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Comparative Analysis of Labor Productivity Coefficient Based on Standardization of Indonesian National Standard 7394:2008 and Regulation of the Minister of Public Works and Housing of the Republic of Indonesia No. 28 of 2016 on Column Fixing Work

Gerry Geraldo Sombolayuk[1*], Novita Tanjung[2]
[1]Plekhanov Russian University of Economics,
[2]Bauman Moscow State Technical University
Corresponding Author: Gerry Geraldo Sombolayuk
gery.geraldo23@gmail.com,

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A B S T R A C T

Construction projects are complex activities that require control of each element. One part of the element that needs to be considered is labor. In Indonesia, general provisions on construction project reference standards have developed since the colonial era known as BOW (Burgeslike Openbare Werken). Over time, BOW analysis has been replaced by SNI (Indonesian National Standard) analysis and Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 28/PRT/M/2016 concerning Guidelines for Unit Price Analysis of Public Works (Permen PUPR No. 28-2016). In this study, the analysis was carried out by comparing the labor coefficient of SNI 7394: 2008 and the Regulation of the Minister of Public Works and Housing No.20 of 2016 on column reinforcement work.

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INTRODUCTION

Construction projects are activities whose success rate is largely determined by the productivity of their workers (Basari et al., 2014). If there is one job in the construction project activity that is delayed, it will greatly affect other jobs so that it is possible that there will be a delay in the construction project. Due to the complexity of construction activities, more attention is needed in controlling the elements. One part of the element that needs attention is labor. In the construction industry, labor is an important factor to measure the performance of a company. This is because construction workers have a major contribution in construction project activities. Therefore it is very important for companies to know the performance of their workforce in order to improve the achievement of time, quality and cost targets. This condition can be achieved if the company can measure the productivity of its workers.

In simple terms, according to Permen PUPR No. 28-2016, productivity can be defined as output (volume of work) divided by input (number of people in working days (OH) or working hours (OJ)), where the result is the quantity of work whose units depend on the type of work. In Indonesia, general provisions on construction project reference standards have developed since the colonial era known as BOW (Burgeslike Openbare Werken). Over time, BOW analysis has been replaced by SNI (Indonesian National Standard) analysis and Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia No. 28/PRT/M/2016 on Guidelines for Unit Price Analysis of Public Works (Permen PUPR No. 28-2016). However, there are still many obstacles in its application, such as the performance of workers in each region may be different or the techniques for using facilities and infrastructure in the field are diverse. Based on these problems, the author tries to analyze the comparative analysis of labor productivity in column work based on Permen PUPR No 28-2016 and SNI 7394: 2008..

THEORETICAL REVIEW

Productivity according to Ministerial and Transmigration Regulation Per.21/MEN/IX/2009

Productivity according to the Ministerial Regulation and Transmigration Per.21/MEN/IX/2009 concerning Productivity Service Guidelines is a mental attitude that always strives to improve the quality of life in a sustainable manner through improvement, namely :

a. Efficiency as a measure of the degree of savings in the use of inputs in a process of producing goods or services.
b. Effectiveness as a measure of the level of achievement of the objectives of a process of producing goods or services, both in terms of quantity and quality.
c. Quality is a measure of the level of achievement of requirements, specifications, and or consumer expectations of a product or service.

According to the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 28/PRT/M/2016 concerning Guidelines for Unit Analysis of Public Works Sector Productivity is defined as the ratio between output (production results) to input (production components: labor, materials, equipment, and time). So in productivity analysis, it can be expressed as a ratio of output to input and time (hours or days). If the input and time are small, the output will be bigger so that the productivity will be higher.

Labor Coefficient according to article 3.24 of the regulation of the Minister of Public Works and Housing of the Republic of Indonesia No.28 of 2016

Labor coefficient is defined as a quantum index that shows the time needed to do each unit of work volume. In the next article 3.25, the labor coefficient or labor quantity is a factor that shows the time needed to complete a volume of work, based on the required labor qualifications. Article 3.6 of SNI 7394:2008 states that the definition of labor coefficient/index is a quantum index that shows the time needed to do each unit of work.

Standard Labor Hours in a Day

There are two different references in determining the Standard Working Hours of Labor in One Day. According to SNI 7394: 2008 in article 5.2 on technical requirements part c states that effective working hours for labor are calculated 5 hours a day. Whereas in regulation of the Minister of Public Works and Housing of the Republic of Indonesia No.28 of 2016 in article 5.2.1.4 concerning standard person days states that a standard person day or one day of work is 8 hours, consisting of 7 working hours (effective) and 1 hour of rest.

