

Produktivitas Tenaga Kerja Industri Manufaktur

Provinsi Kalimantan Utara

ABSTRAK

Sektor industri manufaktur sebagai penyumbang lebih dari 15% pertahun pada pendapatan nasional, dan merupakan kontribusi tertinggi dibandingkan sector lainnya, selain itu menyerap 14,17% dari total tenaga kerja pada tahun 2022. Penelitian ini bertujuan untuk mengukur produktivitas tenaga kerja dan mengetahui faktor yang mempengaruhi produktivitas tenaga kerja industri manufaktur provinsi Kalimantan Utara tahun 2015-2022. Data yang digunakan adalah data statistik industri mikro dan kecil Provinsi Kalimantan Utara yang meliputi nilai output industry manufaktur, jumlah tenaga kerja, upah minimum provinsi, dan indeks pembangunan manusia provinsi Kalimantan Utara yang dihitung oleh Badan Pusat Statistik. Penelitian ini mengindikasikan bahwa peningkatan PDRB dan jumlah tenaga kerja dapat meningkatkan produktivitas tenaga kerja di sektor industri manufaktur. Sementara itu, kebijakan terkait UMP dan peningkatan IPM bidang Pendidikan belum menunjukkan pengaruh signifikan terhadap produktivitas tenaga kerja secara individu.

Kata kunci: produktivitas tenaga kerja, output, upah minimum, indeks pembangunan manusia

Klasifikasi JEL: J24, L60, J31, O4

Labor Productivity in the Manufacturing Industry of North Kalimantan Province

ABSTRACT

The manufacturing industry sector contributes more than 15% annually to national income, making it the highest contributor compared to other sectors. Additionally, it accounted for 14.17% of total employment in 2022. This study aims to measure labor productivity and identify the factors influencing labor productivity in the manufacturing industry of North Kalimantan Province from 2015 to 2022. The data used includes statistics on micro and small-scale industrial sector in North Kalimantan Province, covering manufacturing industry output value, number of workers, provincial minimum wage, and the Human Development Index of North Kalimantan Province, as calculated by the Central Bureau of Statistics. The study indicates that an increase in Gross Regional Domestic Product (GRDP) and the number of workers can enhance labor productivity in the manufacturing sector. Meanwhile, policies related to the provincial minimum wage (UMP) and improvements in the Human Development Index (HDI) in the education sector have not shown a significant individual impact on labor.

Keywords: labor productivity, output, minimum wage, Human Development Index

Klasifikasi JEL: J24, L60, J31, O4

INTRODUCTION

Economic development is one of the key factors in achieving societal welfare. The success of development is not only measured in economic terms; rather, development is considered successful when all aspects economic, social, cultural, and others are improved.

One of the indicators of development achievement is national income. This means that when national income increases, aggregate output also rises. One of the supporting components of national income growth is human resources. According to Indonesia's economic statistics, the annual economic growth rate is 5%, while labor growth is 3%. A persistent issue in the labor sector is the relatively low labor productivity compared to the increase in the minimum wage. From 2015 to 2020, labor productivity grew by only 1,4% per year (Mahfuds et al., 2022). The low productivity is suspected to be caused by the poor quality of human resources and inadequate infrastructure. This aligns with Mankiw's theory, which states that productivity is influenced by

physical capital (including infrastructure), the quality of human resources, natural resources, and technological knowledge that supports the production process.

According to ILOSTAT data, the lowest labor output growth rate from 2014 to 2024 was -1,3% in 2020, while the highest was 4,6% in 2021. The manufacturing industry accounts for over 15% of the national income annually, positioning it as the sector with the highest contribution compared to others. Additionally, it employed 14,17% of the total workforce in 2022. Numerous studies have highlighted the ongoing underperformance of the manufacturing industry sector in Indonesia, which detrimentally affects its competitive position and the productivity levels of its subsectors. According to empirical findings, the application and efficiency of technology in Indonesia's manufacturing industry are significantly lower than that of capital and labor productivity (Lestari & Isnina, 2017).

