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The Influence of Physical Capital, Technological Progress, and Wages on Labor Productivity in 10 Provinces of Kawasan Timur Indonesia

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Abstract

Labor productivity is a crucial indicator for measuring a country's economic performance, as it plays a significant role in enhancing competitiveness. The disparity in labor productivity between Western Indonesia (KBI) and Eastern Indonesia (KTI) has persisted over the past eight years, from 2016 to 2023. Among the seventeen provinces in KTI, ten provinces continue to face challenges related to low labor productivity. This persistent issue poses a major obstacle to achieving the Indonesia Emas 2045 Vision, which aims to improve public welfare, human capital quality, and sustained economic growth. Therefore, it is imperative to enhance labor productivity by examining the influence of human capital, physical capital, technological progress, and wages on labor productivity across ten provinces in KTI. The data employed in this study were obtained from the Statistics Indonesia (BPS) and the Ministry of Manpower. The findings reveal that labor productivity tends to stagnate. The share of the workforce with at least junior secondary education, the proportion of workers with internet access, and the Provincial Minimum Wage (UMP) exhibit an upward trend, whereas gross fixed capital formation (GFCF) per worker shows a declining trend. Furthermore, the application of the Fixed Effect Feasible Generalized Least Squares Seemingly Unrelated Regression (FGLS-SUR) model demonstrates that GFCF per worker, UMP, and internet penetration among workers exert a positive impact on labor productivity, with GFCF contributing the most substantial effect.

Keywords: labor productivity, KTI, FEM FGLS-SUR.

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1. Introduction

The fundamental objective of the Indonesian state, as stipulated in the Preamble to the 1945 Constitution, is to enhance the welfare of the people. According to the United Nations (2015), the enhancement of welfare can be achieved through sustainable development efforts, which encompass three pillars: social, environmental, and economic. Bappenas (2023) highlights that

labor productivity serves as one of the key indicators of the economic development pillar within Sustainable Development Goal (SDG) 8, which promotes inclusive and sustainable economic growth, full and productive employment, and decent work for all. This aligns with classical growth theory, which emphasizes the crucial role of labor in supporting a nation's economic growth. A higher quality of labor contributes to greater productivity, which in turn influences economic development (Todaro & Smith, 2020). Mankiw (2003) argues that labor productivity is not only a measure of the efficiency of human resources in the production process but also a determinant of a nation's real standard of living. Similarly, ILOSTAT (2015) states that labor productivity is a vital indicator for assessing a country's economic performance, as it enhances competitiveness and living standards.

ILOSTAT (2023) reports that Indonesia's labor productivity in 2023 ranked third among developing countries in ASEAN, reaching only USD 8,642, which is significantly lower than Malaysia (USD 24,088) and Thailand (USD 11,431). In contrast, World Bank (2023) recorded Indonesia's economic growth at 5 percent, far exceeding that of Malaysia (3.7 percent) and Thailand (1.9 percent). This indicates that Indonesia's economic growth tends to be driven more by factors other than labor quality. Bappenas (2023) revealed that Indonesia's economic growth pattern has long relied heavily on the exploitation of natural resources and unskilled labor. Such dependency is feared to undermine long-term economic sustainability. Fauzi (2006) explains that economic development that disregards the carrying capacity of natural resources and the environment can disrupt economic activities and negatively impact the economy. Therefore, the government has sought to prepare an economic transformation strategy to ensure that Indonesia's future economic growth will be increasingly driven by labor productivity (Bappenas, 2023).

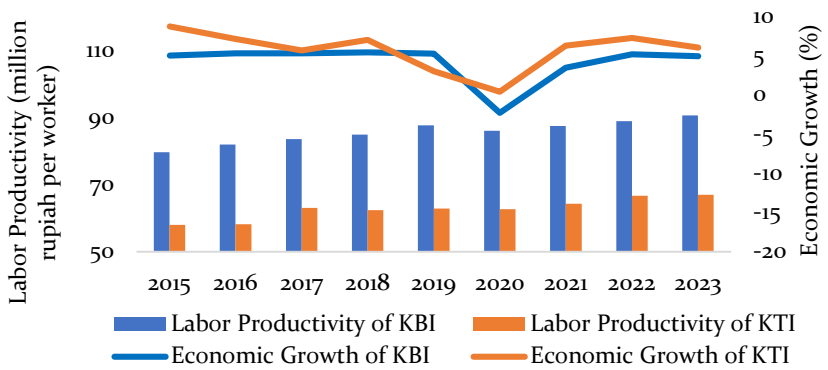

Figure 1. Average Labor Productivity and Economic Growth by Region in Indonesia, 2016–2023

From the perspective of national development planning, Indonesia is divided into two regions: Western Indonesia (Kawasan Barat Indonesia, KBI) and Eastern Indonesia (Kawasan Timur Indonesia, KTI). Figure 1 illustrates that KTI has a considerably lower average labor productivity compared to KBI. However, the average economic growth in KTI surpasses that of KBI. The acceleration of economic growth in Eastern Indonesia is driven by the mining sector,

the commencement of new Industrial Estates (Kawasan Industri, KI)/Special Economic Zones (Kawasan Ekonomi Khusus, KEK), the operation of new smelters, and high international commodity prices, particularly iron and steel (Bappenas, 2022). The combination of high economic growth but low labor productivity in KTI indicates that such growth is primarily driven by sectors like mining and excavation, as well as elevated commodity prices, rather than improvements in labor productivity. Figure 1 excludes the island of Kalimantan due to its consistently high annual labor productivity, which differs significantly from other islands in KTI, making overall labor productivity in KTI appear higher than it actually is.

