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Article

Analysis of the Effect of Labor Quantity on the Output Value of Micro-Industries in Indonesia Using Simple Linear Regression Method

Isna Nugraha [1.a]*, **Nida An Khofiyah**[2.b], **Gilang Ramadhan**[1.c] **and Friska Aryanti**[1.d]

[1]Department of Industrial Engineering, Faculty of Engineering and Science, Universitas Pembangunan Nasional Veteran Jawa Timur, Surabaya 60294, Indonesia
[2]Department of Industrial Engineering, Faculty of Engineering, Universitas Pelita Bangsa, Cikarang 17530, Indonesia

Email: [a]*isna.nugraha.ti@upnjatim.ac.id, [b]nida.khofiyah@pelitabangsa.ac.id
[c]22032010004@student.upnjatim.ac.id, [d]22032010136@student.upnjatim.ac.id
*Corresponding author: (isna.nugraha.ti@upnjatim.ac.id) | Telephone number: +6285293006434

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Abstract

In the current era of globalization, rapid advancements are driving nations to compete in strengthening their economies. Companies and industrial enterprises play a vital role as economic units actively contributing to national economic activities. Economic growth is closely associated with the output value of industries, which is significantly influenced by the number of workers. This study aims to examine the effect of the number of workers in micro-industries on the output value of micro-industries in Indonesia. The research employs two variables: the independent variable (X), representing the number of micro-industry workers, and the dependent variable (Y), representing the output value of micro-industries. A simple linear regression analysis was applied to measure the extent of the relationship between these variables. The results show a regression equation of Y = 217.512,365 + 46,669X with a coefficient of determination (R^2) of 0,896, indicating that 89,6% of the variation in output value can be explained by the number of micro-industry workers. This suggests a strong influence of labor quantity on micro-industry output in Indonesia.

Keywords: Labour, Micro-Industry, Output Value, Regression

1. Introduction

Micro, Small, and Medium Enterprises (MSMEs) are pivotal to Indonesia's economy, contributing approximately 61% to the national Gross Domestic Product (GDP) and employing about 97% of the total workforce [1]. Among these, micro-industries, characterized by having 1 to 4 employees, constitute the majority, accounting for 98.7% of all business units in the country [2]. Their significant presence underscores their role in fostering inclusive economic growth and reducing unemployment rates [3]. Despite their substantial contribution, micro-industries often face challenges related to limited resources, access to capital, and scalability [4]. Understanding the factors influencing their output value is essential for formulating effective development strategies [5].

Labor quantity is a fundamental input in the production process, directly impacting the output levels of micro-industries [6]. Theoretically, an increase in labour should lead to higher production output; however, empirical studies present mixed findings [7]. For instance, research on small-scale footwear industries in Mojokerto indicated that labour quantity significantly affects production output [8]. Conversely, a study in

Magetan found that the number of workers did not have a significant impact on output, suggesting that other factors may play a more dominant role [9]. These discrepancies highlight the need for further investigation into the labour output relationship within micro industries.

Simple linear regression analysis serves as an effective tool to examine the relationship between labour quantity and output value in micro industries [10]. This statistical method allows researchers to assess the strength and direction of the association between an independent variable (labour quantity) and a dependent variable (output value) [11]. Prior studies utilizing regression analysis have provided insights into various factors affecting micro-industries, such as capital investment, raw material availability, and technological adoption [12]. By applying this method, researchers can isolate the effect of labour quantity on output, controlling for other variables that may influence production levels [13]. This approach facilitates a clearer understanding of labour's role in micro industrial productivity.

In the context of Indonesia, where micro-industries are dispersed across diverse regions with varying economic conditions, analysing the labour output relationship becomes even more pertinent. Regional disparities in infrastructure, education, and access to markets can influence the efficiency and productivity of labour in micro-industries [14]. Studies have shown that in areas with better infrastructure and access to resources, labour tends to be more productive, leading to higher output values [15]. Conversely, in regions lacking such facilities, the same quantity of labour may yield lower outputs, emphasizing the importance of contextual factors [16]. Therefore, a comprehensive analysis considering regional variations is crucial for accurate assessments.

