Vol. 18 No.2, Agustus 2025 ISSN : 2301-8968

JURNAL EKONOMI KUANTITATIF TERAPAN

JEKT | Volume 18 | Nomor 2 | Halaman 151-374 | Denpasar Agustus 2025 | ISSN 2301-8968

pISSN : 2301 – 8968
JEKT ♦ 18 [2] : 211-230 eISSN : 2303 – 0186

Assessing Efficiency and Productivity of Micro and Small Industries: An Empirical Study in North Kalimantan

ABSTRACT

The economic statistics of the micro and small industries in North Kalimantan Province indicate that the added value reached IDR. 516.6 billion from micro industries and IDR. 46.6 billion from small industries in 2022. However, these industries only absorbed 2% of the total workforce in North Kalimantan Province. This indirectly suggests that the performance of the manufacturing sector for micro and small industries has not yet been optimized. This study aims to identify the factors influencing efficiency and assess productivity in micro and small industries in North Kalimantan Province from 2015 to 2023. The data analysis used in this research is multiple regression analysis and productivity approach using data from the Central Bureau of Statistics. The findings of this study reveal that only input value and output value have a significant influence on the efficiency of micro and small industries in North Kalimantan Province, with both variables showing a probability value of 0,000, while the number of firms and the workforce do not have a significant impact on efficiency during the 2015–2023 period "with probability values of 0,4545 and 0,3629 for micro industries and 0,6478 and 0,3825 for small industries, respectively. However, simultaneously, input value, output value, number of firms, and workforce influence the efficiency of micro and small industries in North Kalimantan Province with probabilities of 0.000022 and 0.000026 respectively. The productivity measurement results show that the productivity of the micro and small industries in North Kalimantan Province is each greater than IDR.2

Keywords: Efficiency, productivity, input, output, micro and small industries.
JEL Classification: D61, D24

INTRODUCTION

Economic transformation is a transition process that occurs in every developing economy. This period is marked by a shift in contributions among the components that constitute a country's economy. The industrial sector, as a leading sector, serves as the primary strategy to drive economic growth.

In Indonesia's economy, over the past ten years up to 2023, the manufacturing sector has contributed more than 15% annually, making it the highest contributor compared to other sectors. Additionally, the manufacturing industry provides added value to processed inputs, reaching IDR 179.5 trillion from micro industries, IDR 53.5 trillion from small industries in 2022, and IDR 3,128.33 trillion in 2021. The

manufacturing sector also employed 7.4 million workers in micro industries, 1.9 million in small industries, and 5.9 million in medium and large industries, accounting for 14.17% of the total workforce in 2022. Another significant contribution of the manufacturing sector is its role in foreign exchange earnings from exports and as a major contributor to tax and excise revenues.

Despite its substantial contribution, the performance of the industrial sector in the economy remains suboptimal and not yet significant. Several empirical studies indicate that the performance of the national manufacturing sector is still low, affecting its industrial competitiveness and the productivity of its sub-sectors. One of the contributing factors is market structure imbalance, where a few types of businesses dominate the market share within each manufacturing sub-sector.

Empirical findings also provide concrete evidence that the utilization and productivity of technology in Indonesia's manufacturing sector remain relatively low compared to capital and labor productivity (Lestari & WSU, 2017).

Economic statistics of the micro and small industries in North Kalimantan Province indicate that their added value reached IDR 516.6 billion from micro industries and Rp. 46.6 billion from small industries in 2022 (BPS, 2023). Similar to added value, micro industries employ more workers than small industries. In 2022, micro industries employed 9,312 workers, while small industries employed 882 workers (BPS, 2023), but they only accounted for 2% of the total workforce in North Kalimantan Province.

Similar to the overall manufacturing sector in Indonesia, the performance of North Kalimantan's manufacturing industry remains suboptimal and has not yet reached 100% efficiency. This means that the input and output values generated by the manufacturing sector in North Kalimantan are not yet efficient. Therefore, it is necessary to conduct research on the determinants of efficiency in micro and small industries in North Kalimantan Province. A determination analysis is required to

identify the factors influencing the efficiency of micro and small industries in the province.