METHODOLOGY

In this research, the author uses Microsoft Excel application to analyze and process the data that has been obtained in a way:

1. Calculating the volume of reinforcing bars by using the following equation: Volume of main reinforcement = Nominal weight × Height of main reinforcement × Number of main reinforcement (1)

Description:

Height of main reinforcement = m
Nominal weight per meter = kg/m
Number of reinforcing bars = pcs

2. Calculate the volume of stirrup iron using the following equation:

$$\text{Volume of stirrups} = (\text{number of stirrups} \times \text{length of stirrups}) \times \text{weight of reinforcement} \quad (2)$$

RESULTS

SNI 7394: 2008 is a reference standard that establishes the building material index and labor index required for each unit of concrete work that can be used as a uniform basic reference for building and housing construction executors in calculating the unit price of concrete work for buildings and housing. Regulation of the Minister of Public Works and Public Housing No. 28 of 2016 is a guideline issued by the Ministry of Public Works and Public Housing regarding reference standards containing steps to calculate the basic unit price, labor wages, basic unit price of tools and basic unit price of materials, which in turn calculates the unit price of work as part of the estimated price itself, can also be used to analyze the estimated price of planners for handling work in the field of public works.

In this study, the authors used the index of work of concreting, formwork and castings based on the SNI 7394: 2008 standard as a coefficient comparison based on the Regulation of the Minister of Public Works and Public Housing No. 28 of 2016. The analysis of SNI 7394: 2008 and regulation of the Minister of Public Works and Housing of the Republic of Indonesia No 28-216 is carried out by dissecting the labor coefficients on the work of concreting, formwork and casting into the form of person-hour units so that the analysis can be compared. Calculations are also carried out on coefficients with person-day units through analysis of effective working hours because there are differences in effective working hours between SNI 7394: 2008 and the Regulation of the Minister of Public Works and Public Housing No. 28 of 2016. According to SNI 7394: 2008 in article 5.2 on technical requirements part c states that effective working hours for labor are calculated 5 hours a day. The Regulation of the Minister of Public Works and Public Housing No. 28 of 2016 in article 5.2.1.4 on standard person days states that a standard person day or one day of work is 8 hours, consisting of 7 hours of work (effective) and 1 hour of rest.

Table 1. Fixing Index SNI 7394:2008 For 10 kg Fixing

Labor Coefficient

Man Power	Coefficient
Workers	0,070
Iron Worker	0.070
Head builder	0.007
Foreman	0.004

The fixings in the SNI 7394:2008 analysis are for 10kg fixings. Therefore, each coefficient needs to be converted to 1kg so that comparisons can be made to other analyses. The conversion calculation is carried out as follows:

Conversion of workers in column fixing activity for 1kg = Index of fixing workers/10kg (3)

It can be determined that 1kg of concreting can be done by 0.007 workers/laborers, so to find out the coefficient of other labor for 1kg of concreting, the same calculation is carried out.

Table 2. SNI 7394:2008 Fixing Index for 1kg of Fixing

Man Power	Coefficient
Workers	0.007
Iron Worker	0.007
Head builder	0.0007
Foreman	0.0004

The coefficient of SNI 7394:2008 for 1kg of concreting is known, then the conversion of effective working hours can be done as follows:

$$Productivity = \frac{Volume\ of\ work}{Labor\ Coefficient} \quad (4)$$

$$Worker\ productivity\ per\ hour = \frac{Productivity}{total\ working\ hours\ in\ one\ day} \quad (5)$$

After calculating the productivity per hour and per day (7 effective hours). The next step is a further calculation to determine the coefficient value for 1kg of fixings in terms of person-hours and person-days.

$$Productivity = \frac{Volume\ of\ work}{Labor\ Coefficient} \quad (4)$$

$$Productivity \times Labor\ Coefficient = Volume\ of\ Work \quad (6)$$

$$Labor\ Coefficient = \frac{Volume\ of\ Work}{Productivity} \quad (7)$$

Through the conversion of effective hour productivity, it is determined that 1kg of concreting in the analysis of SNI 7394: 2008 can be done by 0.005 workers / laborers per day and 0.035 workers / laborers per hour, then sourced from the productivity of the ironworker can be used as a comparison to determine the productivity of other workers in the the work on fixing, namely workers, head builders and foremen.

Table 3. Fixing Index SNI 7394:2008 1kg Fixing for 7 hours effective working

Man Power	Coefficient
Workers	0.005
Iron Worker	0.005
Head builder	0.0005
Foreman	0.00025

Table 4. Fixing Index SNI 7394:2008 1kg Fixing/hour

Man Power	Coefficient
Workers	0.035
Iron Worker	0.035
Head builder	0.0035
Foreman	0.0020

The labour coefficient in table 4 is then multiplied by 1kg of concreting to obtain the number of workers required to complete 1kg of concreting.

