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The Role of Technology Mastery, Quality of Human Capital, and Wage Rate on Labour Demand In Java Island

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Abstract

Uneven demand for labor in Java Island causes economic inequality. this study aims to determine how the influence of technological mastery, the quality of human resources, and the level of wages on labor demand on the island of Java. this study uses qualitative methods with panel data, through model selection followed by model feasibility tests and classical assumption tests. The result of this research is known that XI with Prob. 0.0321 <0.05, then X1 has a significant effect on Y, for X2 with a Prob value. 0.0000 <0.05, then X2 has a significant effect on Y, and X3 with a prob value. This study concludes that mastery of technology can increase the demand for labor but hurt the decline in the demand for ordinary labor. the quality of human resources has a positive effect on the demand for labor on the island of Java and the level of wages hurts the demand for labor, when wages rise, the demand for labor will decrease. To equalize the demand for labor in Java, the government must equalize the development of good public facilities, easy access, and superior training, so that entrepreneurs are interested in building new economic sectors in areas in Java. thus the demand for labour will occur evenly not only in big cities but also in other regions

Keywords: **Human capital, Java, demand, Labour, Wage, Technology**

INTRODUCTION

Java Island is the most populous island in Indonesia with a population of 154,282,100 million people in 2022 (https://www.bps.go.id/). However, the density of the population on the island of Java does not necessarily mean that the distribution of labor demand is evenly distributed, so workers dominate choosing to work in industrial areas such as JABODETABEK and other big cities on the island of Java. Workers prefer to move to industrial areas or big cities, one of which is due to health facilities, high education standards, easy access to information and technology, and promising living standards or wages, the small population in a region causes minimal demand for labor in certain areas, so employers choose to demand labor in industrial areas and big cities. (Sakketa, 2022). Labor demand is the amount of labor required by employers to be employed during a certain agreement period at an agreed wage rate, labour demand is a demand for production factors where labor is asked to work not for itself but to contribute to the production of goods and services (Sapsford, 1993). (Sapsford, 1993). The marginal effect of wages generally reduces the quality of labor, this provides information that to deal with low labor quality, companies will choose locations with superior human resources even though they have to pay higher costs, but if faced with a choice of high costs with superior worker quality and low wage costs but standard worker quality, then the dominant company will choose low wage costs (Leihou, 2021).

In addition, mastery of technology is an important consideration for companies in employing in the era of economic digitalization as it relates to labor productivity. (Iskandar, 2022). While human resources who have the desired technological skills and education are available in urban areas, especially large or developing cities, this also causes uneven demand for labor on the island

of Java. According to Teshabeave & Kordirova, ICT skills have a specific impact on the digital economy on the labor market, ICT skills are very influential in improving the quality and competitiveness of the National Workforce in the economy in the digital era now, of course, this is an important task for the state to make regulations related to the labor market that is proficient in mastering technology and information (Teshabaeva, 2023). The skills of using information technology in the world of work are dominated by residents in big cities such as DKI Jakarta in 2022 at 92.36% of the population are technologically literate, followed by DIY at 86.98% while the smallest province in the mastery of technology and information is proven. East Java at 73.63% (https:www.bps.go.id/). In developing countries, the use of technology is needed in almost all economic activities, currently, companies need a lot of specialized labor who can operate their production activities using new technology. So that the wages given by the company also increased, the increase in specialization wages is certainly proportional to the efficiency gained by the company (Carroni, 2023). The ability to master technology on the island of Java is not yet evenly distributed, especially the mastery of technology is equated with the level of education, the higher the level of education, the more he masters technology and information. Wages are the main basic material for consideration as labor supply and labor demand, wages are the main factor of urbanization of workers from villages to cities, the higher the wage level, the greater the supply of labor, and vice versa wages are also a calculation for employers in absorbing labor. The wage level determined by the company can differ in terms of sector, and the operational technology used, of course, the company wants low wages to increase profits, on the other hand, low wages may cause economic problems for workers in the form of household breakdown or child exploitation (Jaeger, 2021).

On the other hand, the level of wages will also affect the innovation of workers in the industrial world, of course, with increased worker innovation, it can reduce certain costs (Sandrini, 2021). The big question is why companies want a lower wage level in making requests for labor, especially in cities and regencies that are not developed, this is certainly due to the minimal quality of human resources and regulations that do not fully protect workers regarding wages, especially in certain sectors that are not legal entities (Lichter, 2015). This is evidenced by the example of East Java Province, the placement fulfillment of Manpower by Regency / City and Gender in East Java Province, 2022 The most in Surabaya City as many as 42,154 people followed by Siduarjo 28,324 people then Gersik 19,177 people while the least is Jember, Bondowoso, Sumenep, Mojokerto less than 2000 people, (https;//www, bps,jatim.go.id). Likewise, in West Java in 2021 the dominant workers chose to work in Bekasi City 845,737 workers, Bekasi Regency 995,563 workers, and Bogor Regency 1,200,254 workers (https://www.bps.go.id/). However, the phenomenon that occurred from 2022 to 2023 showed that the quality of labor was not as important to the company as operational costs. In 2022-2023 as many as 97 companies moved from Prov. Banten (City/Cab.Tanggerang) and Prov. West Java (BODEBEK) to Prov. Central Java. It is known that the lowest MSE in Central Java is IDR 1,958,169.69 in Banjarnegara Regency. The highest MSE in Central Java is IDR 3,060,348.78, namely in the city of Semarang. If you look at the data for 2022, the Central Java HDI level is in the category of the 2nd lowest HDI (72.79) on the island of Java after East Java (72.75), this also applies to the mastery of technology and information, but in terms of hourly wages, Central Java is in the category of the cheapest wages on the island of Java with Rp. 12,604 / hour below DIY Rp. 14,916 / hour. (https://www.bps.go.id/)