The objective of this study is to measure and analyze the efficiency level of micro and small industries in North Kalimantan Province from 2015 to 2022 based on output and input values. It also aims to provide economic agents with information on the factors affecting the efficiency of micro and small industries in North Kalimantan Province and to assess their productivity.

This research is directly related to two types of literature. The first type examines the theoretical and empirical impacts of labor productivity and efficiency in micro and small industries. Productivity is the comparison between the output produced and the resources used during the process. It is defined as the relationship between input (I) and output (O) in a production system. This relationship is commonly expressed as the ratio of output to input. If more output is produced with the same input, productivity is said to increase. Similarly, if lower input can produce the same output, productivity is also considered to have increased.

Several studies discussing labor productivity, including those by Contensou & Vranceanu (2021), Boppart, Krusell, & Olsson (2023), and Martins & Melo (2024), indicate that wage levels and working hours influence labor productivity. Studies on labor productivity in both developed and developing countries show that export variables and innovation significantly affect labor productivity (Matsuura & Saito, 2020; Xiong & Wan, 2022; Naveed & Wang, 2023; Cetrulo, Cirillo, & Landini, 2025).

Research by Baharin, Yussof, & Saukani (2020), Xu, Qiu, & Qi (2024), and Allison, Liu, Murtinu, & Wei (2023) on factors influencing labor productivity in small industries found that work experience, age, gender, and education level positively impact labor productivity.

The main difference between this study and related research is that this study employs robust regression analysis due to the presence of outliers in the dataset. Additionally, this research takes an

industrial approach, whereas previous studies used an individual (labor) approach.

RESEARCH METHODOLOGY

This study is a quantitative research, where data presentation is dominated by numerical values, and data analysis is conducted using statistical methods to test hypotheses. This research also has a descriptive-verificative nature to provide an overview of the determinants of efficiency and productivity in micro and small industries in North Kalimantan Province.

This study uses secondary data obtained from the Statistics Indonesia (BPS) of North Kalimantan Province. The data include output value, input value, number of firms, and number of workers in the micro and small industry sector of North Kalimantan Province.

Additional supporting data are collected from various other sources related directly or indirectly to the research problem, serving as references or guidelines for solving the research issues.

The collected data will be analyzed using multiple linear regression analysis**.** The estimation model for the regression is as follows:

Linear Equation Model for Efficiency of Micro Industries in North Kalimantan Province:

$$Y_{Mt} = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_3 X_{3t} + \beta_4 X_{4t} + e \quad \ldots\ldots\ldots\ldots\ldots (1)$$

Log-Linear Equation Model for Efficiency of Micro Industries in North Kalimantan Province:

$$lnY_{Mt} = \beta_0 + \beta_1 LnX_{1t} + \beta_2 LnX_{2t} + \beta_3 LnX_{3t} + \beta_4 LnX_{4t} + e \quad \ldots\ldots\ldots (2)$$

Where:

Y : Efficiency of Micro Industries in North Kalimantan Province (%)

β_0 : Intercept/Constant

β_{1234} : Regression Coefficients

X_1 : Input Value of Micro Industries in North Kalimantan Province (IDR)

X_2 : Output Value of Micro Industries in North Kalimantan Province (IDR)

X_3 : Total of Micro Industry Firms in North Kalimantan Province (Units)

X_4 : Total of Labor in Micro Industries in North Kalimantan Province (People)

t : Years analyzed (2015–2023)

Linear Equation Model for Efficiency of Small Industries in North Kalimantan Province:

$$Y_{Mt} = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_3 X_{3t} + \beta_4 X_{4t} + e \text{ ..... (3)}$$

Log-Linear Equation Model for Efficiency of Small Industries in North Kalimantan Province:

$$lnY_{Mt} = \beta_0 + \beta_1 LnX_{1t} + \beta_2 LnX_{2t} + \beta_3 LnX_{3t} + \beta_4 LnX_{4t} + e \text{ ..... (4)}$$

Where:

Y_{Mt} : Efficiency of Small Industries in North Kalimantan Province (%)

β_0 : Intercept/Constant

β_{1234} : Regression Coefficients

X_1 : Input Value of Small Industries in North Kalimantan Province (IDR)

