≤ 1.0 = Excellent
- 0.8 ≤ RI I < 0.9 = Good
- 0.7 ≤ RI I < 0.8 = Acceptable
- 0.6 ≤ RI I < 0.5 = Questionable
- 0.5 ≤ RI I < 0.6 = Poor
- 0.0 ≤ RI I < 0.5 = Unacceptable

5. RESULTS AND DISCUSSION

5.1. Study population characteristics

The general characteristics of the study population were investigated. Theyinclude the year of establishment, field of work, classification of contractors, experience of respondents and number of employees.

5.1.1. Year of establishment

Figure 2 shows that in this survey 16% of the contracting companies areestablished before 1994, 41% of companies are established from1994 to 2000 and 44% of companies are established after 2000. This indicates that most of companiesare relatively newly established.

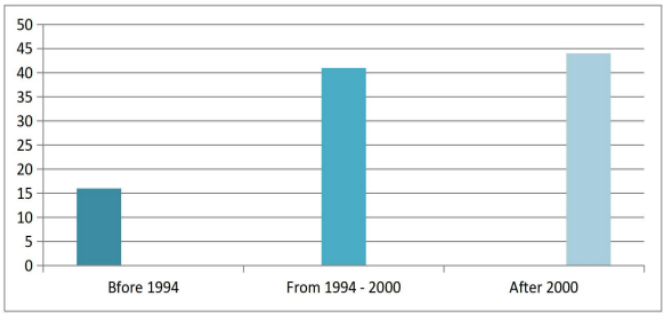

Figure 2. Year of establishment of contracting companies

5.1.2. Field Work

Table 1 Demonstrates that 65% of contracting companies undertake buildingworks, 20% of contracting companies undertake road woks, 10%of contracting companies undertake water and sewage works and 5% of contracting companiesundertake electro mechanics projects. This indicates that most of contractingcompanies go with building works (65%).

Table 1. Field of company specialization

Company work field		Main
Building work	*Frequency*	8
	Percentage	65%
Roads works	*Frequency*	3
	Percentage	20%
Water and sewerage works	*Frequency*	1
	Percentage	10%
Electro mechanics	*Frequency*	1
	Percentage	5%

5.1.3. Respondents designation

Figure 3 shows that 47% respondents are site engineers, 40%respondentsare project managers, 8% respondents are owner organization and 5%respondents areoffice engineers. This indicates that most of respondents are site engineers (47%) andproject managers (40%).

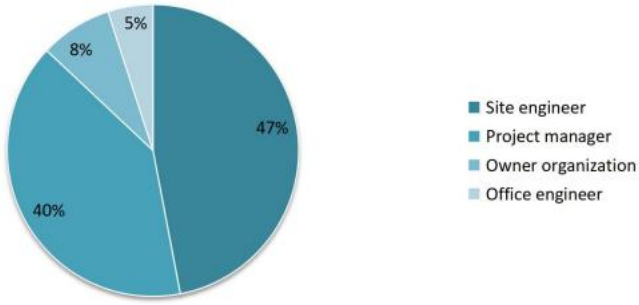

Figure 3. Respondents designation

5.1.4. Experience of respondents

Figure 4 shows that 52% have experience more than 10 years, 35%haveexperience between 5 to 10 years, 8% have experience between 3 to 5 years and5%have experience between 1 to 3 years. This indicates that most of experiencerespondents are more than 10 years (52%).

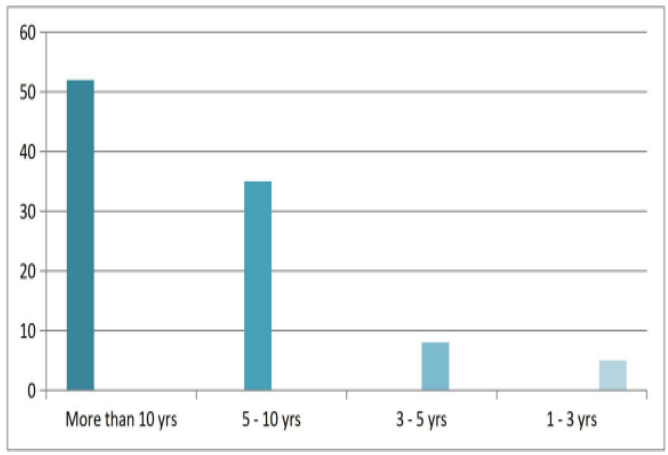

Figure 4. Experience of respindents (years)