Given these regional disparities, a nationwide analysis of labor quantity and its effect on output is necessary to capture the broader pattern across Indonesia's micro-industrial landscape. Micro-industries in Indonesia face persistent challenges in maximizing output due to resource limitations, particularly in labour and capital [17]. Prior research has emphasized that labour dynamics remain a key determinant of productivity, especially in labour-intensive sectors [18]. Therefore, a focused analysis of labour input is necessary to identify efficiency gaps and potential improvements in production systems [19]. This study aims to analyse the effect of labour quantity on the output value of micro-industries in Indonesia using the simple linear regression method. By focusing on this relationship, the research seeks to provide empirical evidence that can inform policymakers and stakeholders in developing targeted interventions to enhance micro-industrial productivity. Understanding whether and how labour quantity influences output can aid in optimizing workforce allocation, training programs, and resource distribution. Ultimately, the findings are expected to contribute to the broader discourse on micro-industrial development and economic planning in Indonesia [20].

2. Materials and methods

This study was conducted to analyse the influence of the number of workers in micro-industries on the output value of these industries in Indonesia. The research covers a three-year period, specifically the years 2018, 2019, and 2020, and includes data from all provinces in Indonesia. A total of 102 data points were collected from the official website of Statistics Indonesia (Badan Pusat Statistik) at www.bps.go.id. These data represent aggregated provincial-level information on two key variables: the number of workers in micro-industries and the output value generated by these enterprises. The use of official and recent government statistics enhances the validity and credibility of the findings.

Table 1. Raw Data

No	Labour	Output Score	No	Labour	Output Score
1	179898	6795754	52	150959	6642139
2	238152	13781637	53	222022	3769162
3	171100	9363817	54	84285	3504442
4	141743	9266144	55	41094	2505327
5	61221	3490856	56	87523	4628206
6	133139	8725800	57	56051	3738328
7	49431	2640432	58	12952	657912
8	185881	10666384	59	60266	3760729
9	39027	2188200	60	185661	5618572
10	46903	2582803	61	223659	9791026
11	61674	5921752	62	94800	3656325
12	935766	49726582	63	46558	5826472
13	1491301	83666788	64	45562	1089979
14	168421	5566152	65	34652	1456260
15	1333853	64317547	66	22478	1335996

DOI:10.4186

No	Labour	Output Score	No	Labour	Output Score
16	189491	13237386	67	11826	961699
17	175761	8206590	68	25420	1413832
18	130693	5474489	69	159683	6534833
19	270440	4874400	70	200851	9334141
20	91612	3975120	71	155646	7495519
21	53747	3062950	72	93070	5385145
22	106071	3720472	73	42643	2106224
23	56530	5599753	74	134620	5859708
24	10749	648675	75	37621	1835187
25	90315	3176011	76	166382	7389456
26	188628	3485271	77	35638	2128497
27	195453	10132397	78	22074	1251394
28	134649	4581725	79	90962	7723022
29	50276	1736235	80	1042971	87451650
30	48139	1231143	81	1459752	51961225
31	68025	2191314	82	240628	6280897
32	47917	3897434	83	1345443	48309789
33	11958	929843	84	182853	11193229
34	25970	1537853	85	221793	9001272
35	172364	6287024	86	143937	4607349
36	217916	10585776	87	212530	3227113
37	165544	8495123	88	75099	3089520
38	107393	5741458	89	34710	1892508
39	44755	2387039	90	83454	3455449
40	141789	7551551	91	43633	2262592
41	40011	2259287	92	8418	434221
42	179673	12252170	93	59419	3269830
43	34693	1913467	94	178605	4301418
44	27187	2736340	95	222034	9217201
45	105517	12023299	96	85924	3868730
46	1107917	64882016	97	46793	1328569
47	1470717	52544382	98	45170	772331
48	247834	10180791	99	30981	1095383
49	1461011	62193230	100	20765	1307239
50	198294	13613687	101	7626	560754
51	234780	11501943	102	22247	1792244

The research model is built around two main variables. The dependent variable (Y) is the output value of micro-industries, defined as the total monetary value of goods and services produced by micro-industrial units, including industrial services from third parties and non-industrial revenues. The independent variable (X) is the number of workers employed in micro-industries, which includes both paid and unpaid workers, measured as the average number of workers per day across the sampled years. These variables were selected to test the hypothesis that the labour force size has a significant impact on production output in micro-scale industrial enterprises.

Data collection involved direct extraction and tabulation of numerical information from publicly available statistical records. The dataset covers a wide range of micro-industries, from very small enterprises employing only a few workers to larger aggregations approaching the upper limit of the micro-industry classification. Such variation ensures a comprehensive analysis across different industrial intensities and geographical regions. The data were processed and analysed using SPSS (Statistical Package for the Social Sciences) version 26.0. SPSS was chosen for its robust statistical processing capabilities and its accessibility for both descriptive and inferential statistical analyses.

