

Factors Affecting Labour Productivity in Building Construction Projects

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Abstract

Labour productivity is a central concern in building construction because the rate at which work is completed affects project time, cost and resource utilisation. Previous studies show that productivity is influenced not only by worker effort but also by material availability, tools, supervision, drawings, communication, planning, site conditions and weather. This paper reviews published research on factors affecting construction labour productivity and develops a practical framework for prioritising improvement actions on building projects. A structured literature assessment was undertaken using peer-reviewed studies, established productivity models and recent reviews covering India and other construction contexts. The evidence was organised into six themes: labour capability, material readiness, equipment and tools, management and supervision, information flow, and site and environmental conditions. The reviewed literature consistently identifies material availability, worker skill and experience, competent supervision, communication, drawing availability, planning and site conditions as recurring influences, although their relative importance varies with project context. Recent research also indicates growing use of digital productivity monitoring, while heat exposure is receiving greater attention because of its effect on workforce output. On the basis of the synthesis, the paper proposes a low-cost Productivity Action Matrix linking each factor group with practical controls and measurable indicators. The contribution is a decision-oriented framework for students, site engineers and project managers and a basis for later empirical validation.

Keywords: labour productivity, building construction, site management, supervision, workforce, construction planning

1.INTRODUCTION

Background and Significance

Building construction depends on coordinated use of labour, materials, plant, information and supervision. Labour productivity is therefore not simply a measure of worker effort; it reflects the amount of useful work obtained from available resources under actual site conditions. Low productivity may appear through waiting, interrupted work, excess movement, material shortages, unclear information, poor sequencing or repeated activities. Because these conditions affect project duration and cost, productivity improvement remains an important concern for construction managers.

Review of Existing Literature

Indian evidence has shown that timely availability of materials, delayed supplier delivery, drawing revisions and timely access to drawings are important influences on construction labour productivity (Thomas and Sudhakumar, 2014). An earlier Indian study based on 44 factors grouped the influences into tool and equipment issues, labour motivation, supervision, material planning, site management, drawing management, project management, craftsmen issues, meetings and communication (Thomas and Sudhakumar, 2013). A 30-year systematic review concluded that construction productivity

research has identified a wide range of factors but no universal agreement on a single set of dominant factors (Hasan et al., 2018).

Research Gap

The literature provides extensive factor lists, but a practical difficulty remains: site teams need to know which factors should be addressed first and what action can be taken when a factor becomes a constraint. Recent systematic evidence confirms that worker skill and experience, competent supervision, communication and weather recur across studies (Jian et al., 2025), while productivity monitoring research increasingly uses digital and automated approaches (Alaloul et al., 2021; Lim et al., 2024). The gap addressed in this paper is therefore not another factor list, but a decision-oriented synthesis that links recurring productivity factors with low-cost management actions and indicators that can later be tested empirically.

Objectives

The objectives are to identify recurring factors affecting labour productivity in building construction; compare how these factors appear across project contexts; classify the factors according to the degree to which project management can intervene; and develop a practical Productivity Action Matrix for use by students, site engineers and project managers.

2.MATERIAL AND METHODS

Research Design and Literature Assessment

The study adopts a structured literature assessment. Peer-reviewed journal articles, systematic reviews and recognised construction-management publications were selected for direct relevance to construction labour productivity, productivity constraints, monitoring, worker conditions and improvement. Foundational studies were retained where they established widely used concepts or measurement approaches. The literature was examined comparatively rather than reproduced as a narrative list.

Analytical Procedure

The selected evidence was organised into six practical groups: labour capability; material readiness; tools and equipment; management and supervision; information flow; and site and environmental conditions. For each group, the review considered the recurring problem, its likely effect on output and the management response suggested by the literature. The synthesis was then converted into an action-oriented framework. This approach is intended to make the research useful beyond description and to provide a basis for later field validation.

Empirical Validation Plan

For empirical validation, the framework can be converted into a five-point questionnaire for project managers, site engineers, supervisors, contractors and skilled workers. A pilot test should be used to check clarity before wider distribution. A practical exploratory sample may be selected according to project access, and descriptive statistics, mean scores, ranking and Cronbach's alpha can be used for an initial assessment. Correlation or regression should be applied only where the final sample and statistical assumptions are adequate.

Ethical Considerations

This manuscript uses published literature and does not represent a questionnaire survey as completed. All ideas and evidence derived from previous work are acknowledged through author-year citations and the reference list. No respondent data, statistical values or field observations have been invented. In the future empirical phase, participation should be voluntary, unnecessary personal identifiers should not be collected, and results should be reported in aggregate form.