X_2 : Output Value of Small Industries in North Kalimantan Province (IDR)

X_3 : Total of Small Industry Firms in North Kalimantan Province (Units)

X_4 : Total of Labor in Small Industries in North Kalimantan Province (People)

t : Years analyzed (2015–2023)

Before conducting regression analysis, it is necessary to determine which regression model linear or log linear is more suitable. The selection of the appropriate regression model is done using the MacKinnon, White, and Davidson (MWD) method. The MWD method is used to compare two non-hierarchical regression models and determine which model best fits the data. This method is known as a model specification test, which aims to assess whether one model explains the data better than the other.

Meanwhile, the productivity of micro and small industries in North Kalimantan Province is determined

using the Total Productivity (PROD) equation as follows:

$$\text{PROD}_t = \frac{Total\ Output\ (O)_t}{Total\ Input\ (I)_t}$$

RESULTS AND DISCUSSION

This study measures the determinants of efficiency in micro and small industries in North Kalimantan Province. The research examines the impact of input value, output value, number of firms, and number of workers in the micro and small industry sector on its efficiency in North Kalimantan Province.

The following table presents the input value, output value, number of firms, and number of workers in the micro and small industries of North Kalimantan Province, along with their effects on industry efficiency.

Table 1: Input and Output Values of Micro and Small Industries in North Kalimantan Province (2015–2023)

Year	Input Value (Million Rupiah)		Output Value (Million Rupiah)	
	Micro Industry	Small Industry	Micro Industry	Small Industry
2015	60.880	52.340	149.580	117.315
2017	273.561	81.934	589.223	214.112
2018	290.417	41.295	648.675	118.016
2019	290.768	30.113	657.912	76.777
2020	207.431	41.773	434.221	110.838
2021	305.621	18.733	635.649	53.400
2022	313.186	41.471	829.871	88.160
2023	260.478	84.499	565.595	211.838

Source: BPS, 2024

In Table 2, the input value of the micro industry in North Kalimantan Province ranges from IDR 60.8 billion to IDR 313.1 billion per year during the study period from 2015 to 2023, while the input value of the small industry in

North Kalimantan Province ranges from IDR 18.7 billion to IDR 84.4 billion. In terms of input value, the micro industry utilizes more inputs compared to the small industry. Likewise, for output, the micro industry also has a higher value compared to the small industry. The output value of the micro industry ranges from IDR 149.5 billion to IDR 829.8 billion, while for the small industry, it ranges from IDR 53.4 billion to IDR 214.1 billion. This indicates that the contribution of the micro industry is higher than that of the small industry, with an input value of IDR 60.8 billion – IDR 313.1 billion generating an output of IDR 149.5 billion – IDR 829.8 billion.

Table 2: Number of Companies and Number of Micro and Small Industry Workers in 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

Regarding the number of companies and workforce in the micro and small industry sector during the research period, it is evident that the micro industry dominates in terms of quantity compared to the small industry (Table 2). The number of micro industries ranges from 1,180 to 7,103, whereas small industries only range from 58 to 235. With this number of companies, the

workforce absorbed by the micro industry ranges from 2,220 to 12,952 workers, while the small industry absorbs between 403 and 1,607 workers. When comparing labor absorption, the micro industry, with a company count between 1,180 and 7,103, can absorb up to 12,952 workers, significantly higher than the small industry, which absorbs a maximum of 1,607 workers. In these two components, the micro industry continues to contribute more significantly.

Table 3: Efficiency Level of Micro and Small Industries in North Kalimantan Province, 2015 – 2019

DMU/Year	Efficiency Level (%)	
	Micro Industry	Small Industry
1 (2015)	92,72	78,43
2 (2017)	81,29	91,44
3 (2018)	84,29	100
4 (2019)	85,39	89,21
5 (2020)	79	92,84
6 (2021)	78,49	99,74
7 (2022)	100	74,38
8 (2023)	81,95	87,72

Source : BPS, 2024

To calculate the efficiency of micro and small industries in North Kalimantan Province, EMS software was used to process input and output data. The EMS results indicate that 100% efficiency was achieved in 2022 for the micro industry and in 2018 for the small industry. The use of inputs by the micro industry resulted in the lowest efficiency of

78.49%, while the small industry had a minimum efficiency of 74.38%.

