FACTORS INFLUENCING PRODUCTIVITY IN CONSTRUCTION INDUSTRY

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Abstract: *The construction industry plays a vital role in economic development, and improving productivity within this sector has been a persistent challenge. This paper presents a review of the factors influencing productivity in the construction industry. Through an extensive analysis of existing literature, this study identifies and examines key factors that have been widely recognized as influential determinants of productivity in construction projects. These factors include project management practices, labor productivity, technological advancements, supply chain management, regulatory environment, safety and health considerations, and external factors such as economic conditions and market demand. The review explores the complex relationships and interactions between these factors, highlighting their impact on overall productivity levels. Additionally, the study discusses the various measurement methods and metrics used to assess productivity in the construction industry, providing an overview of the existing frameworks and approaches. By synthesizing the findings from numerous studies, this research contributes to a deeper understanding of the multifaceted nature of productivity in construction, offering insights into the challenges and opportunities for improvement. The review also highlights the need for holistic approaches that integrate various factors and stakeholders in order to enhance productivity and achieve sustainable growth in the construction industry. The findings of this study can inform industry practitioners, policymakers, and researchers in developing effective strategies, best practices, and targeted interventions aimed at enhancing productivity and driving positive change in the construction sector.*

Key words: Construction industry, Productivity, Factors

1. INTRODUCTION

Due to its frequent discussion within the construction industry, 'Productivity' is widely acknowledged as a crucial aspect by a significant number of economists (Yi and Chan, 2014). The construction sector is characterized by a high demand for labor and relies significantly on the expertise and abilities of its workforce. The workforce represents the industry's greatest asset, contributing to at least 25% of the overall project expenses (Jang *et al.*, 2011). To enhance project performance and mitigate cost overruns and delays, it is essential to possess knowledge and comprehension of the diverse factors impacting construction labor productivity. Typically, the decline in construction productivity is attributed to multiple factors rather than a singular cause. Furthermore, the factors impacting labor productivity in construction are often interconnected, with some factors stemming from the same root cause, while others may be triggered by the occurrence of other factors (Dai *et al.*, 2009). This understanding aids in identifying the key areas requiring attention and facilitates the implementation of effective measures aimed at improving productivity and achieving timely project completion (Soekiman *et al.*, 2011). Researchers worldwide have made numerous efforts to identify the factors that influence construction productivity. Consequently, a significant number of variables impacting construction productivity have been put forward as a result of these endeavors (Hasan *et al.*, 2018). In order to enhance the economic performance of construction projects, it is crucial to identify and address the factors that impact productivity in a suitable manner. By gaining a thorough and comprehensive understanding of these factors, it becomes possible to focus research efforts and effectively direct them, thereby maximizing the potential for improving productivity.(Hasan *et al.*, 2018). Although, many researchers agree that it is a useful strategy to identify a set of global factors, this agreement usually ends on the question of dependence of productivity on a wide range of factors (Soekiman *et al.*, 2011) (Ghoddousi and Hosseini, 2012)(Jarkas and Bitar, 2012).