In North Kalimantan Province, the manufacturing industry employs only

2% of the workforce, with an output growth rate of up to 9% per year. Meanwhile, the manufacturing industry is the fifth-largest contributor to North Kalimantan's economy. Similar to the national condition of the manufacturing industry sector, productivity in North Kalimantan remains low, despite the national income per worker share amounting to IDR 3,9 billion per year.

Given this situation, it is essential to calculate labor productivity in the manufacturing industry of North Kalimantan Province and identify the factors influencing labor productivity in this sector. The objective of this study is to measure labor productivity and determine the factors affecting labor productivity in North Kalimantan's manufacturing industry from 2017 to 2022.

Productivity is a fundamental factor influencing the competitive performance of the construction industry. An increase in productivity levels is related to the time required, particularly due to the reduction in costs incurred by construction workers (Ervianto, 2008). Moreover, labor

productivity is one of the key indicators for a company to achieve its objectives. Human resources are the most strategic element in an organization and must be recognized and accepted by management.

Productivity improvement can only be achieved through human efforts (Siagan, 2002). Therefore, labor is a crucial factor in measuring productivity. This is due to two main reasons: first, the substantial cost allocated to labor, which is the largest expense in product or service production; second, the impact of labor input on other factors such as capital (Kussriyanto, 1993).

In production theory, there is a fundamental assumption regarding the nature of the production function, known as the law of diminishing marginal physical product. This law states that if one factor of production is continuously increased while other inputs remain constant, the total production will initially increase at an accelerating rate. However, after reaching a certain level of production, the rate of increase will slow down and eventually turn negative, causing total

production to first rise, then reach its maximum, and finally decline (Sukirno, 1985).

RESEARCH METHODOLOGY

This study relies on secondary data collected from the Central Bureau of Statistics (BPS) of North Kalimantan Province, which encompasses the manufacturing output value, workforce numbers, the provincial minimum wage, and the Human Development Index (HDI) in North Kalimantan.

This research is quantitative, where data are primarily presented in numerical form and analyzed statistically to test hypotheses. Additionally, this study is descriptive and verificative, aiming to provide an overview of labor productivity in the manufacturing industry sector of North Kalimantan Province.

To calculate the labor productivity of the manufacturing industry in North Kalimantan Province, the following Single Factor Productivity equation is used:

$$Prod L Manufactur_t = \frac{Total\ of\ Output\ (O)_t}{Total\ of\ Labor\ (L)_t}$$

The data will be analyzed using multiple linear regression in the EVIEWS software. The regression estimation model is specified as follows.:

1. Linear Form of the Manufacturing Industry Labor Productivity Equation in North Kalimantan Province:

$$Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_3 X_{3t} + \beta_4 X_{4t} + e$$

2. Log-Linear Form of the Manufacturing Industry Labor Productivity Equation in North Kalimantan Province:

$$\ln Y_t = \beta_0 + \beta_1 \ln X_{1t} + \beta_2 \ln X_{2t} + \beta_3 \ln X_{3t} + \beta_4 \ln X_{4t} + e$$

Where:

Y_t : Labor Productivity in the Manufacturing Industry of North Kalimantan Province (IDR/Person)

β_0 : Intercept/Constant

β_{1234} : Regression Coefficients

X_1 : Manufacturing Industry Sector Output in North Kalimantan Province (Million Rupiah)

- X₂ : Number of Workers in the Manufacturing Industry of North Kalimantan Province (Million Rupiah)
- X₃ : Provincial Minimum Wage in North Kalimantan (IDR)
- X₄ : Human Development Index in the Education Sector of North Kalimantan Province
- t : The year of study, covering 2015–2022

The estimated model is selected using the MWD method (MacKinnon, White, and Davidson). This method is used to compare two models, either the linear or log-linear model. The MWD specification test aims to evaluate which model better represents the data.

RESULTS AND DISCUSSION

Analysis of Labor Productivity in the Manufacturing Industry of North Kalimantan Province

This study aims to measure labor productivity in the manufacturing industry sector of North Kalimantan Province. The measurement of productivity utilizes data on output/Gross Regional Domestic Product (GRDP) of North Kalimantan and the number of workers in the manufacturing industry sector of North Kalimantan Province from 2015 to 2023. The productivity measurement results are presented in table 1.