Determinant Analysis of Micro and Small Industry Efficiency in North Kalimantan Province

The determinant analysis of micro and small industry efficiency in North Kalimantan Province aims to identify the factors influencing the efficiency of micro and small industries from 2015 to 2023. The variables used to assess the impact include input value, output value, number of companies, and workforce.

Selection of Linear and Log-Linear Models

Based on tests using the MWD (Mackinnon, White, and Davidson) method by comparing the Z1 and Z2 statistical values, the following data were obtained:

Table 4: MWD Test with Z1 and Z2 Statistics for Micro Industry in North Kalimantan Province

Variable	Micro Industry	Small Industry
Z1	-75,05220	-98,77711
	(0,0026)	(0,0104)
Z2	-0,001013	0,001214
	(0,2116)	(0,4263)
R^2	0,999851	0,999679
Adj R^2	0,999480	0,998877

Source : Processed Data, 2024

The conclusion drawn from the MWD method testing results for the micro industry, based on Table 4, is that the appropriate model to use is the log-linear model. This conclusion is based on the significance value of Z1, which

rejects the linear model as the correct model, and the insignificance of Z2, indicating that the correct model is the log-linear model.

Similarly, the MWD method testing results for the small industry also indicate that the log-linear model is the best model to use. The significance value of Z1 confirms that the correct model is the log-linear model, while the insignificance of Z2 further supports this conclusion. Thus, the chosen model for both micro and small industries in this study is the log-linear model.

Classical Assumption Testing

Before conducting regression analysis, classical assumption tests were performed to ensure that the model meets the BLUE (Best Linear Unbiased Estimator) criteria. The tests include multicollinearity, heteroscedasticity, and autocorrelation tests.

a. Normality Test

This test was conducted because the study data spans only eight years (n=8), whereas multiple regression analysis typically requires a dataset of at least 30 observations (n=30). However, since this study is necessary despite the limited data, a normality test was performed first to ensure that the data follows a normal distribution before proceeding with other classical assumption tests.

The normality test was conducted by analyzing the probability value with the following assumptions:

- If the probability value < 0.05, the data is not normally distributed.
- If the probability value > 0.05, the data is normally distributed.

The normality test results show a probability value of 0.813801, which is greater than 0.05. Therefore, it is concluded that the data is normally distributed, allowing the study to proceed with other classical assumption tests.

b. Multicollinearity Test

One of the assumptions of the linear regression model is that it must be free from multicollinearity. If multicollinearity is present, it indicates a perfect linear relationship between some or all independent variables in the regression model.

In this study, multicollinearity was detected using the Variance Inflation

Factor (VIF) values obtained from estimation results, with the following criteria:

- H_0: If VIF > 10, multicollinearity exists among independent variables.
- H_a: If VIF < 10, there is no multicollinearity among independent variables.

Table 5: Multicollinearity Test Results for the Micro Industry

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0,001630	1825,555	NA
LOG(X1)	0,000803	137057,9	236,8583
LOG(X2)	0,000349	67626,46	96,15046
LOG(X3)	0,000387	31408,22	131,2847
LOG(X4)	0,000527	48647,08	164,0611

Source : Processed Data, 2024

Table 6: Multicollinearity Test Results for the Small Industry

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0,002374	1512,814	NA
LOG(X1)	0,000188	13753,27	25,87546
LOG(X2)	0,000201	17358,38	25,30959
LOG(X3)	0,000214	3399,066	22,70275
LOG(X4)	0,000170	5250,394	18,50738

Source : Processed Data, 2024

The results of the multicollinearity test show that the VIF value is greater than 10, indicating a perfect linear relationship among independent variables or the presence of a multicollinearity issue. This occurs because the dataset used in the study consists of fewer than 30 observations,

leading to a perfect linear relationship between independent variables. However, since the normality test confirmed that the data is normally distributed, the study can proceed with the next classical assumption test.

a. Heteroskedasticity Test

Heteroskedasticity refers to the inequality of variance in residuals from one observation to another in a regression model. The heteroskedasticity test is used to detect whether there is a heteroskedasticity issue in the regression model. In this study, the Breusch-Pagan-Godfrey Test was used for heteroskedasticity detection.