Therefore, in an effort to achieve the vision of Golden Indonesia 2045, the development of Eastern Indonesia needs to be further enhanced to minimize regional disparities so that national development and its outcomes can be distributed more equitably across all regions of Indonesia, particularly between Western Indonesia and Eastern Indonesia (Bappenas, 2024). The commitment to developing Eastern Indonesia has been initiated since the government issued Presidential Instruction of the Republic of Indonesia Number 7 of 2002 concerning the Implementation of National Policies and Strategies for the Acceleration of Development in Eastern Indonesia. This policy aims to achieve equality in economic and social access, as well as community empowerment between Western Indonesia and Eastern Indonesia and among regions within Eastern Indonesia, in order to promote more balanced development across the country (Instruksi Presiden RI, 2002). Considering the importance of improving labor productivity, numerous studies have examined the factors influencing labor productivity, both by international scholars (Arshad & Malik, 2015; Vinh, 2019; Magableh et al., 2022 ; Abdelgany & Saleh, 2022) and Indonesian researchers (Fadillah et al., 2020; Maharani & Woyanti, 2023). However, studies focusing on specific regions, particularly Eastern Indonesia, remain limited. This is noteworthy given that efforts to develop Eastern Indonesia have been emphasized since the issuance of Presidential Instruction Number 7 of 2002. Therefore, research that specifically examines labor productivity in Eastern Indonesia is still needed. Although previous studies have explored various determinants of labor productivity, comprehensive analyses examining the roles of human capital, physical capital, technology, and wages within the context of Eastern Indonesia remain relatively scarce. Accordingly, this study aims to analyze the effects of human capital, physical capital, technology, and wages on labor productivity in ten provinces of Eastern Indonesia in order to provide deeper empirical insights that may support regional economic development and improve societal welfare in the region.

As Maulana (2023) notes, regions whose economic growth is driven by labor productivity tend to achieve higher levels of societal welfare. In KTI (excluding Kalimantan), the average real per capita expenditure is IDR 9,817 thousand per year, substantially below the national average of IDR 11.899 thousand per year. This reflects the low purchasing power of the population in the region and indicates that economic development in KTI has yet to reach its full potential. Consequently, poverty levels remain high: in 2023, the average proportion of the population living below the poverty line in KTI reached 14.15 percent, compared to the national average of 9.36

percent. This demonstrates that many residents still face difficulties in meeting basic needs, both food and non-food.

The low labor productivity in KTI presents a significant challenge to realizing the Indonesia Emas 2045 Vision, which aims to enhance public welfare, human capital quality, and economic growth. In pursuing this vision, improving labor productivity is key to boosting both economic growth and societal welfare (Kemenkeu, 2023). Moreover, the low labor productivity issue has become a focus of the Ministry of Manpower, with initiatives designed to increase workforce competitiveness and productivity (Kemnaker, 2018).

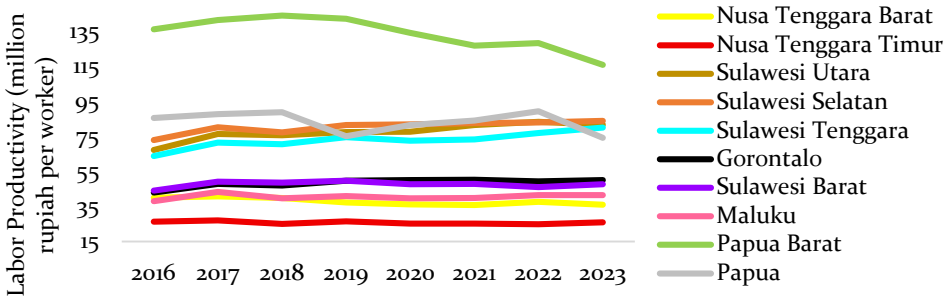

Figure 2. Labor Productivity in the Provinces of Eastern Indonesia (million rupiah per worker), 2016–2023

The labor productivity conditions in each province of Eastern Indonesia are illustrated in Figure 2. Provinces in KTI exhibit varying labor productivity levels. Papua Barat stands out as the province with the highest labor productivity, although it has been experiencing a continuous decline. In contrast, Nusa Tenggara Timur has the lowest and stagnant labor productivity. Among the twelve provinces in KTI with low labor productivity, two provinces—Sulawesi Tengah and Maluku Utara—have shown increasing labor productivity. Consequently, these two provinces are excluded from the analytical units of this study because their labor productivity tends to be consistently rising. In contrast, other provinces in KTI continue to face challenges associated with low and stagnant labor productivity.