Table 1: Labor Productivity in the Manufacturing Industry Sector of North Kalimantan Province (2015–2023)

Year	PDRB (Million Rupiah)	Growth Rate (%)	Manufacturing Industry Workforce (People)	Productivity (Million Rupiah)
2015	4.732.387,8	-	11.513	411,0
2016	5.029.555,5	5,9	28.658	175,5
2017	5.308.102	5,2	26.175	202,8
2018	5.371.017,9	1,2	28.146	190,8
2019	5.629.898,4	4,6	32.758	171,9
2020	5.413.468,9	-3,9	26.062	207,7
2021	5.555.365,4	2,6	28.149	197,4
2022	5.768.312,1	3,7	26.545	217,3
2023	5.864.739,8	1,6	27.754	211,3

Source: BPS, 2024

Table 1 shows that from 2015 to 2023, labor productivity in the manufacturing industry sector of North Kalimantan Province ranged from IDR 171.9 million to IDR 411 million. This means that each worker generated between IDR 171.9 million and IDR 411 million per year.

As seen in table 1, the lowest labor productivity occurred in 2019, which coincided with the COVID-19 pandemic. In 2019, as the initial year of the pandemic, the number of workers increased, but it was not accompanied by a proportional increase in GRDP. However, as the pandemic progressed, labor productivity increased due to a 25% reduction in the workforce. Based on the labor productivity values in the manufacturing industry sector in North Kalimantan Province presented in table 1, it can be concluded that an increase in the number of workers in the manufacturing industry sector was not accompanied by a corresponding rise in GRDP/output in the sector. This indicates that labor productivity in this sector has not yet reached its optimal level, as an increase in the workforce

should lead to higher GRDP. However, in the years 2016, 2018, 2019, 2021, and 2023, the addition of workers was accompanied by a decline in productivity.

Factors Affecting Labor Productivity in the Manufacturing Industry Sector of North Kalimantan Province

Based on the analysis of labor productivity in the manufacturing industry sector of North Kalimantan Province, it can be concluded that as of 2023, productivity in this sector has not yet reached its optimal level, as the increase in the workforce was not accompanied by a corresponding increase in productivity. This study aims to examine the factors influencing changes in labor productivity in the manufacturing industry sector, particularly in North Kalimantan Province, by analyzing the variables of GRDP/output, the number of workers, the provincial minimum wage (UMP), and the Human Development Index (HDI) in the education sector from 2015 to 2023. This analysis is conducted to

determine which of these four factors significantly influence and positively impact labor productivity in the manufacturing industry sector of North Kalimantan Province.

The research model is formulated as follows:

1. Linear Model of Labor Productivity in the Manufacturing Industry Sector of North Kalimantan Province:

$$Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_3 X_{3t} + \beta_4 X_{4t} + e$$

2. Log-Linear Model of Labor Productivity in the Manufacturing Industry Sector of North Kalimantan Province:

$$\ln Y_t = \beta_0 + \beta_1 \ln X_{1t} + \beta_2 \ln X_{2t} + \beta_3 \ln X_{3t} + \beta_4 \ln X_{4t} + e$$

Where:

Y : Labor Productivity in the Manufacturing Industry Sector of North Kalimantan Province (IDR/Worker)

β_0 : Intercept/Constant

β_{1234} : Regression Coefficients

X_1 : Output of the Manufacturing Industry Sector in North

Kalimantan Province (Million IDR)

X_2 : Number of Workers in the Manufacturing Industry Sector of North Kalimantan Province (Million IDR)

X_3 : Provincial Minimum Wage of North Kalimantan (IDR)

X_4 : Human Development Index in the Education Sector of North Kalimantan Province

t : Year of Study (2015–2022)

Selection of Linear or Log-Linear Model Using Mackinnon, White, and Davidson (MWD) Test

Before processing the data using multiple linear regression analysis, it is necessary to select the appropriate model. This requires testing using the MWD (Mackinnon, White, and Davidson) test in EVIEWS.

