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Impact of management practices on construction productivity in Indian building construction projects: an empirical study[1]

Abstract: The objective of this study is to analyse the impact of management practices on the productivity of building construction projects in India. The methodology adopted for this study is to identify and analyse the management practice attributes from the literature review and expert focus group interviews. The identified attributes were analysed and priorities using relative weight were given by the respondents. The collected data were further analysed using SPSS 21 software. The quantitative research methodology was adopted to analyse the collected data and the following tools and techniques were applied to the data: reliability analysis to check the consistency of data collected for this study and relative importance index (RII) to prioritise and rank the attributes based on the weighted average score given by the respondents. The findings of this study concluded that coordination between all stakeholders, ability to handle the crisis by the project managers, social skills of key team managers, timely payment of completed works and design capability and frequent design changes are the most significant attributes of management practice, affecting construction productivity and having a rating on the RII of 0.91, 0.90, 0.88, 0.87 and 0.87.

Keywords: management practice, project management, construction productivity, construction management, built environment, Indian construction industry

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1 Introduction

Indian economy is one of the fastest growing economies in the world with an average growth rate of 6–7%. The construction industry in India is the second largest employer after the agriculture industry and it contributes about 8–10% on an average to the economy. It is growing further as the rate of urbanisation followed by green and brownfield developments will increase (Banawi and Bilec 2014). The construction industry in India is unorganised, and the majority of the workforce employed is uneducated and ignorant to sustainable practices and is driven only by the motive of commercial viability ignoring every other factors such as quality, sustainability, health and safety and operability (Jamil and Fathi 2016; Neelamkavil 2009; Dixit and Sharma 2019). Majority of the construction projects in India is suffering from a delay in construction, over budget, quality and low productivity. Low construction productivity is one of the major issues that impact on the performance of construction projects to get completed on time and within budget (Banawi and Bilec 2014; Khodeir and Othman 2016; Jiang et al. 2016; Ajala et al. 2017; Ameh et al. 2010; Xu et al. 2018; Björnfot and Sardén 2006).

Indian construction industry is very diverse, fragmented and apparently unorganised. The skilled and quality workforce has always been one of the most critical issues for the industry. Due to the unique nature of work, coordination, timely delivery and quality have always been a subject to ponder. The productivity in the construction industry has been studied and documented all around the world and it has the advantage of over 40 years of research that have developed models, identified the factors affecting productivity, studies at the industry level, the study of equipment and technology to enhance productivity and techniques to measure

and improve construction productivity (Zhang and Fan 2013; Ma et al. 2015; Barlow 2009; Sweis et al. 2016; Molavi and Barral 2016; Howell 1999; Castellani et al. 2018) which results in enhancing construction productivity and labour productivity. Various research have been done to find out several factors that influence the construction productivity and the findings include the business culture, education level, tools and technologies used, values and ethics of the people and workers involved, politics, local laws and regulations governing the project, HR policies of the organisation, importance given to the employee, religion of the people, their cultures, languages, etc. (Al-Tabtabai et al. 1997; Ocampo and Clark 2015; Alves et al. 2012).

2 Literature review

Productivity could be measured at different levels, but there are three main productivity measures: metronomic, case-by-case and pricing studies. The financial wealth of nations is determined by their productivity growth (Fulford and Standing 2014; Tsehayae and Fayek 2016; Mani et al. 2017; Grau et al. 2009; Kaming et al. 1997). The countries experienced higher productivity growth as a result of the increase in the average wage of workers which contributes to the profits and tax revenue of the countries. The trend is not consistent over time due to a number of reasons, such as unplanned training sessions, consistency of skills development courses and a decrease in the number of participants (Oglesby et al. 1989; Lee et al. 2007; Moselhi and Khan 2010; Ameh and Osegbo 2011; Mahamid 2013; Santosh and Apte 2014; Alazzaz and Whyte 2015; Chalker and Loosemore 2016; Ma and Liu 2018). Construction productivity has been an area of research interest since the last 4–5 decades.

It is very difficult to set up a benchmark for productivity and standard productivity measures to increase output. The projects are usually planned and calculated based on the historical data and experience. It is important to take into account the differentiator and the variables that we need for the project and the different factors (Neelamkavil 2009; Burgess et al. 2017).