According to human capital theory, Becker (1964) explains that investment in human resources can enhance individual quality, thereby increasing productivity and providing greater opportunities to overcome underdevelopment. In addition to human capital, physical capital is equally important in boosting labor productivity. Capital formation, as an addition to the existing capital stock, is necessary for producing goods and services. Therefore, expanding the capital stock can increase economic production capacity (Domar, 1946). An increase in fixed capital can also stimulate labor productivity (Arnold, 2008). Furthermore, Solow (1956) emphasizes that technological advancement plays a significant role in enhancing labor productivity. Beyond

factors such as human capital, physical capital, and technological progress, the efficiency wage theory highlights that wage levels can also influence labor productivity (Akerlof, 1982).

Based on the issues outlined above, it is crucial to examine the relationship between human capital, physical capital, technological progress, and wages on labor productivity in ten provinces of Eastern Indonesia. This study is particularly relevant given that the welfare levels in the region remain below the national average. Persistently low and stagnant labor productivity constitutes a major obstacle to improving welfare. Therefore, efforts to enhance labor productivity are needed by analyzing the effects of human capital, physical capital, technological progress, and wages on labor productivity in ten provinces of KTI.

2. Research method

2.1. Data dan Data Sources

This study employs panel data with the analytical units consisting of ten provinces in Eastern Indonesia, namely Sulawesi Utara Province, Sulawesi Selatan, Sulawesi Tenggara, Gorontalo, Sulawesi Barat, Nusa Tenggara Barat, Nusa Tenggara Timur, Maluku, Papua, and Papua Barat, covering the annual period from 2016 to 2023. The year 2016 was selected as the starting point of the study because labor productivity growth in KTI experienced a slowdown during that year. Data collection was conducted using secondary data sourced from Statistics Indonesia (BPS) and the Ministry of Manpower. A complete overview of the data used, along with their sources, is presented in Table 1.

Table 1. Data and Source Data

Variable	Notation	Source
Labor Productivity (million rupiah per worker)	LP	Statistics Indonesia (BPS) website
Percentage of workforce with at least junior secondary education (%)	Perc_SMP	Indonesian Labor Force Situation Publication (August)
Gross Fixed Capital Formation (GFCF) per worker (million rupiah per worker)	GFCF_Worker	Statistics Indonesia (BPS) website
Percentage of workforce with internet access (%)	Inet	Statistics Indonesia (BPS) website
Provincial Minimum Wage (rupiah)	PMW	Ministry of Manpower website

2.2. Analytical Method

This study employs both descriptive and inferential analysis methods. The descriptive analysis presents the development of all variables used in the study over the period from 2016 to 2023. The inferential analysis utilizes panel data regression. This method is chosen because labor productivity in each province tends to vary annually, and panel data regression provides deeper

insights compared to using cross-sectional or time-series data separately. The steps for conducting the panel data regression analysis are as follows.

2.2.1. Data Exploration

Prior to selecting a panel data regression model, an initial identification of the relationship between the independent variables and the dependent variable is conducted. This can be assessed using a correlation matrix. The relationship between the independent variables and the dependent variable can be interpreted as linear, or exhibiting a linear association, if the Pearson correlation coefficient approaches one. Conversely, if an independent variable has a Pearson correlation coefficient close to zero, the variable will be recoded from a numerical scale into a categorical scale based on its median value. The categorization is divided into two groups: code 0 for observations less than or equal to the median, and code 1 for observations greater than the median.

2.2.2. Regression Model Specification

The variation in labor productivity across provinces suggests the presence of heterogeneity, or individual effects, in labor productivity. Therefore, the Fixed Effect Model (FEM) is proposed in this study. However, to confirm the initial model choice, the Hausman test is conducted to select the most appropriate model between FEM and the Random Effect Model (REM). The FEM and REM models are specified as follows.

Fixed effect model:

$$\ln (LP)_{it} = (\alpha+\mu_i) + \beta_1 Perc\_SMP_{it} + \beta_2 \ln(GFCF\_Worker)_{it} + \beta_3 Inet_{it} + \beta_4 \ln(PMW)_{it} + v_{it} \quad (5)$$

Random effect model:

$$\ln (LP)_{it} = \alpha + \beta_1 Perc_{SMP_{it}} + \beta_2 \ln(GFCF_{Worker})_{it} + \beta_3 Inet_{it} + \beta_4 \ln(PMW)_{it} + (v_{it} + \mu_i) \quad (6)$$

2.2.3. Parameter Estimation of the Regression Model

If the selected model is FEM, it is necessary to determine the appropriate parameter estimation method based on the structure of the variance–covariance matrix. This selection is carried out through statistical testing. The Lagrange Multiplier (LM) test is employed to examine whether the variance–covariance matrix structure exhibits homoskedasticity or heteroskedasticity, while the Lambda LM test (λ_{LM}) is used to detect the presence of cross-sectional correlation.

2.2.4. Assumption Testing of the Panel Data Regression Model

If the best model is FEM or CEM with OLS estimators, classical assumption tests are performed, including tests for homoskedasticity, absence of autocorrelation, and normality. However, if the best model is FEM-GLS/FGLS or REM-GLS, only the normality assumption is tested.

2.2.5. Parameter Testing of the Regression Model

There are two types of parameter tests for the regression model: the F-test and the t-test. The F-test is used to determine whether at least one independent variable has a significant effect on the dependent variable. Meanwhile, the t-test is employed to assess whether the independent variables have a significant partial effect on the dependent variable.