The test results show that the Prob. Chi-Square(4) value is 0.1722 for the micro industry, which is greater than 0.05, and the Prob. Chi-Square(4) value is 0.1254 for the small industry, which is also greater than 0.05 (*ρ*-value = 0.1254 > 0.05). This indicates that both regression models exhibit homoskedasticity, meaning there is no heteroskedasticity issue in the models.

Table 7: Heteroskedasticity Test Results for the Micro Industry

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
Null hypothesis: Homoskedasticity			
F-statistic	2,963022	Prob. F(4,3)	0,1994
Obs*R-squared	6,384066	Prob. Chi-Square(4)	0,1722
Scaled explained SS	0,409012	Prob. Chi-Square(4)	0,9817

Source : Processed Data, 2024

Table 8: Heteroskedasticity Test Results for the Small Industry

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
Null hypothesis: Homoskedasticity			
F-statistic	6,799626	Prob. F(4,3)	0,0736
Obs*R-squared	7,205259	Prob. Chi-Square(4)	0,1254

Scaled explained SS	1,309789	Prob. Chi-Square(4)	0,8597

Source : Processed Data, 2024

b.Autocorrelation Test

Autocorrelation refers to the degree of similarity of a variable between two consecutive time intervals. The purpose of the autocorrelation test is to determine the correlation between observation members ordered by time or space.

To assess whether the variables are free from autocorrelation issues, a test was conducted using EVIEWS with the Breusch-Godfrey Serial Correlation LM Test method.

The autocorrelation test results in Tables 13 and 14 show that Prob. Chi-Square (2) > 0.05, indicating that there is no autocorrelation issue in the efficiency models for micro and small industries in North Kalimantan Province.

Table 9: Autocorrelation Test Results for the Micro Industry

Breusch-Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0,242016	Prob. F(2,1)	0,8209
Obs*R-squared	2,609279	Prob. Chi-Square(2)	0,2713

Source : Processed Data, 2024

Table 10: Autocorrelation Test Results for the Small Industry

Breusch-Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0,168925	Prob. F(2,1)	0,8646
Obs*R-squared	2,020255	Prob. Chi-Square(2)	0,3642

Source : Processed Data, 2024

Ordinary least square

The regression results are shown in table 11.

Table 11: Multiple Linear Regression

Variabel	Micro Industry	Small Industry
C	3,660031	3,488647
	(0,0000)	(0,0000)
LOG(X1)	-1,003382	-1,006715
	(0,0000)	(0,0000)
LOG(X2)	1,006853	1,006882
	(0,0000)	(0,0000)
LOG(X3)	0,016865	-0,007394
	(0,4545**)**	**(**0,6478**)**
LOG(X4)	-0,024579	0,013318
	(0,3629)	(0,3825)
R^2	0,999580	0,999522
Adj R^2	0,999020	0,998884
Prob(F-statistic)	0,000022	0,000026

Source : Processed Data, 2024

Based on Table 11, the Log-Linear Model for Micro and Small Industries Can Be Formulated as Follows:

$$Y_M = 3{,}660031 - 1{,}003382X_1 + 1{,}006853X_2 + 0{,}016865X_3 - 0{,}024579X_4 + e \quad \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

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

- A constant value of 3.660031 means that if input value, output value, number of firms, and labor in the micro industry of the province are

zero, the efficiency of the micro industry will be 3.660031.