The analytical method employed in this study is simple linear regression, a statistical technique used to model the relationship between a single independent variable and a dependent variable. Prior to regression analysis, data were tested for normality, linearity, and significance through Pearson correlation, ANOVA, and model validity tests. To explore the relationship between the number of workers and output value in micro-industries, this study employed a quantitative approach.

This method was chosen to model the linear association between the number of workers (independent variable) and the output value of micro-industries (dependent variable). To ensure the validity of the model, supporting statistical tests were conducted prior to the regression analysis. A concise summary of the key components in the data analysis process is presented in Table 1.

Table 2. Data Analysis Overview

No	Component	Detail
1	Analysis Technique	Simple Linear Regression
2	Purpose	To assess the relationship between labor and output
3	Preliminary Tests	Pearson Correlation, Linearity Test, ANOVA
4	Regression Tool	SPSS (Statistical Package for the Social Sciences)
5	Output Disagree	Regression equation and significance test results

3. Results and Discussion

In this research, data analysis involved several stages including correlation testing, linearity verification, model significance evaluation through ANOVA, and regression analysis using SPSS software. The results are presented in a sequential manner, beginning with correlation testing, followed by linearity testing, regression analysis, and model interpretation through SPSS output.

3.1. Pearson Product Moment Correlation Test

The first step in the analysis involved testing the strength and direction of the relationship between the number of workers (independent variable) and the output value of micro-industries (dependent variable). The Pearson Product Moment Correlation coefficient was calculated to determine whether a statistically significant correlation exists between the two variables.

Table 3. Pearson Correlation Result

		Number of workers	Output Value
Number of Workers	Pearson Correlation	1	.947**
	Sig. (2-tailed)		.000
	N	102	102
Output Value	Pearson Correlation	.947**	1
	Sig. (2-tailed)	.000	
	N	102	102

** Correlation is significant at the 0.01 level (2-tailed).

The analysis yielded a correlation coefficient (R) of 0,947 which indicates a very strong positive linear relationship. Furthermore, the p-value was 0,000 which is significantly lower than the standard significance threshold of 0,05. As a result, the null hypothesis (Ho), which posits that no correlation exists, is rejected in favour of the alternative hypothesis (Ha). Therefore, it can be concluded that a strong and statistically significant correlation exists between the number of workers and the output value of micro-industries in Indonesia.

3.2. Linearity Test

To ensure the appropriateness of applying linear regression, the next step involved verifying whether the data exhibit a linear relationship. The Test of Linearity was conducted via SPSS to evaluate this assumption.

Table 4. Linearity Test Result

			Sum of squares	df	Mean square	F	Sig.
New Output Value*New Number of Labor Employees	Between Groups	(Combined)	28009.766	4	700.441	319.143	.000
		Linearity	26501.879	1	26501.879	1207.850	.000
		Deviation from Linearity	1507.886	3	502.629	22.908	.000
	Within Groups		2128.313	97	21.941		.000
	Total		30138.078	101			

The analysis produced a significance value of 0,000 for the linearity component. Since the significance value is less than 0,05; the null hypothesis (that the data are not linear) is rejected. Consequently, it can be concluded that the relationship between the number of workers and output value is linear, which justifies the application of linear regression for further analysis.

3.3. Simple Linear Regression Analysis

3.3.1. Model Summary

Table 5. Model Summary

Model	R	R square	Adjusted R square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	Df1	Df2	Sig. F Change
1	.947[a]	.896	.895	5599473.894	.896	864.415	1	100	.000

[a] Predicators: (Constant), Total Empower Employment

The Model Summary output provides the R and R Square values, which represent the strength of the model's explanatory power. The analysis resulted in an R Square value of 0,896; meaning that 89,6% of the variance in the output value can be explained by the number of workers. The remaining 10,4% may be attributed to other external factors not included in the model, such as capital investment, production technology, or managerial efficiency.

3.3.2. ANOVA (F-Test)

Table 6. ANOVA Test

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.710E+16	1	2.710E+16	864.415	.000[b]
	Residual	3.135E+15	100	3.135E+13		
	Total	3.024E+16	101			

a. Dependent Variable: Output Value
b. Predictors (constant), Number of Workers

To determine whether the overall regression model is statistically significant and suitable for prediction, an Analysis of Variance (ANOVA) test was performed. ANOVA evaluates the proportion of the variance in the dependent variable that can be attributed to the independent variable. The results show an F-statistic of 864,415 with a significance value (p) of 0,000. Since the p-value is well below the commonly accepted alpha level of 0,05; the null hypothesis that the regression model has no predictive power is rejected. This indicates that the number of

workers significantly explains the variation in output value across micro-industries in Indonesia.

