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Analysis of Labor Coefficients Based on Labor Productivity in Palembang City

Rahmad Hidayat Saputra[1*], Sudarmadji[1], Lega Reskita Lubis[1], Rianti Patricia[1], Zalika Aulia Madani[1], Lutfia Salsabila[1]

[1]*Civil Engineering Department, Politeknik Negeri Sriwijaya, South Sumatra, Indonesia*

[*]*rahmad.hidayat.saputra@polsri.ac.id*

Abstract

The construction industry is a major contributor to Indonesia's infrastructure development, covering various civil engineering works, including buildings, highways, bridges, and other infrastructure facilities. The achievement of construction project objectives depends on effective planning, appropriate management practices, and the competence of the workforce involved. Effective construction planning requires competent workers and adequate productivity. Project scheduling helps organize activities, allocate resources, and control progress, with work durations largely influenced by labor requirements and productivity. In Indonesia, labor needs are estimated using standardized coefficients from the Indonesia National standard (SNI) and Work Unit Price Analysis (AHSP), which serve as references for construction planning and cost estimation. Field data were obtained through on-site surveys conducted using interviews and questionnaire distribution. The questionnaire responses were subsequently compiled and analyzed using Microsoft Excel to identify the types of work, their respective cost value, and time required to complete each activity. The collected data were further examined to evaluate workforce productivity and establish the labor coefficients reflecting actual construction site performance. Based on the data processing result, the daily working time was established as 8 hours. For reinforcement work, 4 workers were required to complete a work volume of 65 kg within 5 days. Based on the field observations, the labor productivity of reinforcement workers was determined to be 130 kg/worker-day, with a labor coefficient of 0,0077 OH/kg. For formwork activities, 5 workers were required to complete a work volume of 1,5 m^2 within 5 days. The resulting labor productivity of carpenters was 0,3 m^2/worker-days, with a corresponding labor coefficient of 0,3333 OH/m^2. Furthermore, for concrete casting activities, 4 workers were required to completed a work volume of 0,8 m^3 within 5 days. The resulting labor productivity of concrete workers was 3,2 m^3/worker-day, with a corresponding labor coefficient of 0,3125 OH/m^3. Following the data analysis, a comparative assessment was conducted between the labor coefficients obtained from field observations and those specified in the AHSP issued by the PUPR of Palembang City. For reinforcement work, the labor coefficient obtained from the field observations was 0,0077 OH/kg, compared with 0,0070 OH/kg specified in the AHSP. For formwork activities, the field-based labor coefficient was 0,3333 OH/m^2, whereas he AHSP coefficient was 0,3300 OH/m^2. Meanwhile, for concrete casting activities, the labor coefficient obtained from the field observations concrete casting activities, the labor coefficient obtained from the field observations was 0,3125 OH/m^3, compared with 0,2750 specified in the AHSP.

Keywords: *Productivity; Labor Coefficient; Workers; Construction; AHSP.*

1. Introduction

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Construction projects play an important role in supporting infrastructure developments in Indonesia, including building, road, bridge, and other civil engineering works [1]. Project success depends on achieving the planned time, cost, and quality targets. However, project performance may vary across locations due to differences in geographical, environmental, and soil conditions, which can affect construction methods and labor productivity [2]. Effective project implementation requires proper planning and competent human resources. Both aspects must work together to ensure that construction activities meet the established project objectives [3].

On essential component of project planning is the preparation of work schedule, with depends on accurate estimates of activity durations and labor requirement. In Indonesia, labor needs are generally calculated using standardized coefficients established in the Indonesia National Standards (SNI). However, geographical and regional differences may influence workers' skills, behavior, and productivity, resulting in variations between standard coefficients and actual field conditions [4].

Government regulations governing construction planning based on the Indonesia National Standards (SNI) provide significant benefits by establishing standardized guidelines for construction practitioners. However, the applications of uniform Indonesian National Standards (SNI) based labor coefficients in project planning may also affect the performance of construction projects, particularly because labor characteristics and productivity levels vary across different regions. In some areas, construction workers may demonstrate high levels of diligence and productivity, whereas workers in other regions may spend relatively more time on non-productive activities, such as socializing and taking longer rest periods during working hours. Differences in labor productivity can influence construction project performance, particularly in terms of work duration and resource efficiency. Therefore, evaluating labor coefficients is essential to understanding their relationship with workforce productivity and project performance [5].