3. Results and Discussion

3.1. Overview of Labor Productivity and Its Relationship with Human Capital, Physical Capital, Technological Progress, and Wages in Ten Provinces of Eastern Indonesia, 2016–2023

3.1.1. Overview of Labor Productivity

The ten provinces in Eastern Indonesia (Kawasan Timur Indonesia/KTI) exhibit an average level of labor productivity that is substantially lower compared to their counterparts in Western Indonesia (Kawasan Barat Indonesia/KBI). Furthermore, labor productivity in KTI tends to remain stagnant. This is reflected in the deceleration of labor productivity growth observed from 2016 to 2023, as illustrated in Figure 3. During this period, the distribution of labor productivity across the ten provinces in KTI ranged between approximately 40 and 80 million rupiah per worker.

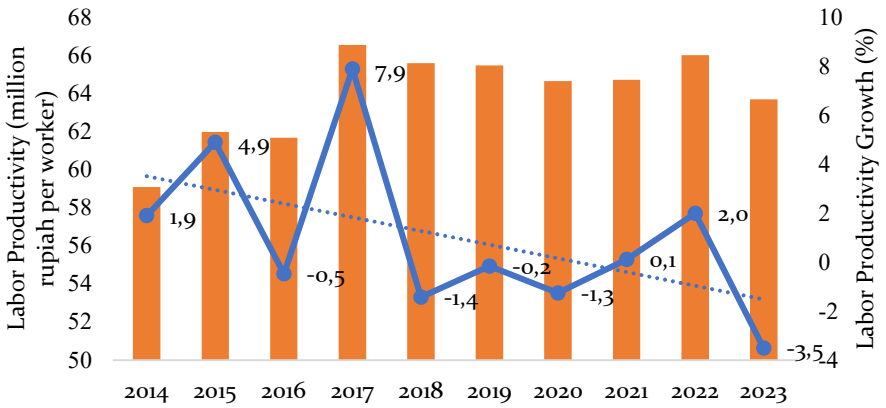

Figure 3. Labor Productivity in Ten Provinces of KTI (million per worker), 2016–2023

The development of labor productivity values in each province of KTI is presented in Figure 4. Labor productivity across the ten provinces in KTI shows considerable variation both across

years and among provinces. During the period 2016–2023, West Papua recorded the highest labor productivity compared to other provinces. Despite having the highest productivity, its value has continuously declined. Meanwhile, labor productivity in Sulawesi Selatan, Sulawesi Utara, Sulawesi Tenggara, and Papua was at a medium level relative to other provinces in KTI, exhibiting a slightly increasing trend, although Papua's productivity fluctuated over the period. On the other hand, provinces such as Gorontalo, Sulawesi Barat, Maluku, Nusa Tenggara Barat, and particularly Nusa Tenggara Timur recorded the lowest labor productivity among the provinces in KTI.

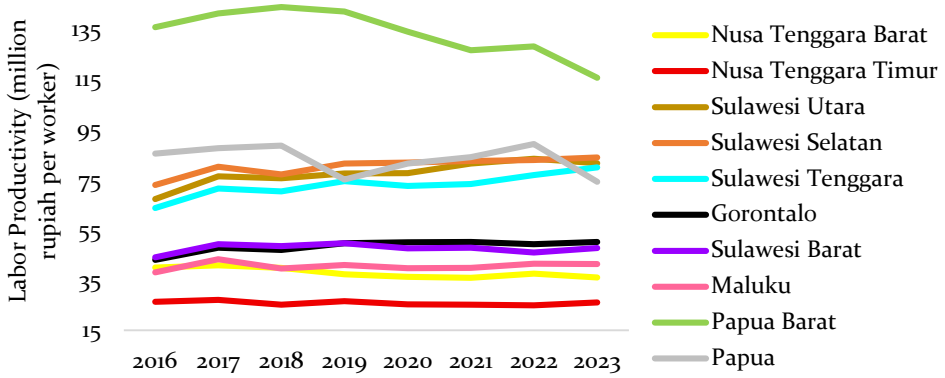

Figure 4. Labor Productivity in Ten Provinces of KTI, 2016–2023 (million rupiah per worker)

According to Kementerian Keuangan (2023), the low labor productivity in East Nusa Tenggara (NTT) is closely related to the high proportion of the population with low educational attainment, exceeding 60%, as well as the dominance of workers in primary sectors such as agriculture, forestry, and fisheries, which account for approximately 50% of employment. Although these sectors absorb a large portion of the workforce and contribute significantly to the region's gross regional domestic product (GRDP), the remuneration provided to workers is relatively low, and these sectors do not contribute substantially to labor productivity. Meanwhile, the manufacturing sector, which offers high value added, still plays a very limited role in Nusa Tenggara Timur's economy. In constrast, Papua Barat exhibits labor productivity levels that are substantially higher than those in other provinces. The high productivity in Papua Barat is associated with the province's economic structure, which relies heavily on capital-intensive sectors such as manufacturing and mining. However, high labor productivity does not necessarily correspond to inclusive welfare. This is evident in Papua Barat, where high labor productivity is not accompanied by low poverty levels. This condition reflects that the high output, particularly in the mining sector, is not equitably distributed among the wider population in the province (ILO, 2011).