3.3.3. Regression Coefficient Analysis

Table 7. Regression Coefficient Result

Model		Unstandardized Coefficients		Standardized Coefficients			Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	217512.365	647574.720		.336	.738					
	Number of employe	46.669	1.587	.947	29.40	.000	.947	.947	.947	1.000	1.000

a. Dependent Variable: Output Value

The strength and direction of the relationship between the independent and dependent variables are further elaborated through the regression coefficients. The unstandardized coefficient (slope) of 46,669 indicates that for every additional unit of labour (e.g., worker), the output value increases by approximately IDR 46,669; assuming all other factors are held constant. The intercept of 217.512,365 represents the estimated base output when no labour is employed, which may reflect baseline productivity or fixed output factors.

Both coefficients were found to be statistically significant with p-values of 0000; strongly suggesting that the model terms contribute meaningfully to explaining the variation in output. This reinforces the conclusion that labour is a key determinant of output in Indonesia's micro-industrial sector and that the formulated model:

$$Y = 217.512{,}365 + 46{,}667X$$

3.3.4. Regression Coefficient Analysis

To validate the assumptions of classical linear regression, particularly the normality of residuals, a Normal Probability Plot (P-P Plot) of the standardized residuals was reviewed. This plot assesses whether the residuals—the differences between observed and predicted values—are normally distributed. The visual output illustrates that the data points align closely with the diagonal line, suggesting that residuals are symmetrically distributed and do not deviate markedly from normality.

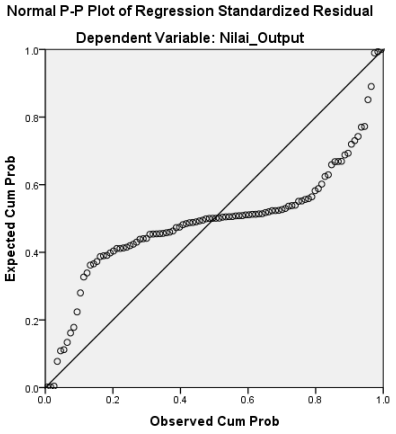

Fig 1. Regression Coefficient Result

This outcome supports the assumption that the residuals of the regression model are normally distributed, satisfying a key requirement for the reliability of inferential statistics derived from the regression. Therefore, the regression results can be interpreted with greater confidence in their validity and generalizability.

3.4. Analysis and Interpretation

The findings of this study demonstrate a strong and statistically significant relationship between the number of workers in micro-industries and their output value. The correlation coefficient of 0,947 reflects a robust positive association, while the regression analysis shows that 89,6 percent of the variation in output can be explained by changes in the number of workers. The resulting regression equation, Y = 217.512,365 + 46,669X; indicates that each additional worker contributes approximately IDR 46,669 to the output value. These results are further supported by the ANOVA test, which confirms the overall model significance with a p-value of 0,000.

The linearity of the data was validated through a Linearity Test, which showed a significance value of 0,000; confirming the appropriateness of the linear regression approach. In addition, the Normal Probability Plot confirmed that the residuals were normally distributed, satisfying one of the core assumptions of regression modelling. The combination of these statistical indicators underscores the reliability and robustness of the analytical model used in this study.

From a policy and managerial perspective, the results offer valuable implications. They suggest that expanding employment within micro-

industries could directly and substantially enhance productivity. This highlights the potential of micro-industrial sectors as engines of inclusive economic growth, particularly in areas with labour surpluses. Supporting initiatives such as workforce training, business incentives, and employment subsidies could therefore play a critical role in strengthening the output capacity of micro-industries across Indonesia.

4. Conclusion

Evidence from the regression analysis highlights the crucial role that labor plays in shaping the productivity of micro industries in Indonesia. A strong positive correlation between the number of workers and output value, supported by an R Square of 0,896 and a significance level of 0,000, affirms that labor is not only a production input but a key economic lever in this sector. This suggests that enhancing the scale and quality of the workforce could lead to substantial improvements in industrial performance, especially in labor surplus regions. To capitalize on this potential, it is recommended that government agencies, local authorities, and industry stakeholders invest in workforce development through vocational training, business assistance programs, and targeted employment incentives. Supporting micro industries with integrated labor and productivity strategies may also increase resilience, competitiveness, and sustainability. Additionally, future studies are encouraged to incorporate other explanatory variables such as capital input, infrastructure, or market access to build a more comprehensive model of micro industrial growth.

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