- The coefficient of micro industry input value is -1.003382, meaning that if input value increases by 1%, efficiency will decrease by 1.003382%.
- The coefficient of micro industry output value is 1.006853, meaning that if output value increases by 1%, efficiency will increase by 1.006853%.
- The coefficient of number of micro industry firms is 0.016865, meaning that if the number of firms increases by 1%, efficiency will increase by 0.016865%.
- The coefficient of micro industry labor is -0.024579, meaning that if labor increases by 1%, efficiency will decrease by 0.024579%.

$$Y_S = 3{,}488647 - 1{,}006715X_1 + 1{,}006882X_2 - 0{,}007394X_3 + 0{,}013318X_4 + e \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

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

- A constant value of 3.488647 means that if input value, output value, number of firms, and labor in the micro industry of the province are zero, the efficiency of the micro industry will be 3.488647.
- The coefficient of small industry input value is -1.006715, meaning that if input value increases by 1%, efficiency will decrease by 1.006715%.
- The coefficient of small industry output value is 1.006882, meaning that if output value increases by 1%, efficiency will increase by 1.006882%.
- The coefficient of number of small industry firms is -0.007394, meaning that if the number of firms increases by 1%, efficiency will increase by 0.007394%.
- The coefficient of small industry labor is 0.013318, meaning that if labor increases by 1%, efficiency will decrease by 0.013318%.

Hypothesis Testing

t-Statistic Test

For t-table value with α = 5% and df (n-k) = 2.35, and the t-calculated values for each variable affecting micro industry efficiency in North Kalimantan Province, the following conclusions can be drawn based on significance levels from Table 11:

- Micro Industry Input Value (t-calculated -35.41685) significantly affects micro industry efficiency in North Kalimantan, as its probability value is less than 5%.
- Micro Industry Output Value (t-calculated 53.92220) significantly affects micro industry efficiency in North Kalimantan, as its probability value is less than 5%.
- Number of Micro Industry Firms (t-calculated 0.856788) does not significantly affect micro industry efficiency in North Kalimantan, as its probability value is greater than 5%.
- Micro Industry Labor (t-calculated -1.070385) does not significantly affect micro industry efficiency in North Kalimantan, as its probability value is greater than 5%.

For the small industry in North Kalimantan Province:

- Small Industry Input Value (t-calculated -73.36708) significantly affects small industry efficiency.
- Small Industry Output Value (t-calculated 70.98776) significantly affects small industry efficiency.
- Number of Small Industry Firms (t-calculated -0.505803) does not significantly affect small industry efficiency.
- Small Industry Labor (t-calculated 1.020803) does not significantly affect small industry efficiency.

F-Statistic Test

The F-statistic test is used to determine the overall effect of input value, output value, number of firms, and labor on the efficiency of micro and small industries in North Kalimantan Province. Based on Table 11, with an F-table value of 9.12 at α = 5%, the results are as follows:

- For micro industry efficiency, with F-calculated = 1784.438, the

independent variables significantly influence micro industry efficiency. The probability F-statistic = 0.000022, further confirming a simultaneous effect.

- For small industry efficiency, with F-calculated = 1567.458, the independent variables significantly influence small industry efficiency. The probability F-statistic = 0.000026, confirming a simultaneous effect.

Determination Test (R^2)

The determination test measures how well input value, output value, number of firms, and labor explain efficiency in micro and small industries in North Kalimantan Province. Based on Table 11:

- For micro industry efficiency, the Adjusted R^2 = 0.999020 (99.9020%), meaning the independent variables explain 99.9020% of efficiency variations.
- For small industry efficiency, the Adjusted R^2 = 0.998884 (99.8884%), meaning the independent variables explain 99.8884% of efficiency variations.

Thus, input value, output value, number of firms, and labor explain 99% of micro and small industry efficiency variations in North Kalimantan Province.

Productivity of Micro and Small Industries in North Kalimantan Province

Total productivity **(**PROD**)** was calculated using the formula:

$$\text{PROD}_t = \frac{Total\ Output\ (O)_t}{Total\ Input\ (I)_t}$$

The results for micro and small industry productivity in North Kalimantan Province from 2015 to 2023 are presented in Table 12.

Table 12: Productivity of Micro and Small Industries in North Kalimantan Province (IDR/workforce) (2015-2023)

Table	Mikro	Kecil
2015	2,456965	2,241402
2017	2,1539	2,613225
2018	2,233599	2,857876
2019	2,26267	2,54963
2020	2,093327	2,653341
2021	2,07986	2,850585
2022	2,64977	2,125823
2023	2,171373	2,506988

Source : Processed Data, 2024

Based on Table 12, the productivity of the micro industry in North Kalimantan Province from 2015 to 2023 is more than IDR 2, meaning that for every input usage of IDR 1, the output produced is more than IDR 2. The same results apply to the productivity of the small industry in North Kalimantan Province from 2015 to 2023, where for every input usage of IDR 1, the output produced is also more than IDR 2.

