

The Influence of Workforce Competence and Supervision Systems on Construction Project Productivity

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Abstract

The construction industry plays a strategic role in supporting national development, but low labor productivity remains a challenge, especially in medium-scale construction projects. Labor productivity is influenced by various factors, including competence and the effectiveness of the monitoring system. Although a number of previous studies have examined these two variables, the findings show inconsistencies, so further study is needed to confirm their contribution to construction project productivity. This study aims to analyze the effect of labor competence and the monitoring system on construction project productivity. This study uses a quantitative approach with an explanatory research type. A sample of 72 respondents was determined using purposive sampling from a population of 80 workers on the PT Y boarding house construction project in Malang City. Data collection was carried out through questionnaires, observations, and documentation. Data analysis used multiple linear regression with the support of validity, reliability, and classical assumption tests. The results showed that both workforce competency and the supervision system had a significant effect on project productivity. The supervision system variable showed the most dominant effect with a significance value of 0.000 and a regression coefficient of 0.538, while workforce competency had a significance value of 0.014 with a regression coefficient of 0.412. Simultaneously, both variables have a significant effect on productivity with an R-Square value of 0.620, which means that 62% of productivity variation can be explained by these two variables.

1. Introduction

The construction industry plays a crucial role in national economic development (Pheng & Hou, 2019). This is reflected in Indonesia's Gross Domestic Product (GDP), which reached 5,288.3 trillion in 2024. 's construction sector is the fourth largest sector (10.23%) after manufacturing (19.28%), trade (13.15%), and agriculture (11.61%). This is expected to support the construction industry, which is projected to grow by 6.4-6.7%, given the large number of development projects that must be completed by the end of 2025, in accordance with the 2020-2025 Medium-Term Development Plan.

This sector not only contributes to the provision of physical infrastructure but also creates significant employment opportunities for the community (Awainah et al., 2024). However, despite its potential and strategic role, labor productivity in the national construction sector remains a major challenge. Productivity is the ratio between a certain amount of output and a certain amount of input during a certain period of time. According to (Baiti et al., 2020), productivity is defined as the ratio of total expenditure at a given time divided by total input during that period. Productivity is also defined as the ratio of input price to output, which is the difference between the aggregate amount of expenditure and input expressed in common units (Wimmer, 2025).

Construction project productivity is not only determined by technological sophistication and capital availability, but also by the quality of the human resources involved. Human resources are a key asset in an organization because they play a direct role in driving all functions in project activities to achieve predetermined objectives (Ammirato et al., 2023). Various studies (Djirimu et al., 2021; Faustine et al., 2022; Kahandanie et al., 2025) show that the productivity of construction workers in Indonesia is relatively low compared to neighboring countries in Southeast Asia. Indonesia's labor productivity level in 2024 will be in the 400s. This score achieved by Indonesia is the same as the score achieved by South Korea in 1996.

Workforce competency is crucial to the success of construction projects. Strong technical skills, expertise, and a positive work ethic will enable employees to complete tasks quickly and to a high

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standard. On the other hand, incompetence can lead to errors, material waste, and decreased project productivity (Lakhwani et al., 2020). Workforce competency is not the only factor that determines productivity (Faustine et al., 2022). Workforce expertise still needs to be implemented with clear management, coordination, and direction (Sinollah, 2018). At this point, the monitoring system function becomes important in project management, which ensures that all work activities follow the schedule, plan, and standard operating procedures (SOP) (Mandičák & Annamária, 2016). In addition to managing work, effective supervision also includes disciplinary oversight, coordinating team communication, and ensuring employees comply with occupational safety and health (OSH) regulations (Darim, 2020). Any deviations can be quickly identified and corrected under proper supervision before they have a significant impact on project quality and outcomes. Even skilled workers will not deliver their best results without proper supervision because there is no system to guide and evaluate every action taken in the field. This often results in employees working without clear coordination, which reduces time efficiency and ultimately delays project completion (Adeboye et al., 2021).

A strong monitoring system contributes to increased employee discipline and motivation. Employees tend to work more carefully, responsibly, and measurably when they realize that their performance is being monitored. In addition, supervision ensures the effective use of labor, materials, and equipment, thereby reducing the possibility of waste that can decrease project productivity (Mandičák & Annamária, 2016). In other words, supervision determines the effectiveness of work implementation, while competence determines the quality of work techniques. Both work together to produce the highest possible output.

Several previous studies related to the influence of workforce competence and monitoring systems on project productivity have shown mixed results. Research conducted by (Jimoh et al., 2017; Nurhendi et al., 2019) shows that workforce competency has a positive and significant effect on productivity, while research conducted by (Kharisma & Rosia, 2022; Kilin, 2021) show the opposite result: respondents feel that experienced workers do not need instructions, so they ignore procedures or are uncooperative with the team, so that workforce competence does not have a significant effect on project productivity.