3.1.2. Overview of the Percentage of Workforce with at Least Junior Secondary Education

Overall, the educational attainment of the workforce in the ten provinces of KTI remains relatively low. The labor force is still dominated by workers with no schooling, incomplete primary education, or only primary school education. Figure 5 shows that, in general, the percentage of the workforce with at least a junior secondary education (SMP) in each province has increased from 2016 to 2023. Papua Province consistently recorded the lowest percentage of workers with at least a junior secondary education among the ten provinces in KTI. This condition is likely due to limited educational facilities and workforce capacity in the region, which results in a low proportion of highly educated workers. The continued predominance of low-educated workers indicates that the quality of the workforce in Papua remains very low (BPS, 2023). The province with the highest percentage of workers with at least a junior secondary education is Maluku, followed by Sulawesi Utara and Papua Barat.

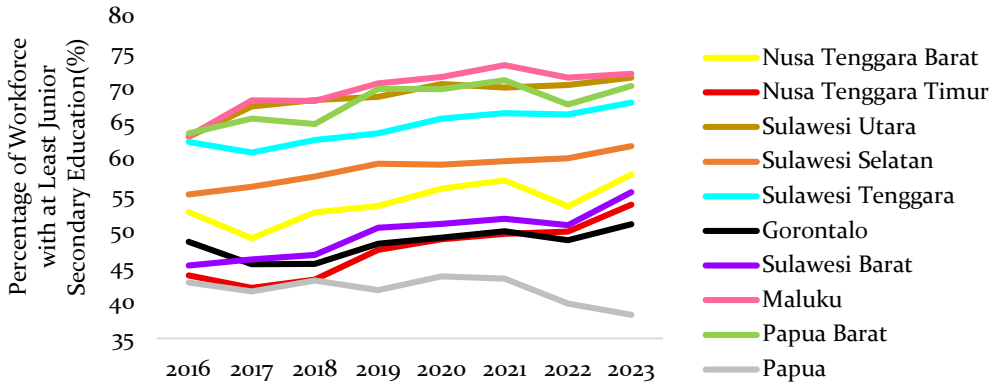

Figure 5. Percentage of Workforce with at Least Junior Secondary Education in Ten Provinces of KTI, 2016–2023 (%)

3.1.3. Overview of Gross Fixed Capital Formation (GFCF) per Worker

The development of gross fixed capital formation (GFCF) per worker in each province of KTI is presented in Figure 6. GFCF per worker shows considerable variation across time and provinces. The indicator tends to fluctuate significantly, with some regions experiencing sharp increases and decreases, such as Papua Barat and Papua. In Papua Barat, a continuous decline in GFCF per worker has been observed from 2020 to 2023, despite a growing working population. Meanwhile, Papua experienced a decrease in 2023, which may be attributed to the establishment of new provinces, Papua Tengah, Papua Selatan, and Papua Pegunungan.

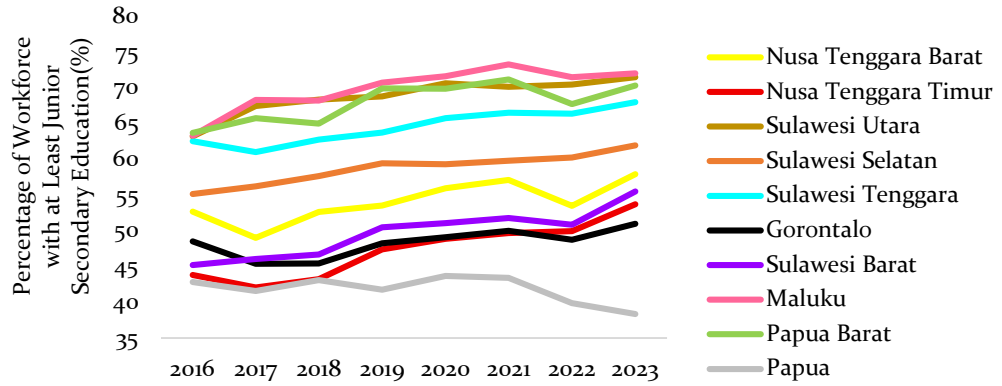

Figure 6. GFCF per Worker in Ten Provinces of KTI, 2016–2023 (million rupiah per worker)

3.1.4. Overview of the Percentage of Workforce Accessing the Internet

The development of the percentage of the workforce accessing the internet is presented in Figure 7. Overall, the proportion of workers using the internet has increased, except in 2018. After 2018, internet usage among the workforce grew at a very rapid pace. Most provinces exhibit a similar pattern. In contrast, Papua Province experienced the slowest growth in internet access among all provinces and consistently recorded the lowest proportion from 2018 to 2023. In 2023, out of 2.448.947 workers in Papua, only 27.15 percent, approximately 665.000 individuals, utilized the internet.