The various factors include:
1. Size of the project undertaken
2. Project design complexities
3. Wearing site conditions such as soil drainage topography
4. Weather conditions such as rain, summer, winter, etc.
5. Seasons changes
6. Manpower and labour conditions such as skilled and unskilled labour
7. Government or regulatory requirements
8. Material source supply and IDs
9. Complexity to transport and logistics
10. Design changes (Chalker and Loosemore 2016; Wang et al. 2013; Doloi et al. 2012; Teizer et al. 2013; Jarkas and Bitar 2012)

Labour productivity or yield per hour is the best among other measures of construction productivity. The final objective of each sector in the country, including construction, is to increase productivity. Macroeconomics information indicates that the overall productivity of work in the construction sector decreased during the period 1979–1998. Productivity information of the construction sector in the United States from 1979 to 1998 determined its legitimacy and reliability (Poirier et al. 2015). To ensure the suitability of the BIM usage process, it is crucial for associations hoping to change to BIM to have the capacity to manage and measure these advantages. This article showed the discoveries of an activity study of a project with a small mechanical temporary worker who was investigating the effect of BIM on the productivity of work on an expansive business project (Kwon et al. 2014). The findings showed the assumption that Australian subcontractors are large contract workers only. Productivity multipliers for construction productivity are regularly evaluated on a specially designed premise, subject to the task attributes. Safa et al. (2016) studied the use of automated rebar mounting machines to improve the productivity of construction work and reduce the likelihood of accidents involving rebar yard workers. The author concluded that work is concentrated and costly, with a high learning curve that limits speciality capabilities to a lot of field involvement in construction. Research and construction controls for rebar tie have been sensibly constrained. This study showed that the programmed rebar mounting machine could lower the learning curve, reduce the preparation time and limit the overtime. The results of this study showed that the programmed rebar mounting machine can possibly spare time, money and economic liabilities without gambling labour productivity. The analysis of a complex subject is very difficult to develop and it requires a lot of imagination (Table 1).

Tab. 1: Selected variables for the current study

Selected variables for the current study	References
Urgency emphasised by the owner while issuing the tender, customer/client satisfaction, inadequate project formulation in the beginning	Chancellor and Abbott (2015), Aziz and Hafez (2013) and Dixit (2018)
Scope clarity of the project, the exceptional difference between client and architect	Dixit (2018), Sezer and Bröchner (2014) and Dixit et al. (2019a)
Coordination between all stakeholders, contractual disputes, design capability and frequent design changes	Jarkas et al. (2012), Afifi et al. (2016) and Lim and Alum (1995)
Developing and maintaining a short and informal line of communication, human resource and a labour strike, ability to delegate authority, rework	Sezer and Bröchner (2014), Dixit et al. (2019a) and Jarkas et al. (2012)
Timely payment of completed works, site clearance/availability, cost, quality, supply chain	Afifi et al. (2016), Lim and Alum (1995) and Assefa Tsehayae et al. (2016)
Social skills of key team managers, interpersonal skills, climate conditions, social environment, political and economic environments	Assefa Tsehayae et al. (2016), Ma and Liu (2014) and Abdul Kadir et al. (2005)
Willingness to adopt change, claim geniuses, conflict of interests among team members, ability to handle the crisis by the project managers, availability of training and development for enhancing skills	Abdul Kadir et al. (2005), Ma et al. (2016) and Ok and Sinha (2006)

3 Research methodology and data analysis

The methodology adopted for this study is to identify and analyse the management practice attributes from the literature review and expert focus group interviews. The identified attributes were analysed and priorities using relative weight were given by the respondents. The data were collected using a structured questionnaire on pan India basis, and both online and offline modes of data collection were used. The collected data were further analysed using SPSS 21 software. Quantitative research methodology was adopted to analyse the collected data and the following tools and techniques were applied to the data: reliability analysis to check the consistency of data collected for this study and relative importance index (RII) to priorities and rank the attributes on the basis of weighted average score given by the respondents were performed on the data collected.