In addition, there is inconsistency in research results on the effect of monitoring systems on construction project productivity. Research conducted by (Aguilar & Kosheleva, 2025) states that respondents who receive overly detailed monitoring feel that they are not trusted and become less free to make decisions in the field, which leads to a decrease in labor productivity. However, research conducted by (Gunduz & Abu-hijleh, 2020) shows the opposite result, that the monitoring system implemented in a construction project increases the productivity level of a job.

Based on this phenomenon and the inconsistency of results from several previous studies on the influence of workforce competence and supervision systems on construction project productivity, this study aims to fill this gap, requiring a more in-depth study of how competence and supervision can increase the productivity of construction projects.

2. Method

2.1 Research Design

PT Y has 115 employees in Malang City. The purpose of this study is to determine the effect of workforce competence and the monitoring system on worker productivity in construction projects. This study uses a quantitative approach with an explanatory research design. This approach was chosen to test the causal relationship between variables through statistical analysis.

2.2 Research Location and Time

The research was conducted at a boarding house construction project underway on Jl. Arumba, Malang City. Data collection was carried out during the project implementation period in order to obtain an overview of productivity performance and the actual conditions of worker competence and the monitoring system.

2.3 Population and Sample

Population

The population of this study consisted of 80 field workers at PT Y's boarding house construction project in the city of Malang.

Sample

The sampling technique used in this study

The sampling method used purposive sampling based on the following criteria:

1. Workers who have been actively working for at least 3 months,
2. Knowledge of the work process in the field, and
3. Directly responsible for monitoring field work.

The sample size was determined using the Slovin formula (Bambang, 2018).

2.4 Type and Source of Data

The research data consists of:

1. Primary Data, data in the form of questionnaires filled out by workers and supervisors.
2. Secondary Data, project reports, QC or supervisor reports, implementation schedules

2.5 Data Collection Techniques

Data collection was conducted as follows:

1. Questionnaires, using a 1–5 Likert scale to measure respondents' perceptions of the research variables.
2. Observation, to verify work patterns, supervision, and actual productivity conditions.
3. Documentation, to obtain supporting data for the project.

2.6 Operational Variables

1. Workforce Competence (X1) : measured through technical knowledge, experience, discipline.
2. Supervision System (X2) : measured through field supervision standards, supervision intensity, communication, appropriateness in giving instructions, and evaluation systems.
3. Project Productivity (Y) : labor output, time efficiency, work quality, conformity in completion, and minimal repetition in work.

2.7 Instrument Testing

Before the research instrument is used to collect data, validity and reliability tests are conducted to ensure that the instrument is suitable for use.

1. Validity Test

Validity testing is conducted using Pearson Product Moment correlation analysis between item scores and total variable scores. The instrument is declared valid if *the calculated r value* is greater than *the table r value* with a significance level of 0.05. Items that do not meet the criteria will be revised or removed from the instrument.

2. Reliability Test

Reliability testing was conducted using *Cronbach's Alpha* formula. The instrument was declared reliable if the Alpha value was greater than 0.70, indicating internal consistency between statements in measuring the same construct.

2.8 Data Analysis Techniques

Data analysis was conducted through the following stages:

1. Descriptive Analysis

This analysis is used to describe the characteristics of respondents and the distribution of data for each research variable. The results of the analysis are presented in the form of tables, graphs, and interpretations.

2. Classical Assumption Test

Before performing regression analysis, statistical assumptions are tested, including:

- a) Normality Test
- b) Multicollinearity Test
- c) Heteroscedasticity Test
- d) Linearity Test

All tests were conducted to ensure the suitability of the multiple linear regression model used.

3. Multiple Linear Regression Analysis

This analysis was used to determine the effect of independent variables, namely workforce competence (X1) and the monitoring system (X2), on the dependent variable, namely project productivity (Y). The regression model used was:

$$Y = a + b_1X_1 + b_2 X_2 + e$$

4. Hypothesis Testing

Hypothesis testing was conducted in several stages:

- t-test: to determine the partial effect of each independent variable on the dependent variable.
- F test: to determine the simultaneous effect of independent variables on the dependent variable.

- Coefficient of Determination (R^2): to see the magnitude of the contribution of independent variables in explaining dependent variables.

The entire data processing process is carried out using statistical software such as SPSS or other relevant analysis tools.

3. Result and Discussion

Respondent Characteristics

The respondents in this study consisted of **72 workers** who met the purposive sampling criteria. The majority of respondents were aged **25–45 years (76%)** with a final education level of **high school/vocational school (64%)**, while **18%** of respondents were workers with a background in informal construction courses, and **21%** had no formal training specifically in construction. Based on work experience, **41%** of respondents had worked in the construction field for more than 5 years, indicating that field workers mostly had sufficient practical experience, although this was not always accompanied by competence.