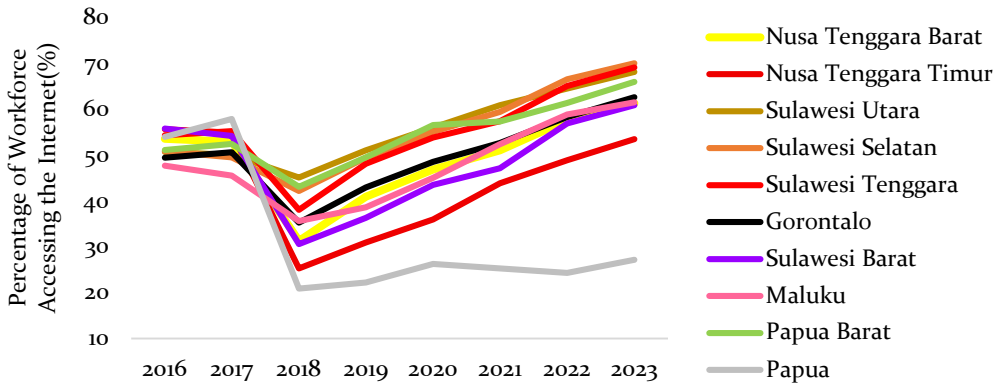

Figure 7. Percentage of Workforce Accessing the Internet in Ten Provinces of KTI, 2016–2023 (%)

3.1.5. Overview of Provincial Minimum Wage

Figure 8 illustrates that the provincial minimum wage (UMP) in the ten provinces of KTI has generally shown a continuous increase each year. The lowest wage level in 2023 was recorded in Nusa Tenggara Timur, amounting to 2.123.994 rupiah, whereas Papua recorded the highest wage at 3.864.696 rupiah in the same year. Consequently, Papua consistently held the highest UMP among the ten provinces in KTI during the 2016–2023 period. This difference reflects the higher cost of living in Papua compared to other regions in KTI.

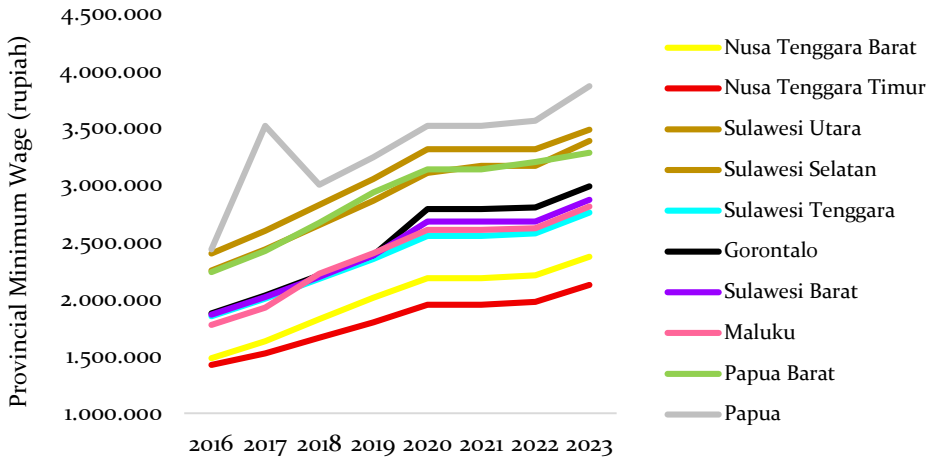

Figure 8. Provincial Minimum Wage in Ten Provinces of KTI, 2016–2023 (rupiah)

3.1.6. Interrelations among Variables in the Labor Productivity Model

Prior to conducting panel data regression analysis, an initial assessment of the associations between the percentage of the workforce with at least a junior secondary education, GFCF per worker, the percentage of the workforce accessing the internet, and the Provincial Minimum Wage (PMW) with labor productivity is required. These associations can be examined using a correlation matrix and scatter plots to evaluate the direction and strength of the linear relationships among the independent variables in constructing the labor productivity model. As shown in Figure 9, all four independent variables exhibit a positive association with labor productivity.

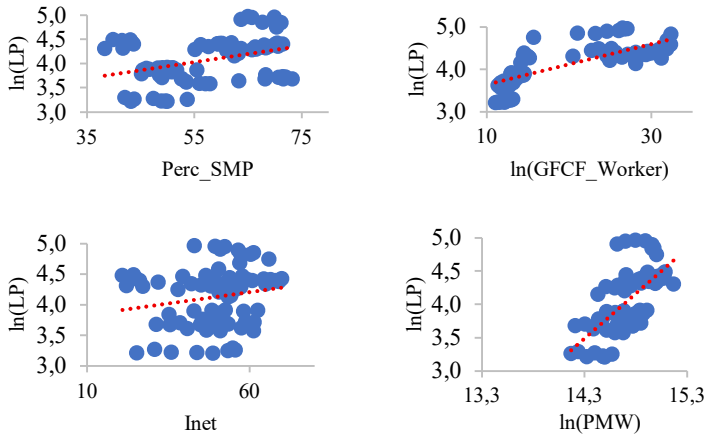

Figure 9. Scatter Plots of Independent Variables against Labor Productivity

Among the four variables, the percentage of the workforce with prior internet access appears to exhibit a wider data spread, indicating a weak linear relationship. In contrast, the other three variables show patterns that tend to be more linear. A clearer depiction of the strength of these linear relationships can be found in Table 2.