Construction activities are highly dependent on workforce capabilities and working conditions, which may vary across regions. Consequently, the application of standardized labor coefficients under the Indonesia National Standards (SNI) may not always reflect actual worker performance at construction site [6][7]. This study therefore examines the relationship between labor coefficients and actual workforce productivity in construction projects.

2. Methods

This research employed a quantitative approach to data processing and analysis. All collected data were required to be relevant to the research scope and support the achievement of the research objectives. Primary data were collected through field surveys involving interviews and questionnaire distribution. The questionnaires and interviews were administered to relevant parties, particularly construction workers involved in construction projects in Palembang City.

The questionnaires were distributed online using Google Forms, with the questionnaire link disseminated through WhatsApp. In addition to online data collection, questionnaires were also administered through direct interviews with construction workers at project sites in Palembang City. The minimum required sample size was determined using Slovin's formula, as follows:

$$n = \frac{N}{[1+(N\ x\ e^2]} \qquad (1)$$

Where: (n) = minimum sample size
(N) = total number of construction workers in Palembang City
(e) = margin of error (%)

The questionnaires data were subsequently processed using Microsoft Excel by identifying and recording the construction work items, work volumes, and completion

durations for each activity. These data were then analyzed to determine labor productivity and calculate the labor coefficients under actual field conditions. The analysis incorporated information obtained from both questionnaires and direct interviews with construction workers to establish the labor coefficients for each construction activity.

The labor coefficients obtained from field observations were then compared with the standard labor coefficients specified in the AHSP PUPR of Palembang City. This comparative analysis aimed to identify differences between actual field-based labor coefficients and the standard coefficients established by the local government. The final output of this research was comparative assessment of labor coefficients derived from actual construction site conditions and those specified in the AHSP PUPR issued by the government of Palembang City.

2.1. Labor Productivity

Labor productivity is a concept that describes the relationship between the output produced by a worker and the amount of time required to produce that output. A worker is considered productive when he or she is able to produce a greater output than other workers within the same period or to produce the same output while utilizing fewer resources. In other words, a higher level of labor productivity is demonstrated when a worker is able to achieve a greater output that other workers within the same period or to produce the same output while utilizing fewer resources. In other words, a higher level of labor productivity is demonstrated when a worker is able to achieve the specified production target within a shorter period or with fewer resources. When productivity is measured solely in terms of time, labor productivity is strongly influenced by the workers physical skills and technical expertise. However, the level of technology and equipment employed also affects labor productivity, as differences in equipment and technological capabilities may result in different levels of worker productivity[8][9].

2.2. Analysis of Construction Works Unit Prices

The Work Uni Price Analysis (AHSP) is a systematic method used to calculate the cost required to complete each unit of construction work by calculating the quantities of construction materials, labor requirements, and equipment required for each unit of work and multiplying them by the applicable material prices, standard labor wages, and equipment rental or purchase costs. This calculation is used to determine the cost required to complete one unit of construction work[6][10][11].

The analysis of unit prices for construction works (AHSP) is influenced by coefficient values representing the unit requirements for material, equipment, and labor, as well as the corresponding unit rates for each construction activity[12][13]. These coefficients serve as references or guidelines for estimating and controlling construction cost. Material prices are obtained from prevailing market rates and subsequently collected and compiled into a list referred to as the unit price list for construction materials. Meanwhile, labor wages are determine based on prevailing rates at the project locations and compiled into a labor wage unit price list. The unit prices used in the calculation must be adjusted to actual field conditions, equipment conditions and efficiency, construction methods, and material hauling distances[14][15].

2.3. Labor Coefficient

A coefficient is a multiplying factor used as the basis for calculation material cost, equipment cost, and labor wages. A coefficient or quality refers to the amount of resources required to complete one unit of specific construction work item[7][16]. The determination of

the coefficient values is based on the analysis of unit prices for construction works (AHSP), which is adjusted to the work specifications and actual conditions in the field[17][18].