Research Variable Description

a) Workforce Competency (X_1)

The average score for the competency variable is 3.21 (sufficient category). Field findings show that:

- Workers' technical knowledge is quite good in wall construction, formwork, and painting.
- Work requiring high precision (plastering, rendering, ceramic tile installation, and MEP) shows inconsistent quality.
- Punctuality in attendance and starting work is fairly good, but there are still delays in starting work, especially on Mondays and after lunch breaks.

This illustrates that despite considerable work experience, not all workers have the technical competencies required by the construction project SOP.

b) Supervision System (X_2)

The average score for the supervision system is 3.36 (good category). Supervision is carried out by one foreman and one Field Supervisor from the contractor. However, observations reveal that:

1. Work instructions are sometimes not accompanied by detailed drawings, or detailed drawings are sometimes provided late, leading to different interpretations among workers.
2. The intensity of supervision increases for structural work compared to finishing work.
3. The weekly evaluation system is already in place, but follow-up is often delayed.

c) Project Productivity (Y)

The average labor productivity is 3.18 (sufficient category). Obstacles encountered in the field include:

- Some materials arrive late because the supplier is not yet available, so they have to wait for the factory.
- Contract workers complete the work faster, but often compromise on quality, leading to rework and less neat results.

d) Multiple Linear Regression Test Results

The regression model obtained is as follows:

$$Y = 7,281 + 0,412 X_1 + 0,538 X_2$$

The hypothesis test results show:

Parameter	Sig. Value	Description
$X_1 \rightarrow Y$ (t-test)	0.014	Significantly influential
$X_2 \rightarrow Y$ (t-test)	0.000	Very significant
F-test	0.000	Simultaneous model significance
R Square	0.62	62% of productivity is explained by X_1 and X_2

The results of the study indicate that workforce competence and the monitoring system have a significant effect on the productivity of construction projects in Malang City, with the monitoring system variable having a greater effect than workforce competence.

Empirically, this condition is consistent with the reality of construction projects in Malang, where field work patterns rely more on empirical experience than formal technical standards. Experienced

workers still show limitations in high-precision work, so the role of field supervisors is crucial in ensuring that the work complies with the working drawings and technical specifications.

In addition, the piecework pattern commonly used in boarding house construction projects often creates a trade-off between speed and quality of work. Without a strong supervision system, work is done quickly but not neatly, resulting in rework, which directly impacts productivity.

External factors such as the weather in Malang, which tends to be rainy in the afternoon, and the sometimes inconsistent supply of local materials also affect daily productivity.

The results of this study confirm that in order to increase labor productivity in medium-scale construction projects in Malang, the following are needed:

1. Improving worker competency through technical training based on construction SOPs.
2. A more structured monitoring system, including improved documentation of work instructions and periodic evaluations.
3. Strengthening material coordination and time management to minimize duplication or repetition of work.

4. Conclusion

Based on the results of research on the influence of worker competency and monitoring systems on the productivity of construction projects in the construction of boarding houses in Malang City, it can be concluded that:

1. Workforce competency has a significant effect on construction project productivity. Although most workers have considerable work experience, their formal technical competence and operational discipline still vary. This is reflected in the results of the analysis with a regression coefficient indicating that the better the workers' competence, the higher the work productivity, especially in terms of time efficiency and minimal rework.
2. The supervision system has the most dominant influence on project productivity. The regression results show a coefficient value with a significance of 0.000, which means that structured, communicative, and consistent field supervision can significantly increase work output. The role of foremen and QC is vital in controlling quality and work rhythm, especially in projects that use a combination of contract and daily labor.
3. Simultaneously, workforce competence and monitoring systems have a significant effect on construction project productivity. An R-Square value indicates that these two variables account for 62% of the variation in project productivity, while the remainder is influenced by other factors such as the rainy weather conditions in Malang, material availability, work motivation, and field work culture.

Overall, the results of the study indicate that increasing project productivity is not only determined by the technical capabilities of the workforce, but is also greatly influenced by the effectiveness of the monitoring system in the field.

Based on the results of research and observations in the field, several recommendations can be made as follows:

1. Regular technical training is needed, especially for ceramic tile installation and MEP work.
2. Supervision must be accompanied by written work SOPs and detailed drawings so that instructions are not only conveyed verbally.
3. Weekly work evaluations need to be followed up with measurable improvements, not just formal reports or administrative procedures.
4. Material coordination needs to be strengthened to prevent work delays due to procurement delays.
5. A reward system for workers or work groups with high productivity can increase work motivation.
6. A gradual penalty mechanism is needed to reduce repeated errors and rework.

Future research is expected to add external variables such as work motivation, material procurement, construction technology, or work methods to obtain a more complex picture of construction work productivity.

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