Table 2. Correlation Matrix

	ln(LP)	Perc_SMP	ln(GFCF_Worker)	Inet	ln(PMW)
ln(LP)	1.00				
Perc_SMP	0.37	1.00			
ln(GFCF_Worker)	0.83	0.32	1.00		
Inet	0.17	0.49	0.15	1.00	
ln(PMW)	0.67	0.24	0.55	0.11	1.00

Based on Table 2, the variables representing the percentage of the workforce with at least a junior high school education, gross fixed capital formation (GFCF) per worker, and the provincial minimum wage (PMW) exhibit correlation values ranging from 0.36 to 0.83 with labor productivity. Among these variables, GFCF per worker shows a "strong" correlation with labor productivity across ten provinces in KTI. In addition, Table 2 indicates that UMP has a positive correlation of "moderate" strength with labor productivity. Meanwhile, the variable representing the percentage of the workforce with prior internet access only shows a correlation of 0.17, a value close to zero, indicating a weak relationship with labor productivity. This finding aligns with the initial indication from the scatter plot, as shown in Figure 9, where the data appear widely dispersed and do not follow a linear pattern. Therefore, the measurement scale of this variable was converted into a categorical form, to differentiate provinces with high internet penetration among the workforce from those with low penetration. Consequently, the notation for this variable was changed to Med_inet. Generally, the higher the proportion of the workforce accessing the internet in a province, the higher the labor productivity in that region. Conversely, provinces with lower internet access among workers tend to exhibit lower labor productivity.

Table 3. Correlation Matrix Among Independent Variables

	Perc_SMP	GFCF_Worker	PMW
Perc_SMP	1.00		
GFCF_Worker	0.34	1.00	
PMW	0.19	0.52	1.00

Source: Eviews 12 (Processed)

Next, in addition to examining the relationships between the independent and dependent variables, it is also necessary to obtain an initial overview of the potential presence of multicollinearity. Preliminary identification of multicollinearity can be obtained through the correlation matrix, which is presented in Table 3. All independent variables have correlation values below 0.8, indicating that none of the independent variables exhibit a perfect linear relationship (non-multicollinearity). Therefore, the next step is to model changes in labor productivity across ten provinces in Eastern Indonesia for the period 2016–2023.

3.2. Panel Data Regression Model for Labor Productivity in Ten Provinces of KTI, 2016–2023

Based on Figure 4, the variation in labor productivity values across provinces suggests the presence of heterogeneity or individual effects in labor productivity. Therefore, the initial model considered the most appropriate for this study is the Fixed Effect Model (FEM). To determine whether FEM or the Random Effect Model (REM) is more suitable, a statistical test using the Hausman test was conducted. The Chi-square value of 46.539 exceeds the critical value of χ_((0.05;4))^2 = 9.487, indicating that FEM is more appropriate than REM. The next step is selecting the parameter estimation method based on the structure of the residual variance-covariance matrix, tested using the LM and λ_LM statistics, as shown in Table 4.

Table 4. Summary of Variance-Covariance Structure Tests

Test Statistic	Value	Critical Value	Decision
LM Test	$LM = 39.012$	$X^2_{(0.05;9)} = 16.919$	Reject H_0
λ_{LM} Test	$\lambda_{LM} = 71.409$	$X^2_{(0.05;45)} = 61.656$	Reject H_0

Source: Eviews 12 (Processed)

The LM statistic of 39.012 exceeds the critical value of 16.919, indicating heteroskedasticity in the variance-covariance structure. Similarly, the λ_LM statistic of 71.409 exceeds its critical value of 61.656, suggesting cross-sectional correlation (autocorrelation) in the residuals. Therefore, the residuals violate the assumptions of homoskedasticity and no autocorrelation. Consequently, the panel data regression model suitable for this study is FEM with parameter estimation using Feasible Generalized Least Squares (FGLS) or Seemingly Unrelated Regression (SUR). Next, the assumptions of normality and non-multicollinearity were examined. Multicollinearity was assessed using the Pearson correlation among independent variables (Table 3) and the Variance Inflation Factor (VIF) shown in Table 5. The results indicate that all variables have VIF values below 10, confirming the absence of multicollinearity.

Table 5. Multicollinearity Test Results (VIF)

Variabel	VIF
Perc_SMP	4.469
Log(GFCF_Worker)	1.424
Med_Inet	1.170
Log(PMW)	3.960

Source: Eviews 12 (Processed)

For normality, Table 6 shows that the p-value is greater than the significance level (α = 5%), leading to a failure to reject H_0, indicating that residuals are normally distributed.

Table 6. Residual Normality Test (Jarque-Berra)

Jarque Berra-Test	
Jarque Berra	0.6148
Probability	0.7353

Source: Eviews 12 (Processed)

With assumptions satisfied, parameter testing was conducted, as presented in Table 7.

Table 7. FEM FGLS-SUR Parameter Estimation Results

Variable	Koefficient	*Std. error*	t-*statistic*	*p-value*
C	0.9498	0.5397	1.7598	0.0415
Perc_SMP	0.0005	0.0017	0.2828	0.3891
ln(GFCF_Worker)	0.5714	0.0484	11.806	0.0000*
Med_Inet	0.0137	0.0059	2.3077	0.0121*
ln(PMW)	0.0955	0.0425	2.2431	0.0141*
Variabel Dependen		ln(LP)		
$t_{(0.05;66)}$	1.6683			
R-*squared*	0.9985			
Adjusted R-squared	0.9982			
F-*Statistic*	3495.382			
Prob (F-*statistic*)	0.0000			

Notes: *significant at α=5%

Source: Eviews 12 (Processed)