For the MWD test on the linear model, the hypotheses are:

H0: The appropriate model is the linear model.

Ha: The appropriate model is the log-linear model.

For the MWD test on the log-linear model, the hypotheses are:

H0: The appropriate model is the log-linear model.

Ha: The appropriate model is the linear model.

The results of the MWD test conducted in EVIEWS are presented in table 2 and table 3.

Table 2: Number of Enterprises and Number of Workers in the Micro and Small Industries of North Kalimantan Province (2015–2023)

Year	Total of Firms (Units)		Total of Labor (People)	
	Micro Industry	Small Industry	Micro Industry	Small Industry
2015	1.180	120	2.220	895
2017	7.103	235	11.186	1.483
2018	5.939	143	10.749	1.204
2019	7.032	162	12.952	1.078
2020	4.771	192	8.418	1.607
2021	6.224	58	11.395	403
2022	5.221	133	9.312	882
2023	5.763	207	9.748	1.377

Source: BPS, 2024

Throughout the research period, the micro industry sector consistently exhibited a higher number of businesses than the small industry sector (Table 2). The micro industry comprised between 1.180 and 7.103 businesses, whereas the small industry only ranged from 58 to 235 businesses. In terms of workforce absorption, the micro industry employed between 2,220 and 12,952

workers, while the small industry employed between 403 and 1,607 workers. The micro industry, which comprises a larger number of businesses, employed up to 12,952 workers. This employment level is significantly higher than that of the small industry, which employed a maximum of 1,607 workers. Therefore, the micro industry contributes more

significantly in terms of both the number of businesses and employment

absorption.

Table 2: MWD Test with Z1 and Z2

Variable	Z1	Z2
Coefficient	-186,9033 (0,0003)	2,99E-06 (0,5762)
R ²	0,999764	1,000000
Adj R ²	0,999369	1,000000

Source : Processed Data, 2024

Based on table 2, the probability value of Z1 is 0.0003, which is significant at $\alpha = 5\%$. This means that H_a is accepted, indicating that the log-linear model represents the most suitable approach. Meanwhile, the probability value of Z2 is 0.5762, which is not significant at $\alpha = 5\%$, meaning that H_0 is accepted, confirming that the appropriate model is also the log-linear model. Therefore, the log-linear model will be used for further data processing.

Multiple Regression Analysis

The multiple regression analysis in this study aims to examine the effect of Gross Regional Domestic Product (GRDP)/Output, number of workers, provincial minimum wage (UMP), and the Human Development Index (HDI) in the education sector of North Kalimantan Province on labor

productivity in the manufacturing industry sector of North Kalimantan Province. This method is conducted using EVIEWS. Before processing data using the regression equation model, a classical assumption test is performed to ensure that the data used meets the BLUE (Best Linear Unbiased Estimator) criteria.

1. Normality Test

This test is conducted due to the limited dataset of only 9 years ($n=9$), whereas multiple regression analysis typically requires a sample size of at least 30 observations ($n=30$). Given the restricted data availability ($n=9$), it is essential to first confirm that the data adheres to a normal distribution before proceeding with additional classical assumption tests.

The normality test is performed by examining the probability value under the following assumptions:

- If the probability value is $< 0,05$, the data is not normally distributed.
- If the probability value is $> 0,05$, the data is normally distributed.

The results of the normality test using EViews show a probability value of 0,492317, which is greater than 0,05, indicating that the data is normally distributed. Therefore, the analysis can proceed with further classical assumption tests.

2. Multicollinearity Test

The purpose of the multicollinearity test is to ensure that the model is free from multicollinearity issues, meaning there is no perfect linear relationship between the independent variables in the regression model.

The multicollinearity test is conducted using EViews by examining the Variance Inflation Factor (VIF). The results of the multicollinearity test can be seen in table 3.