CONCLUSION

Based on the data analysis, the following conclusions were obtained:

1. Based on the t-statistic hypothesis test, it is concluded that input value and output value significantly affect the efficiency of the micro industry in North Kalimantan Province from 2015 to 2023, while the number of companies and workforce do not affect the efficiency of the micro industry in North Kalimantan Province from 2015 to 2023.
2. Based on the t-statistic hypothesis test, it is concluded that input value and output value significantly affect the efficiency of the small industry in North Kalimantan Province from 2015 to 2023, while the number of companies and workforce do not affect the efficiency of the small industry in North Kalimantan Province from 2015 to 2023.

3. Based on the f-statistic hypothesis test, it is concluded that input value, output value, number of companies, and workforce have a significant simultaneous effect on the efficiency of the micro industry in North Kalimantan Province from 2015 to 2023.
4. Based on the f-statistic hypothesis test, it is concluded that input value, output value, number of companies, and workforce have a significant simultaneous effect on the efficiency of the small industry in North Kalimantan Province from 2015 to 2023.
5. The productivity measurement results show that the productivity of the micro and small industries in North Kalimantan Province is each greater than Rp.2, meaning that an input usage of Rp.1 will generate an output value of more than Rp.2 for the micro and small industries in North Kalimantan Province.

From the research findings on partial effects, only the input value and output value of the micro and small industry sectors in North Kalimantan Province significantly affect the efficiency of the micro and small industries. Therefore, it is necessary to optimize the use of inputs from the costs incurred by companies to maximize output. Further research is needed to examine the effect of the number of companies and workforce in the micro and small industry sectors in North Kalimantan Province on the efficiency of micro and small industries.

REFERENSI

Allison, L., Liu, Y., Murtinu, S., & Wei , Z. (2023). Gender and firm performance around the world: The roles of finance, technology and labor. *Journal of Business Research, 154*, 113322.

Baharin, R., R. H. , S., Yussof, I., & Saukani, N. (2020). Impact of human resource investment on labor productivity in Indonesia. *Iranian Journal of Management Studies, 13*(1), 139–164.

Boppart, T., Krusell, P., & Olsson , J. (2023). Labor supply when

productivity keeps growing. *Review of Economic Dynamics, 50*, 61-87.

BPS. (2023). *Statistik perekonomian industri mikro dan kecil Provinsi Kalimantan Utara.* Kalimantan Utara: Badan Pusat Statistik.

Cetrulo, A., Cirillo, V., & Landini, F. (2025). Labour, unions and R&D in Italian firms. *Structural Change and Economic Dynamics, 73*, 262-281.

Contensou, F., & Vranceanu, R. (2021). Working time and wage rate differences: Revisiting the role of preferences and labor scarcity. *Research in Economics, 75*(2), 164-175.

Lestari, E., & WSU, I. (2017). Analisis Kinerja Industri Manufaktur Di Indonesia. *Jurnal Riset Ekonomi Dan Manajemen, 17*(1), 183.

Matsuura, T., & Saito, H. (2020). Foreign Direct Investment and Labour Market Dynamics in a Developing Country: Evidence from Indonesian Plant-Level Data. *ERIA Discussion Paper Series, 318*, 1-30.

Martins, P., & Melo , A. (2024). Making their own weather? Estimating employer labour-market power and its wage effects. *Journal of Urban Economics, 139*(103614).

Naveed , A., & Wang, C. (2023). Innovation and labour productivity growth moderated by structural change: Analysis in a global perspective. *Technovation, 119*, 102554.

Xiong, R., & Wan, Q. (2022). Labor protection and private firms' exportsLabor protection and private firms' exports. *China Economic Quarterly International, 2*(4), 278-289.

Xu, G., Qiu, Y., & Qi, J. (2024). Artificial intelligence and labor demand: An empirical analysis of Chinese small and micro enterprises. *Heliyon, 10*(13), e33893.