In general, productivity is defined as the ratio output to input, where input is expressed in person-hours or person-days, while output represents the quantity of work accomplished, with units varying depending on the type of work being measure. Labor productivity measurement plays a crucial role in evaluating worker performance, thereby providing an indication of the level of productivity achieved[19].

2.4. Data Collection Method

The information gathered was selected based on its relevance to the research scope and its contribution to fulfilling the established research objectives. Primary data were collected through field surveys involving interviews and the distribution of questionnaires to relevant construction practitioners. The collected data were subsequently evaluated based on their intended use and the locations where data were obtained. The details of the data utilization and data collection locations are presented in the following table:

Table 1. Types and Locations of Primary Data Collection

Primary Data	Data Collection Locations
Distribution of construction project	Interviews and questionnaire surveys were administered to construction workers and relevant project personnel in various regions of Indonesia, with particular attention given to areas experiencing intensive construction activities, especially Palembang City.
Field-based construction labor coefficients	
Description of construction project performance	

Source: Prepared by the authors (2026)

Supporting data were collected from government agencies and relevant institutions responsible for providing the information required for this study. The data categories and their corresponding sources are summarized in the following table:

Table 2. Types and Locations of Secondary Data

Secondary Data	Source Institution
Data on the number of construction workers in Palembang City	PUPR Department
Indonesian National Standards (SNI) data on construction labor coefficients	PUPR Department
Data on construction works items	PUPR Department, Consultants, and Contractors
Related map data	Indonesian information portal

Source: Prepared by the authors (2026)

2.5. Data Analysis Method

The questionnaire data collected were subsequently processed using Microsoft excel by recording the work items, work quantities, and completion durations for each work item. Based on these data, labor productivity was analyzed to determine the field-based labor coefficients obtained from both questionnaire responses and interviews. The labor coefficients obtained from field observations were the compared with the labor coefficients specified in the applicable Indonesian National Standards (SNI)[20]. The final results provide a comparative analysis between the labor coefficients observed in actual field conditions and the SNI-based labor coefficient established by the Government.

The questionnaire instrument was developed by establishing the research objectives and formulating relevant, clear, and easily understandable questions for the respondents. The

questionnaire covered three main aspects: respondent characteristics, including name, age, project position, and work experience in the construction sector; general project information, including the type of construction project and the effective working hours per day; and labor productivity in three construction activities, namely reinforcement work, formwork installation, and concrete casting. The productivity-related data include the number of workers required, the work volume completed per day, the duration required to complete activities on specific structural elements such as beams, columns, slabs, and stair, as well as factors influencing labor productivity, including the type of reinforcement material, formwork material, and concrete casting methods.

3. Results and Discussion



Source: Documentation in this study (2026)

Figure 1. Preliminary Survey

An initial field assessment was undertaken to obtain relevant background information, examine the research subject, and identify the main issues requiring further investigation. For this study, the assessment involved direct observations at several construction sites across Palembang City.

3.1. Questionnaire Distribution and Interviews

The survey was conducted by administering structured questionnaires to respondents, either through direct engaged or online platforms. In this study, the questionnaires were distributed directly to construction workers at project locations to obtain field-based information.



(a)



(b)



(c)

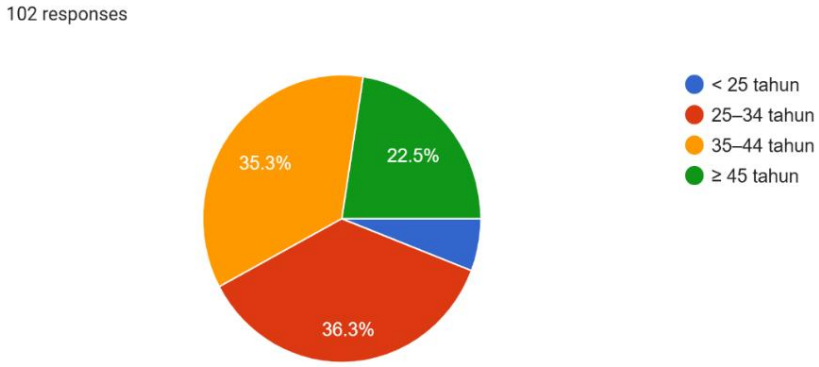
Source: Documentation in this study (2026)

Figure 2. (a) Interviews with reinforcement work laborers, (b) Interviews with formwork laborers, (c) Interviews with concrete work laborers

The questionnaire survey targeted construction workers engaged in project throughout Palembang City. According to records from the Palembang City PUPR through the Construction Service System (SIPJAKON), 136 active construction workers were registered. The required sample size was determined using Slovin's formula with a 5% margin of error, resulting in a minimum sample of 102 respondents.