2. FACTORS INFLUENCING PRODUCTIVITY IN CONSTRUCTION INDUSTRY

Construction productivity can be influenced by various factors including weather conditions, site and job conditions, labor skill levels, training, and motivation. This is due to the labor-intensive nature of construction projects and their exposure to both internal and external environments (Hasan *et al.*, 2018).
Previous studies have identified 113 factors that impact construction labor, which have been categorized into 15 groups based on their characteristics. These groups are as follows: design (5 factors), execution plan (5 factors), material (8 factors), equipment (6 factors), labor (18 factors), health and safety (4 factors), supervision (6 factors), working time (6 factors), project factor (15 factors), quality (3 factors), financial (6 factors), leadership and coordination (5 factors), organization (12 factors), owner/consultant (4 factors), external factors (10 factors). These factors have been identified through previous research and play a significant role in influencing various aspects of construction labor (Oglesby CH, 1989) (Thomas and Sanders, 1991)(Thomas, 1992)(Langford *et al.*, 1995)(Makulsawatudom, Emsley and Sinthawanarong, 2004)(Ibbs, 2005)(Hanna and Sullivan, 2004) (Nepal, Park and Son, 2006) (Enshassi *et al.*, 2007)(Alinaitwe, Mwakali and Hansson, 2007)(Hanna *et al.*, 2008) (Kazaz, Manisali and Ulubeyli, 2008).
Considering their consistent importance across different studies and the diverse project environments in both developing and developed construction markets, it is justifiable to assert that the key factors that significantly hinder construction productivity, ranked in decreasing order of their criticality, are as follows: non-availability of materials, insufficient supervision, shortage of skilled labor, inadequate tools and equipment, incomplete drawings and specifications, ineffective communication, rework, inadequate site layout, unfavorable weather conditions, and change orders. (Hasan *et al.*, 2018)
(Assaf and Al-Hejji, 2006) conducted surveys that identified 56 primary factors contributing to delays in large-scale construction projects, Delay factors are assembled into nine major groups with different levels of importance to different parties.
(Jarkas and Bitar, 2012) conducted a questionnaire survey among a statistically representative sample of contractors, focusing on 45 productivity factors categorized into four primary groups: management, technological, human/labor, and external. Among the explored factors, the following ten were found to have the most significant impact on labor productivity: clarity of technical specifications, extent of variation/change orders during execution, coordination level among design disciplines, lack of labor supervision, proportion of work subcontracted, design complexity level, lack of incentive scheme, lack of construction manager's leadership, stringent inspection by the engineer, and delay in responding to requests for information.
The study carried out by (Kazaz, Manisali and Ulubeyli, 2008) using questionnaire survey, examined the impact of 37 factors on construction worker productivity in Turkey, classifying them into four main groups: organizational, economic, physical, and socio-psychological factors. Surprisingly, organizational factors were found to have the most significant effect on productivity, followed by economic, physical, and socio-psychological factors. Although economic factors have historically been highly regarded, the findings highlight the increasing recognition of organizational management's importance in developing countries. The study emphasizes the need to consider all four groups comprehensively to effectively motivate the workforce by improving motivating factors and addressing demotivating ones simultaneously.
(Alinaitwe, Mwakali and Hansson, 2007) findings revealed the ten primary factors impacting labor productivity, which are identified as follows: incompetent supervisors, insufficient worker skills, rework, inadequate tools/equipment, poor construction methods, ineffective communication, inaccurate drawings, work stoppages due to consultant rejection, political insecurity, equipment breakdown, and harsh weather conditions. Notably, despite the lack of materials being ranked highest in terms of time loss based on the average rating, it did not make it into the top ten when considering the importance index, which accounts for factors such as time, cost, and work quality.

3. DISCUSSION AND CONCLUSIONS

The construction industry is inherently labor-intensive and susceptible to various internal and external factors that can significantly influence productivity. This conclusion is supported by several studies that have explored the numerous elements impacting construction labor productivity. These factors can be broadly categorized into different groups, such as design, execution plan, material, equipment, labor, health and safety, supervision, working time, project factors, quality, financial aspects, leadership and coordination, organization, owner/consultant factors, and external influences.

From a multitude of studies conducted in both developing and developed construction markets, certain key factors consistently emerge as critical hindrances to construction productivity. These factors, ranked in decreasing order of their criticality, include non-availability of materials, insufficient supervision, shortage of skilled labor, inadequate tools and equipment, incomplete drawings and specifications, ineffective communication, rework, inadequate site layout, unfavorable weather conditions, and change orders.

Delays in large-scale construction projects have also been investigated, and various contributing factors have been identified and grouped into different categories. These delays impact different parties involved in the projects to varying degrees.

In terms of improving construction labor productivity, it is essential to recognize the significance of organizational factors. Studies have shown that organizational management plays a crucial role in motivating the workforce and enhancing productivity. Economic, physical, and socio-psychological factors also have their share of influence, but the focus on organizational management is gaining importance, especially in developing countries.

Moreover, when considering the impact of various factors on construction worker productivity, it is evident that the role of supervisors, the competence of workers, the availability of suitable tools and equipment, and effective communication are of utmost importance. Furthermore, external factors such as political insecurity and harsh weather conditions can significantly affect productivity.

One notable finding is that the lack of materials, although causing substantial time loss according to the average rating, does not rank among the top ten most critical factors when considering the importance index that accounts for time, cost, and work quality.

In conclusion, construction productivity is a complex interplay of numerous factors, both within and beyond the control of the project stakeholders. To improve productivity, it is vital to address organizational management, ensure competent supervision, provide proper training and resources to workers, and foster effective communication throughout the construction process. Understanding and managing these factors will be instrumental in enhancing labor productivity and overall project success in the construction industry. As construction practices continue to evolve, ongoing research and proactive efforts to mitigate productivity-impacting factors will be essential for the sustainable growth and development of the construction sector.

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