3.1 Data collection

The questionnaire floated to the professionals associated and working in the Indian construction industry and 105 valid responses were received. The data were collected using a structured questionnaire survey consisting of the 19 identified attributes from the literature. The received responses were analysed using SPSS 21 software and excel spreadsheets.

3.1.1 Respondents profile

The questionnaire data collection was adopted because of the scarcity of the secondary data available on the research topic in Indian scenario. The respondents selected for this study were directly associated with the Indian construction industry such as architects, clients, consultants, contractors, academicians and other stakeholders. The respondents were selected irrespective of their gender, demography and the type of projects to give an equal change to the population. The finding of this study concluded that the respondents represented the industry and also different roles and responsibilities. The respondents were selected randomly and the questionnaire was sent over mail to the respondents for seeking information on this study. The respondents were followed by three reminders to submit their responses. A total of 108 responses were received out of which three were discarded because of incomplete information. Finally, 105 valid responses were considered for this study. The similar approach for collecting primary data using questionnaire survey was recommended and adopted by few expert groups in previous studies.

3.1.1.1 Position/designation of the respondents

Of note, 35% of the respondents were working at the operational level, followed by middle management, top management, others (academician, NGOs and other groups) and advisor/consultant level having the percentage shares of 27, 19, 11 and 8%, respectively. If we club the top

management and middle management, then the percentage of the respondents would become 46% (Figure 1).

3.1.1.2 Years of respondents' experience

The respondents were having a rich years of experience in assessing their material quality and their hard work when choosing the study sample, which enabled the respondents to provide a simple and accurate description of the characteristics that affect the construction efficiency and demonstrate the reliability and accuracy of the collected data (value of Cronbach's alpha for the current study is 0.87) (Figure 2).

3.1.2 Reliability analysis of the sample

To assess the internal consistency of the survey instrument, the Cronbach's alpha test was carried out. The research discussed the precision and consistency of the collection of specimens. As a rule, the precision and consistency of the collected data were measured at a minimum of 0.5. The experiment showed a value of Cronbach's alpha of 0.87 for the current study, making the results perfect for analysis (Dixit et al. 2019b).
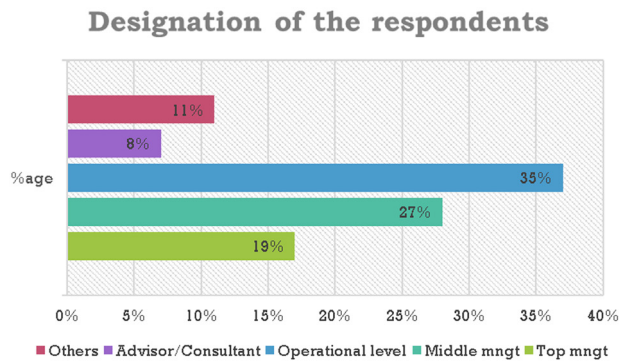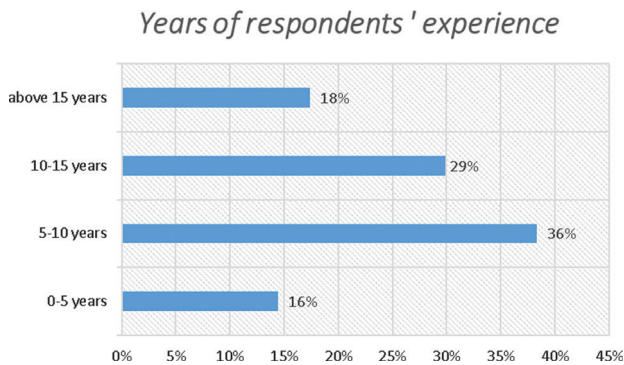

Fig. 1: Position/designation of the respondents.

Fig. 2: Years of respondents' experience.

3.1.3 RII of the attributes in this study

The contribution of each variable to the overall significant attributes of management practices affecting construction productivity in the Indian construction industry was determined using the relative significance index measured by the respondent using the equation for its criticality, and the qualitative effects are shown in the Table 3. The ranking of different attributes from the point of view of the contractor, developers and consultant was assessed using the RII equation (Dixit 2018; Dixit et al. 2017).