3.2. Compilation of Interview Data

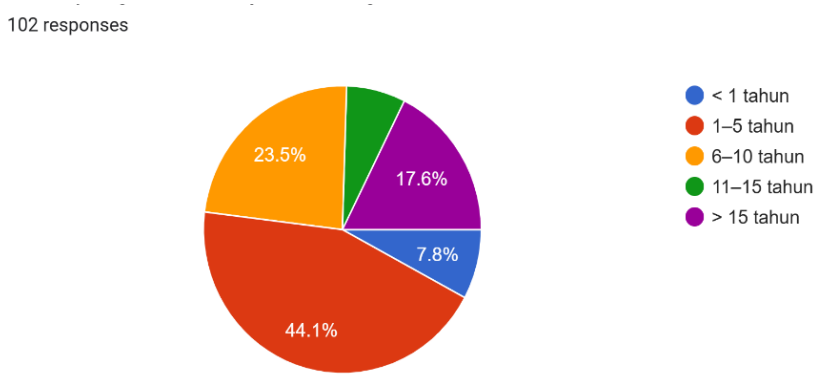
Interview and questionnaire responses were organized and classified according to the respondents' age groups. The survey involved a total of 102 participants. The majority of construction workers were within the 24-44 age group, accounting for 71.6% of the total respondent.



Source: Prepared by the authors (2026)

Figure 3. Age-Based Classifications

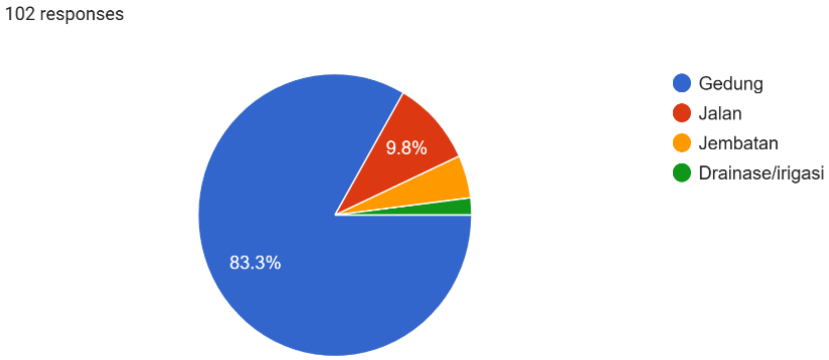
Based on data from 102 respondents, the majority of workers had 1-5 years of work experience, accounting for 44.1% of the respondents. This was followed by those with 6-10 years of experience (23.5%), more than 15 years (17.6%), less than 1 year (7.8%), and 11-15 years (6.9%). These findings indicate that most respondents had 1-10 years of work experience, which may serve as one of the factors in analyzing labor productivity in construction activities.



Source: Prepared by the authors (2026)

Figure 4. Work Experience Classifications

Based on data from 102 respondents, the most common of type of construction project undertaken was buildings construction, accounting for 83.3% of the respondents. This was followed by road construction at 9.8%, bridge construction at 4.9%, and drainage or irrigation project at 2.0%. These findings indicate that the majority of respondents have experience in building construction, making this type of work the dominant characteristic in describing the workforce involved in this research.



Source: Prepared by the authors (2026)

Figure 5. Type of Construction Classifications

3.3. Reinforcement Work Analysis

Based on the analysis conducted, the reinforcement work required worker to complete a total work volume of 65 kg (for every 10kg of reinforcement work) within 5 working days, with an operational duration of 8 hours per day.