5.1.5. Classification of contractors

Table 2 illustrates that 65% are classified as first class in buildingworks, 20% are classified as first class in roads works and 15% are classified as first classinsewage and water works. This indicates that most of the contractor's class is first class

Table 2. Degree of classification

Company classification according the contracting union for the following fields		First class	Second class	Third class
Building works	*Frequency* (7)	4	2	1
	Percentage	65%	20%	15%
Roads works	*Frequency* (3)	1	1	1
	Percentage	55%	25%	20%
Water and sewerage works	*Frequency* (3)	1	1	1
	Percentage	40%	30%	30%

5.1.6. Number of employees and their qualifications

Figure 5 shows that 47% of companies have employee less than 10, 35%number of employee between10 to 15, 9% of companies have employee between15to 20 and 9% of companies have employee more than 20. This indicates that most ofcompanies are of small size.

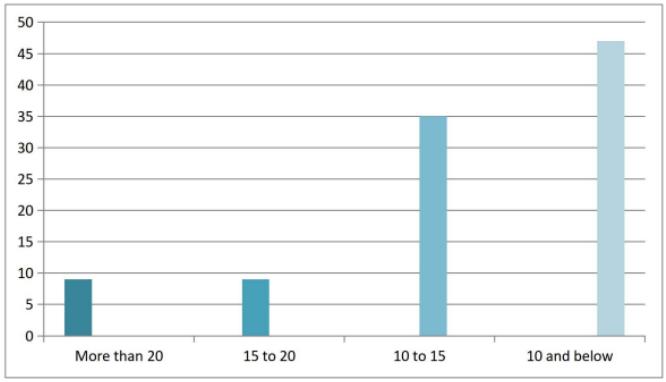

Figure 5. Distribution of respondents' number of employee.

6. CONCLUSION

Construction Resources Management system (CRMS) was developedtosatisfy some needs of Indian contracting companies in managing constructionresources. This chapter introduces the research conclusions and recommendations formany parties involved in the construction process to improve the local practicesinconstruction resources management. Recommendations for further studies are also included.

- The contracting companies in India are:
  - Relatively newly established.
  - Involved mainly in building works.
  - Small size organizations.
  - Depending heavily on subcontractors.
- Main benefits of implementation of materials management systemon constructionprojects are reducing the costs of projects materials, availability of materials timeto with the right quantity and reducing duplication of materials orders.
- Several Benefits of knowing the importance of waste percentage for different building materials will help to determine the exact required quantities helpcontractors to price tenders more accurately and help to finish the project successfully and have profits.
- There are many factors that affecting on the increasing of labor productivitylikework satisfaction, the stability of the work, good management of the workers, incentive payments and relation between workers.
- There are many factors that affecting on the reducing of labor productivitysuchasthe workers are not satisfied, misunderstanding between workers, unqualifiedtraining for workers and management experience.
- Most contracting companies are interested in using some techniques of managingconstruction resources such as building archive for previous projects about thecost of resources creating and save the effort and minimizing errors.
- CRMS suits India contracting companies and has the potential to contributeinimproving the construction resources management practice in India. It has agoodperformance and adequate accuracy

The successful completion of a project depends on many factors of which proper delay mitigation is one of the most important. This research undertaken to perform a comparative study of the delay mitigation clauses from the popular form of contract conditions adopted from India and Developed Country's construction industry. Such a comparative study has helped to make the critical analysis of the delay mitigation capability of the developing contract management system in India with the developed contract management system. To make the comparative study more effective, this research has identified the popular form of contract condition and procurement method adopted from Developed Countries and India, i.e., FIDIC contract in Developed Countries and MOSPI contract in India. The significant risks associated with the traditional methods were identified from the literature review and the top 10 delays were prioritized through a comprehensive assessment of their impact severity, likelihood of occurrence established through the research survey. The contractual delay mitigation mechanism for the top 10 delay factors was identified through the data analysis process. The key findings obtained from this comparative study of FIDIC (Developed Countries) with MOSPI (India) for mitigating the delays associated with the traditional contract methods shall help to improve the condition of Indian Construction Industry. This comparative study helps to get to know about the delay mitigation capacity of the Indian construction projects. However the recommendations made by this research project is not conclusive, but to provide a comparative list of delay mitigation techniques adopted by both the contractual and industry perspective. Hence the reader of this research shall consider these recommendations as a guide note to mitigate delay rather consider as conclusive solution to mitigate delays

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