3.RESULT AND DISCUSSION

Recurring Factors

Across the reviewed literature, productivity constraints are consistently distributed across several domains. Indian research gives particular importance to material and drawing availability (Thomas and Sudhakumar, 2014), while craft-worker research identifies tools, consumables, materials, drawing management and equipment among important influences (Dai et al., 2009). Studies in Malaysia, Jordan, Gaza and Egypt also highlight material shortage, worker experience, supervision, management, communication and changing project information (Abdul Kadir et al., 2005; Hiyassat et al., 2016; Enshassi et al., 2007; El-Gohary and Aziz, 2014). The comparison indicates that productivity problems are partly project-specific and should be diagnosed before selecting an improvement measure.

Table 1: Recurring Productivity Factors and Practical Actions

Factor group	Recurring issue in literature	Low-cost project response
Labour capability	Skill, experience, motivation, fatigue and absenteeism (Jian et al., 2025; Naoum, 2016).	Task-based training, competence checks and manpower planning.
Materials	Shortage, late delivery and poor material readiness (Thomas and Sudhakumar, 2014; Abdul Kadir et al., 2005).	Daily material readiness check and delivery planning.
Tools and equipment	Availability, breakdowns, suitability and access (Dai et al., 2009; Thomas and Sudhakumar, 2013).	Pre-shift tool and equipment check.
Management	Supervision, planning, coordination and site organisation (Hasan et al., 2018; Durdyev and Mbachu, 2011).	Daily constraint review and active supervision.
Information	Drawing availability, revisions, specifications and communication (Thomas and Sudhakumar, 2014; Adebawale and Agumba, 2023).	Controlled drawing register and prompt information response.
Environment	Weather, heat and site conditions (Jian et al., 2025; Han et al., 2024; Alahmad et al., 2025).	Work sequencing, heat management and site-flow planning.

Comparison Across Project Contexts

The relative importance of productivity factors changes with project conditions. Thomas and Sudhakumar (2014) reported timely material availability and drawing-related conditions prominently in Kerala. Abdul Kadir et al. (2005) identified material and project-delay factors in Malaysian residential construction. Hiyassat et al. (2016) found worker experience, incentives, material availability and supervision important in Jordan, while Enshassi et al. (2007) reported material shortage, lack of experience, labour surveillance and drawing changes in Gaza. A Middle East meta-analysis

similarly identified delayed information responses, inadequate supervision, skilled-labour shortage, change orders and specification clarity as major factors (Adebowale and Agumba, 2023). These results support project-specific diagnosis rather than universal ranking.

Productivity Action Matrix

The principal contribution of the study is to connect recurring causes to controllable actions. The matrix is deliberately simple so that it can be used without expensive equipment or specialist software. A project team can record the constraint before a work front starts, identify the responsible action, and then compare the planned and achieved output. The framework can subsequently be tested against actual site data.

Table 2: Proposed Productivity Action Matrix

Priority area	Control action	Suggested indicator
Resource readiness	Confirm materials, tools and current drawings before releasing a work front.	Percentage of work fronts released without a resource constraint.
Workforce capability	Match task requirements with competence and provide short task-specific instruction.	Competency coverage and supervisor assessment.
Management flow	Review daily constraints and assign clear responsibilities.	Number of unresolved constraints carried to the next shift.
Information control	Control drawing revisions and close critical information requests.	Information-response time and related work interruptions.
Site conditions	Plan access, storage, sequence and weather or heat controls.	Recorded lost time attributable to site conditions.
Feedback	Compare planned and achieved output and record the reason for variance.	Daily productivity variance by coded cause.

Technology and Future Research

Productivity monitoring is increasingly moving from manual records toward computer vision, photogrammetry, machine learning and building information modelling (Alaloul et al., 2021; Lim et al., 2024). These technologies can reduce manual monitoring effort, but their adoption should be proportionate to project scale and information needs. For many small and medium contractors, a reliable daily productivity record may provide the most economical first step. Heat exposure also deserves greater attention. Han et al. (2024) synthesised evidence from 14 studies, and Alahmad et al. (2025) reported measurable productivity losses among construction workers under hot-humid conditions. Future Indian research can therefore combine simple productivity records with readily available weather observations before moving to advanced sensing systems.

4.CONCLUSION

Conclusion

The literature shows that labour productivity in building construction is influenced by interacting workforce, resource, management, information and environmental conditions. Material availability, worker capability, supervision, communication and drawing control recur in several countries, but their relative importance changes with project context. The proposed Productivity Action Matrix converts these recurring findings into practical controls and simple indicators. Its value is that it provides a clear path from identifying a productivity constraint to assigning an improvement action and

checking the resulting effect. The principal limitation is that the framework is literature-based and has not yet been statistically validated using original project data. The next stage should collect genuine field responses, establish the relative ranking of factors in the selected study context and test the reliability and explanatory strength of the proposed assessment instrument. This will determine whether the framework can provide a useful low-cost tool for the construction industry and for future postgraduate research.

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