Table 3. Labor Analysis Data for Reinforcement Work

Item	Mean	Unit
Work Volume	650	Kg
Working Days	5	Days
Working Hours	8	Hours/Day

Source: Prepared by the authors (2026)

The analysis results labor productivity in reinforcement work and labor coefficients as follows:

Productivity reinforcement work:

$$P = \frac{V}{N\,x\,T} = \frac{650}{1\,x\,5} = 130\ kg/person - day$$

Labor coefficient:

$$K = \frac{N\,x\,T}{V} = \frac{1\,x\,5}{650} = 0.0077\ OH/kg$$

The analysis revealed that the productivity of reinforcement work is 130 kg/person-day, with a corresponding labor coefficient of 0.0077 OH/kg.

3.4. Formwork Analysis

Based on the analysis conducted, the formwork required worker to complete a total work volume of 1.5 m^2 (for every 10 m^2 of formwork) within 5 working days, with an operational duration of 8 hours per day.

Table 4. Labor Analysis Data for Formwork

Item	Mean	Unit
Work Volume	15	M^2
Working Days	5	Days
Working Hours	8	Hours/Day

Source: Prepared by the authors (2026)

The analysis results labor productivity in formwork and labor coefficients are as follows:

Productivity formwork:

$$P = \frac{V}{N\,x\,T} = \frac{15}{1\,x\,5} = 3\ m^2/person - day$$

Labor coefficient:

$$K = \frac{N\,x\,T}{V} = \frac{1\,x\,5}{15} = 0.3333\ OH/m^2$$

The analysis revealed that the productivity of formwork is 3 m^2/person-day, with a corresponding labor coefficient of 0.3333 OH/m^2.

3.5. Concrete Work Analysis

Based on the analysis conducted, the concrete work required worker to complete a total work volume of 0.8 m^3 (for every 10 m^3 of concrete casting work) within 5 working days, with an operational duration of 8 hours per day.

Table 5. Labor Analysis Data for Concrete Casting Work

Item	Mean	Unit
Work Volume	8	M^3
Working Days	5	Days
Working Hours	8	Hours/Day

Source: Prepared by the authors (2026)

The analysis results labor productivity in concrete casting work and labor coefficients as follows:

Productivity concrete casting work:

$$P = \frac{V}{N\,x\,T} = \frac{8}{1\,x\,5} = 1.6\ m^3/person - day$$

Labor coefficient:

$$K = \frac{N\ x\ T}{V} = \frac{1\ x\ 5}{8} = 0.625\ OH/m^3$$

The analysis revealed that the productivity of concrete casting work is 1.6 m^3/person-day, with a corresponding labor coefficient of 0.625 OH/m^3.

Based on the research findings on the analysis of labor productivity regarding labor coefficient in the Work Unit Price Analysis (AHSP) in Palembang City, the labor coefficients for several work items-such as reinforcement, formwork, and concrete casting are presented as follows:

Table 6. Comparison of Labor Coefficients

Descriptions	Labor Coefficient (Person-day/Unit)	
	Research Result	AHSP PUPR Palembang City
Reinforcement Work	0.0077 OH/kg	0.0070 OH/kg
Formwork	0.3333 OH/m^2	0.3300 OH/m^2
Concrete Casting Work	0.625 OH/m^3	0.400 OH/m^3

Source: Prepared by the authors (2026)

4. Conclusion

The analysis revealed that the total labor coefficient values were higher than the AHSP PUPR in Palembang City standards. For reinforcement work, the coefficient derived from the research was 0.0077 OH/kg, which is 0.0007 OH/kg higher than the AHSP PUPR baseline 0.0070 OH/kg. for formwork, the research recorded a coefficient of 0.3333 OH/m^2, slightly exceeding AHSP value of 0.3300 OH/m^2 by 0.0033 OH/m^2. Meanwhile for concrete casting work, the research coefficient of 0.625 OH/m^3 was also 0.225 OH/m^3 higher than the value specified in the Palembang City PUPR AHSP standard of 0.400 OH/m^3.

The findings of this research indicate that onsite labor coefficients frequently deviate significantly from the Palembang City PUPR AHSP standards. This variation could be influenced by several contributing factors, such a difference between actual worker productivity and baseline standards, labor training requirements, and unforeseen field conditions. Higher labor productivity can effectively shorten project completion schedules, underscoring the necessity of conducting a comprehensive analysis to enhance construction efficiency.

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