Table 5. Labor Coefficient Per Hour for 1kg Fixing SNI 7394:2008

Man Power	Coefficient	volume(kg)	Total Worker
Workers	0.035	1	0.035
Iron Worker	0.035	1	0.035
Head builder	0.0035	1	0.0035
Foreman	0.002	1	0.002
	Total		0.0755

The coefficient analysis on SNI 7394: 2008 formwork is carried out so that the coefficient is relevant to be compared with regulation of the Minister of Public Works and Housing of the Republic of Indonesia No.28 of 2016. The analysis procedure is carried out based on the following calculations:

Table 6. Indeks regulation of the Minister of Public Works and Housing of the Republic of Indonesia No.28 of 2016 1kg Fixing

Man Power	Coefficient
Workers	0.0021
Iron Worker	0.014
Head builder	0.0014
Foreman	0.0021

The coefficients in the table above are based on the need for people in one day to complete 1kg of concreting. The next calculation is done with the same method as the previous labour coefficient calculation. The calculation results are as follows:

Table 7. Hourly Labor Coefficient For 1kg fixing regulation of the Minister of Public Works and Housing of the Republic of Indonesia No.28 of 2016

Man Power	Coefficient
Workers	0.147
Iron Worker	0.098
Head builder	0,0098
Foreman	0.0147

The labour coefficient in Table 7 is then multiplied by 1kg of concreting to obtain the number of workers required to complete 1kg of concreting.

Table 8. Man Power Per Hour for 1kg Fixing Regulation of the Minister of Public Works and Housing of the Republic of Indonesia No.28 of 2016

Man Power	Coefficient	volume(kg)	Total Worker
Workers	0.147	1	0.147
Iron Worker	0.098	1	0.098
Head builder	0,0098	1	0,0098
Foreman	0.0147	1	0.0147
	Total		0.2597

Table 9. Payment Analysis SNI 7394:2008 for 1kg Fixing

Man Power	Coefficient (people/hour)	Volume (kg)	price (rupiah)	total price (Rupiah)
Workers	0.035	1	90000	3150
Iron Worker	0.035	1	120000	4200
Head builder	0.0035	1	130000	455
Foreman	0.002	1	150000	300
			Total	8105

Table 10. Payment Analysis Regulation of the Minister of Public Works and Housing of the Republic of Indonesia No.28 of 2016 for 1kg Fixing

Man Power	Coefficient (people/hour)	Volume(kg)	price (rupiah)	total price (Rupiah)
Workers	0.147	1	90000	13230
Iron Worker	0.098	1	120000	11760
Head builder	0.0098	1	130000	1274
Foreman	0.0147	1	150000	2205
			Total	28469

Based on the results of data analysis, the value of the coefficient of concreting work from both analyses is obtained in units of person-days, but in order to be comparable between the analyses, the coefficient is converted into person-hours. The result of the coefficient in person-hours is then multiplied by 1kg of concreting to obtain the amount of labour.

Table 11. Labour Comparison of 1kg Fixing

Work type	SNI 7394:2008	regulation of the Minister of Public Works and Housing of the Republic of Indonesia No.28 of 2016
column fixing work	0.0755	0.2695

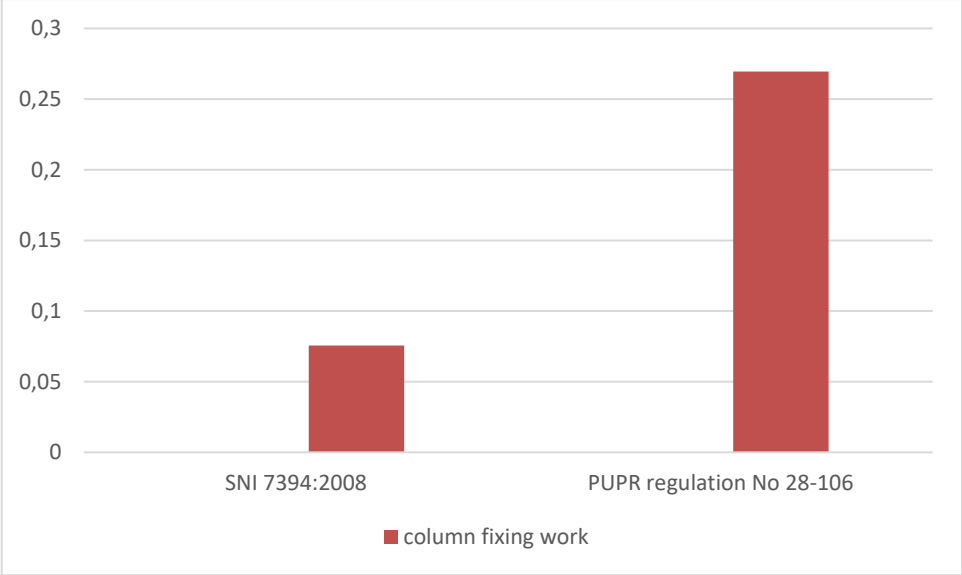

Figure 1. Labour Comparison Chart of 1kg Fixing

It can be seen from the comparison results that the labour of SNI 7394:2008 is 0.0564 times the labour of regulation of the Minister of Public Works and Housing of the Republic of Indonesia No.28 of 2016. After analysing the coefficients, a price analysis was carried out on each analysis to determine the profitability comparison between the two analyses. Comparison of analyses can be seen in the following table:

Table 12. 1kg Fixing Wage Comparison

Work type	SNI 7394:2008		regulation of the Minister of Public Works and Housing of the Republic of Indonesia No.28 of 2016	
column fixing work	Rp	8,105.00	Rp	28,469.00

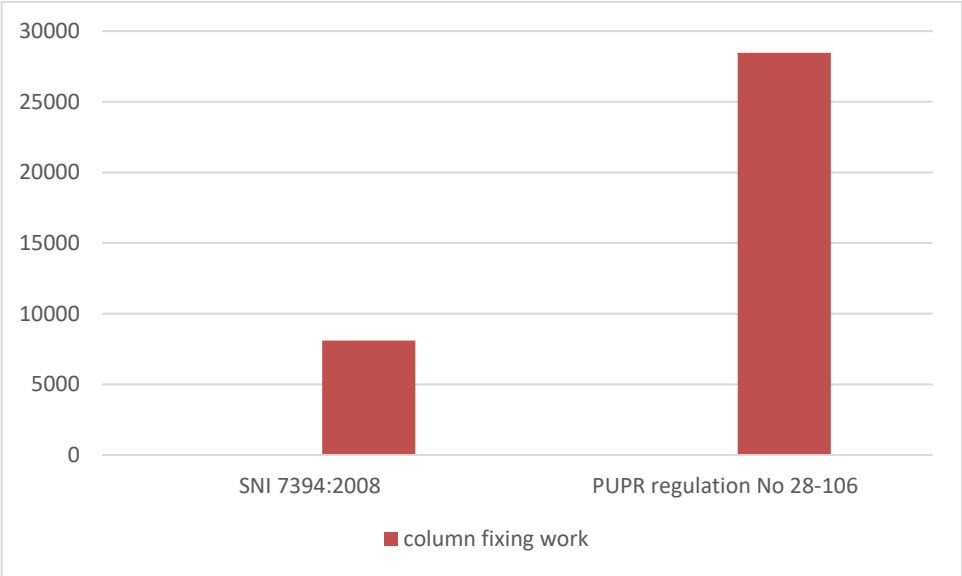

Figure 2. Labour Comparison Chart of 1kg Fixing

Based on the results of the price analysis in both analyses, it shows that to do 1kg of drilling, the wage required in the SNI 7394: 2008 analysis is Rp. 8,105 and the analysis of regulation of the Minister of Public Works and Housing of the Republic of Indonesia No.28 of 2016 is Rp. 28,469.

DISCUSSION

Given the considerable difference between the wage calculations for working with 1 kg of rebar based on the two analyses conducted (IDR 8,105 in the SNI 7394:2008 analysis compared to IDR 28,469 in the Minister of PUPR Regulation No. 28-2016 analysis), it is important to further investigate the factors underlying these differences. Future discussions could focus on investigating the specific methodologies, criteria and parameters used in each analysis to determine the wage rates for construction works involving reinforcement. By comparing and contrasting the approaches and considerations adopted in the two analyses, a better understanding can be gained of the reasons behind the different wage calculations.

CONCLUSIONS AND RECOMMENDATIONS

Based on the data analysis comparing the labour coefficients in the SNI 7394:2008 analysis and the Minister of PUPR Regulation No. 28/2016, significant differences were revealed regarding the wage requirements for working 1 kg of reinforcement. The conversion of the coefficient values from person-days to person-hours allows for a more standardised comparison between the two analyses. This adjustment facilitates the calculation of the number of workers required for tasks involving 1 kg of iron, thus providing valuable insights into labour requirements for construction projects. The disparity analysis of the labour coefficient between SNI 7394:2008 and the Regulation of the Minister of PUPR No. 28-2016 shows the variation in labour costs and wage structure. The SNI 7394:2008 labour coefficient of 0.0564 times that of the PUPR Ministerial Regulation No.

28/2016 highlights the differences in pricing models and wage standards used in both analyses. Understanding these differences is critical for project planning, budgeting, and resource allocation in the construction industry.

FURTHER STUDY

Further studies on the comparison of SNI 7394:2008 and Permen PUPR No 28-2016 can be conducted by conducting practical trials or case studies to evaluate how the application of these standards impacts construction practices and infrastructure development in real-world scenarios. The limitations of this study may stem from several factors such as limitations in the application of the standards to specific construction projects or contexts that may affect the generalisability of the study findings.

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