Table 3: Multicollinearity Test Results

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0,003376	1354172,	NA
LOG(X1)	1,99E-05	1921379,	32,43305
LOG(X2)	1,19E-07	4919,532	3,919191
LOG(X3)	2,60E-06	228168,5	28,07255
LOG(X4)	0,000143	274383,8	75,51316

Source : Processed Data, 2024

In table 3, it is shown that among the four independent variables, only the number of workers has a VIF value < 10 , while the other three variables have VIF

values > 10 . This indicates the presence of multicollinearity or a perfect linear relationship among the independent variables within the regression model.

Nevertheless, as the data satisfy the normality assumption, the analysis may proceed to the subsequent classical assumption test.

3. Heteroskedasticity Test

Heteroskedasticity refers to the unequal variance of residuals across different observations in a regression model. The heteroskedasticity test is used to detect whether heteroskedasticity issues exist in the regression model.

Table 4: Heteroskedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
Null hypothesis: Homoskedasticity			
F-statistic	0,544572	Prob. F(4,3)	0,7147
Obs*R-squared	3,173143	Prob. Chi-Square(4)	0,5293
Scaled explained SS	0,771876	Prob. Chi-Square(4)	0,9422

Source : Processed Data, 2024

3. Autocorrelation Test

The autocorrelation test aims to detect correlation between observations that are ordered based on time or space. To determine whether the variables are free from autocorrelation issues, a test was conducted using EVIEWS with the

In this study, the Breusch-Pagan-Godfrey Test was conducted using EVIEWS to test for heteroskedasticity. Based on the data in Table 4, the results indicate that no heteroskedasticity issue is present in the regression model, as evidenced by the Chi-square probability value of 0,5293, which is greater than 0,05.

Breusch-Godfrey Serial Correlation LM Test.

Based on table 5, it is concluded that the variables in the regression model are free from autocorrelation issues, as indicated by the Chi-square probability value of 0,1603, which is greater than 0,05.

Table 5: Autocorrelation Test

Breusch-Godfrey Serial Correlation LM Test:

Null hypothesis: No serial correlation at up to 2 lags

F-statistic	0,686021	Prob. F(2,2)	0,5931
Obs*R-squared	3,661989	Prob. Chi-Square(2)	0,1603

Source : Processed Data, 2024

Based on table 5, it is concluded that the variables in the regression model are free from autocorrelation issues, as indicated by the Chi-square probability value of 0,1603, which is greater than 0,05.

Ordinary least square

The results of data processing for multiple linear regression are shown in table 6 below.

Table 6: Multiple Linear Regression

Variabel	Coefficient	t-Statistic	Prob.
C	-0,057696	-0,993067	0,3769
LOG(X1)	1,004168	224,9274	0,0000
LOG(X2)	-1,000039	-2896,910	0,0000
LOG(X3)	0,001311	0,812410	0,4621
LOG(X4)	-0,011852	-0,989943	0,3782
R ²			1,000000
Adj R ²			1,000000
Prob(F-statistic)			0,000000

Source : Processed Data, 2024

From table 6, the multiple regression equation can be formulated as follows:

$$Y = -0,057696 + 1,004168X_1 - 1,000039X_2 + 0,001311X_3 - 0,011852X_4 + e \dots\dots\dots (1)$$

Interpretation of the Multiple Regression Results for the Efficiency Model of the Micro Industry in North Kalimantan Province:

1. The constant value of -0,057696 means that if GRDP, number of workers, provincial minimum wage

(UMP), and Human Development Index (HDI) in the education sector of North Kalimantan Province are all zero, then labor productivity will be -0,057696.

2. The GRDP coefficient of 1,004168 indicates that if GRDP increases by 1%, labor productivity will increase by 1,004168%.
3. The coefficient for the number of workers is -1,000039, meaning that if the number of workers in the manufacturing industry sector of North Kalimantan Province increases by 1%, then labor productivity will decrease by 1,000039%.
4. The UMP coefficient of 0,001311 means that if the provincial minimum wage increases by 1%, labor productivity will increase by 0,001311%.
5. The HDI (Education) coefficient of -0,011852 indicates that if the HDI in the education sector increases by 1%, then labor productivity will decrease by 0.011852%.