3.2.1. Effect of the Percentage of Workforce with at Least Junior High School Education on Labor Productivity

Based on Table 7, human capital proxied by the percentage of the workforce with at least junior high school education does not significantly affect labor productivity in the ten provinces. According to the Indonesian Central Bureau of Statistics (BPS), the labor force in these provinces is still dominated by workers with only primary education, as shown in Table 8. Consistent with Adam (2016), low-educated workers, typically with only primary schooling, generally possess limited knowledge and skills, and are usually employed in low-productivity sectors. Furthermore, the imbalance between the available labor force and job opportunities has resulted in many recent graduates remaining unemployed, thereby limiting their contribution to enhancing labor productivity (Baharin et al., 2020).This finding is also supported by Sihombing (2009), who found that education does not have a significant effect on labor productivity in North Sumatra Province, as the workforce is predominantly concentrated in the agricultural sector, which generally does not require a high level of formal education. This result is consistent with the findings of the present study, where the majority of the workforce is employed in the agriculture, fisheries, and forestry sectors.

Several other studies also support these findings. Fadillah et al. (2020) found that the Human Development Index (HDI) does not significantly affect labor productivity in Indonesia.

Furthermore, Djirimu et al. (2021) and Maharani & Woyanti (2023) also found that the average years of schooling has no significant effect on labor productivity in Indonesia. The insignificant effect suggests that improvements in education alone are insufficient to enhance labor productivity if they are not accompanied by job training.

Table 8. Percentage of the Labor Force by Educational Attainment in 10 Provinces of Eastern Indonesia, 2016 and 2023

Educational Attainment	Percentage of Labor Force (2016)	Percentage of Labor Force (2023)
No schooling / Never attended school	7,8	5,0
Incomplete primary education / Primary school	39,4	36,2
Junior secondary school	15,2	14,7
Senior secondary school	18,4	22,4
Vocational high school	6,3	7,0
Academy/Diploma	2,7	2,1
University	10,2	12,6

3.2.2. Effect of GFCF per Worker on Labor Productivity

Table 7 indicates that physical capital, proxied by GFCF per worker, has a positive and significant effect on labor productivity in the ten provinces during 2016–2023. The regression coefficient of 0.5714 implies that a 1% increase in GFCF per worker raises labor productivity by approximately 0.5714%, holding other variables constant. This result is consistent with Arnold (2008), who states that increasing fixed capital investment enhances labor productivity. Inklaar & Timmer (2013) argue that higher capital accumulation per worker in developing countries contributes more significantly to labor productivity. Hendarmin (2019) also notes that physical investment increases expenditure for business expansion and new equipment, thereby increasing capital stock and productivity.

3.2.3. Effect of Provincial Minimum Wage (PMW) on Labor Productivity

UMP has a positive and significant effect on labor productivity, with a regression coefficient of 0.0955. This indicates that a 1% increase in PMW raises labor productivity by approximately 0.0955%, ceteris paribus. This finding aligns with efficiency wage theory, which posits that higher wages incentivize workers to exert greater effort, increasing productivity (Mankiw, 2007). Higher wages improve worker nutrition and health, further enhancing productivity. Similar positive and significant effects of minimum wages on labor productivity in Indonesia were reported by Fadillah et al. (2020) and Maharani & Woyanti (2023).

3.2.4. Effect of Internet Penetration on Labor Productivity

As previously described, the workforce internet access variable was converted into a categorical variable based on the median value to distinguish provinces with high and low internet penetration. Table 7 shows that this variable has a positive and significant effect on labor productivity, with a regression coefficient of 0.0137. This implies that provinces with high internet

penetration among workers are expected to have approximately 1.37% higher labor productivity than provinces with low penetration, holding other variables constant. This finding supports Najarzadeh et al. (2014), who concluded that increased internet usage enhances labor productivity. Hsieh & Goel (2019) further explain that workers accessing the internet outside of work to acquire new knowledge can indirectly improve performance. Provinces with low internet penetration during 2016–2023 include Nusa Tenggara Timur, Gorontalo, Maluku, and Papua, whereas high-penetration provinces include Nusa Tenggara Barat, Sulawesi Selatan, and Papua Barat.

4. Conclusion and Recommendations

Labor productivity in the ten provinces of KTI has generally stagnated between 2016 and 2023. The highest productivity was observed in West Papua, and the lowest in Nusa Tenggara Timur. During this period, the percentage of the workforce with at least junior high school education, internet access, and PMW tended to increase, whereas GFCF per worker tended to decline. All four independent variables have a positive linear relationship with labor productivity. GFCF per worker, PMW, and internet penetration positively affect productivity, while the percentage of workforce with at least junior high school education does not.

Recommendations:

a. The government should encourage the enhancement of physical capital (GFCF) in provinces with low labor productivity and GFCF per worker, such as Nusa Tenggara Timur, Nusa Tenggara Barat, Maluku, Sulawesi Barat, and Gorontalo.
b. Internet access should be expanded, especially in provinces with low workforce internet penetration (Nusa Tenggara Timur, Gorontalo, Maluku, Papua), through equitable digital infrastructure development. Increasing minimum wages can also incentivize higher productivity.
c. Businesses should optimize technology and internet use to improve workforce productivity.

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