The responses received were compiled in the Excel datasheet and evaluated using the SPSS21 package. The RII was carried out to define the importance of attributes and was accompanied by a reliability test to validate the accuracy of the results obtained (0.87; Table 2).

$$\mathrm{RII} = \frac{\sum_{r=1}^{5} r \star \mathbf{n}_r}{5\mathbf{N}}. \tag{1}$$

3.1.3.1 The most significant attributes of management practices affecting construction productivity in the Indian construction industry

The most significant attributes of management practices affecting construction productivity in Indian construction industry are coordination between all stakeholders, ability to handle the crisis by the project managers, social skills of key team managers, timely payment of completed works and design capability and frequent design changes having a rating on the RII of 0.91, 0.90, 0.88, 0.87 and 0.87, respectively (Table 3). Coordination between stakeholders and social skills are the main significant attributes in the success of any projects as reported by Hughes and Thorpe (2014) and Iyer and Jha (2005).

3.1.3.2 The significant attributes of management practices affecting construction productivity in the Indian construction industry

The significant attributes of management practices affecting construction productivity in Indian construction industry are contractual disputes, availability of training and development for enhancing skills, conflict of interests

Tab. 2: Reliability analysis of the attributes selected for this study

Cronbach's alpha	No. of items
0.87	19

Tab. 3: Relative importance index (RII) of attributes of management practice affecting construction productivity

Rank	Total responses	Total score	RII	Attribute name
1	105	476	0.91	Coordination between all stakeholders
2	105	470	0.90	Ability to handle the crisis by the project managers
3	105	462	0.88	Social skills of key team managers
4	105	458	0.87	Timely payment of completed works
5	105	455	0.87	Design capability and frequent design changes
6	105	442	0.84	Contractual disputes
7	105	420	0.80	Availability of training and development for enhancing skills
8	105	418	0.80	Conflict of interests among team members
9	105	410	0.78	Scope clarity of the project
10	105	387	0.74	Exceptional difference between client and architect

among team members, scope clarity of the project and exceptional difference between client and architect having a rating on the RII of 0.84, 0.80, 0.80, 0.78 and 0.74, respectively (Table 3). The contractual disputes and conflict of interest were the reason of failure for a number of projects as reported by world bank report and other researchers irrespective of the type of construction and the value of funds associated (Zouher Al-Sibaie et al. 2014; Jarkas et al. 2015).

3.1.3.3 The least significant attributes of management practices affecting construction productivity in the Indian construction industry

The least significant attributes of management practices affecting construction productivity in the Indian construction industry are customer/client satisfaction, willingness to adopt change and claim geniuses having a rating on the RII of 0.65, 0.64 and 0.62, respectively (Table 3).

4 Conclusion and discussion

This study revealed that the minimum value of reliability analysis for all the attributes is above 0.62, i.e. all the attributes selected for this study had a significant impact on construction productivity of the building projects. This study highlighted and concluded that the management attributes are significant and could be managed and controlled by identifying the key issues and taking the initiative to resolve them. Nguyen and Chileshe (2015) concluded that the factors for the failure of any construction project could be avoided by timely identification of critical factors. Rezakhani (2012) also explained the main significant risk factors for the success of any construction project. The similar trait revealed in this article is the impact of management on the success and the productivity of construction projects was also reported by previous

research articles in different demographic conditions (Svejvig and Andersen 2015; Gurmu and Aibinu 2017; ISO 31000 2009). The success of a project is depended on several attributes and it is possible to complete the project within the time frame and within the budget allocated to the project. It requires a dedicated management team, lead by a capable leader who could make the right decisions on time and delicate the authority to make decisions for the benefit of the project. One of the main attributes for the success of any project is the commitment of top management and the presence of the right culture at the management level. This research added the value to the existing knowledge bank by identifying and analysing the impact of management practices/techniques on the construction productivity of building construction projects. This study provided a solution to the construction managers and project managers to apply the findings of this study in their projects to control the issues of low productivity and delays in completion of the projects using the identified most significant attributes of management practices affecting construction productivity in the Indian construction industry. The scope of the current study was limited to the Indian building industry, and the analytical unit chosen to conduct research and collect data at the project/site level. Furthermore, the only building construction project has been selected for the present study.

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