Hypothesis Testing

t-Statistic Test

The t-statistic test is conducted to determine whether GRDP, number of workers, UMP, and HDI in the education sector of North Kalimantan Province have a partial effect on labor productivity in the manufacturing industry sector of North Kalimantan Province.

This test is conducted using two approaches:

1. Comparing the t-calculated value with the t-table value.
2. Comparing the probability value of each independent variable with $\alpha = 5\%$.

The partial hypothesis test results indicate. Based on the comparison between the t-table value (2,01505) and the t-calculated values for each independent variable:

- t-calculated for GRDP (224,9274)
- t-calculated for number of workers (-2896,910)
- t-calculated for UMP (0,812410)
- t-calculated for HDI in education (-0,989943)

From Table 6, it can be seen that GRDP and the number of workers have a significant effect on labor productivity in the manufacturing industry sector of North Kalimantan Province, while the provincial minimum wage (UMP) and HDI in education do not have a significant effect.

From the probability values of the independent variables in Table 6, it is shown that GRDP and the number of workers significantly influence labor productivity because their probability values are less than 5%, whereas UMP and HDI in education have no effect as their probability values are greater than 5%.

F-Statistic Test

The F-statistic test is conducted to determine whether GRDP, number of workers, UMP, and HDI in education have a simultaneous effect on labor productivity in the manufacturing industry sector of North Kalimantan Province.

This test is conducted using EVIEWS by comparing the F-calculated value with the F-table value under the following assumptions:

- If $F_{\text{calculated}} < F_{\text{table}}$, then H_0 is accepted, meaning GRDP, number of workers, UMP, and HDI in education do not simultaneously affect labor productivity in the manufacturing industry sector of North Kalimantan Province.
- If $F_{\text{calculated}} > F_{\text{table}}$, then H_a is accepted, meaning GRDP, number of workers, UMP, and HDI in education simultaneously affect labor productivity in the manufacturing industry sector of North Kalimantan Province.

Additionally, the probability value of the F-statistic also confirms a simultaneous effect, as its probability value is less than 0,05.

Coefficient of Determination (R^2)

The coefficient of determination is calculated to assess how much of the variation in labor productivity in the manufacturing industry sector of North Kalimantan Province can be explained by GRDP, number of workers, UMP, and HDI in education, or how well these four independent variables represent other potential factors influencing labor productivity.

From table 6, the Adjusted R-Square value is 1,00 (100%), meaning that GRDP, number of workers, UMP, and HDI in education explain 100% of labor productivity in the manufacturing industry sector of North Kalimantan Province.

This extremely high value is due to the limited dataset (only 9 years of data), making the reliability of the results questionable. However, for the time being, this result suggests that over the 9-year research period, GRDP, number of workers, UMP, and HDI in education fully explain labor productivity in the manufacturing industry sector of North Kalimantan Province.

CONCLUSION

1. From 2015 to 2023, labor productivity in the manufacturing industry sector of North Kalimantan Province ranged from IDR 171,9 million to IDR 411 million. This means that each worker contributed between IDR 171,9 million and IDR 411 million per year.
2. Based on the t-statistic hypothesis test, the variables that significantly

affect labor productivity in the manufacturing industry sector of North Kalimantan Province are GRDP and the number of workers, while the provincial minimum wage (UMP) and HDI in education do not significantly affect labor productivity.

3. Based on the F-statistic hypothesis test, GRDP, the number of workers, UMP, and HDI in education simultaneously affect labor productivity in the manufacturing industry sector of North Kalimantan Province. These four independent variables explain 100% of the variation in labor productivity.
4. Regarding labor productivity measurement, table 1 shows that increasing the number of workers does not necessarily lead to higher GRDP/output. This suggests that worker quality plays a crucial role. Therefore, both the government and company management should provide support in the form of training, competency certifications, seminars, and other programs to improve the skills and capabilities

of workers, particularly in the manufacturing industry sector of North Kalimantan Province.

5. The analysis also indicates that labor productivity is not yet at its maximum potential. This means that workers are not fully contributing to output creation. Therefore, it is essential for workers to make greater efforts to maximize their contributions to output generation, particularly in the manufacturing industry sector of North Kalimantan Province.

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