Technological gaps, price, and wage differences will stimulate labor migration, resulting in imbalances in the sectoral economy, besides that sectoral economic imbalances will accelerate aggregate growth, which means that the unevenness of economic development is considered to continue to grow (Shangaoli, 2020). In addition, achieving economic equalization through the demand for labor by companies can be done by slowing down the rate of economic growth in provinces or cities with a very large economy and diverting it to areas that are targeted for growth (Yungker, 1998). Of course, in this process, it is not easy to move companies as an economic sector

to want to relocate to areas that become growth destinations, if not balanced with supporting production factors.

METHODOLOGY

The type of research used in this research is quantitative descriptive, where the data source used is secondary data with a panel data model, and the panel data type is a composite of time series data with span data (Ghozali, 2017). where the objects taken are all (6) provinces in Java with a period of 5 years (2018-2022) obtained from the Central Statistics Agency (BPS).

Variable data

The regression equation model used in this study is

$$Y \text{ it} = \beta^{\circ} + \beta 1 X 1 \text{it} + \beta 2 X 2 \text{ it} + \beta 3 X 3 \text{ it} + e \text{ it}$$

There are 4 types of research variables used, namely

β° : Constant

β1-3 : Regression coefficient of Variable

i: Names of provinces on the island of Java

t : year 2018 to 2022

Y : *Labour demand* from each province for 5 consecutive years the measure used is the number of people who have worked in various sectors.

X1 : *The quality of labor* of each province with the measure used is the number of citizens who use ICT technology and information (in the form of %). in each province for 5 consecutive years

X2 : *Quality of human resources* measured using HDI figures for each province for 5 consecutive years.

X3 : *Wage level* with the measure used is the wage received by workers in each province for 5 consecutive years.

Processing Method Panel data regression

Cow test: This is a test conducted to find out which model will be used in this study whether *Common Effect* (CEM) or *Fixed Effect* (FEM) (Ghozali, 2006). determining it is done by measuring the prob Cross Section Chi-Square with Alpha (a), if the prob value is> from 0.05 then the selected model is CEM but if the prob < from 0.05 then the selected model is FEM. Hausman test: This is a further test that will be used after the Cow test to determine which model will be used whether *Random Effect* REM or *Fixed Effect* (FEM) determining it is done by measuring the prob Cross Section Chi-Square with Alpha (a), if the prob value is> 0.05 then the selected model is REM but if the prob <0.05 then the selected model is FEM. Lagrange Multiplier Test: The LM test is the last test performed when the Hausman test shows a different test from the Cow test. Determining it is done by measuring the prob Cross Section Chi-Square with Alpha (a), if the prob value is> from 0.05 then the selected model is CEM but if the prob < from 0.05 then the selected model is REM.

Model feasibility test, To test the feasibility of the model used in this study, panel data regression analysis and ditermination coefficient analysis were conducted. Regression analysis is needed especially for research that tests whether independent variables affect other independent variables (Sekaran, 2016). Classical Assumption Test, It is a test carried out as a statistical prerequisite in conducting multiple liner analyses using the ordinary least square basis. In panel data, the classical assumption test used consists of the Normality Test, Multicollinearity Test, and Heteroscedasticity Test (Firmansyah, 2022). Hypothesis Test; *Partial test (T test*), Partial test (t test) is conducted to determine the significance of the influence of the independent variable on the dependent variable individually (partially), assuming other variables are constant. The decision is made by looking at the significance value compared to the probability value of 0.05%. *Simultaneous*

Test (F Test), The F test is used to test variables X1, X2, and X3 simultaneously to see the effect of each on variable Y, with a probability level of 0.05%.

RESULT AND DISCUSSION

Model selection estimation

Based on the selected data in the form of panel data, testing the use of the model must be done repeatedly using CEM, FEM, and REM so that data analysis decisions can be taken according to model conditions. After testing the CEM model equation, then test the Fixed Effect Model equation which will continue the Cow Test. From the results of the Fixed Effect equation, the Cow test is then carried out to find out which model to choose between the CEM or FEM model.

Cow test

Table 1. Cow Test Result

Redundant Fixed Effects Tests

Effects Test	Statistic	d.f.	Prob.
Cross-section F	8326.397451	(5,21)	0.0000
Cross-section Chi-square	227.778178	5	0.0000

Source: Author Estimation (2023)

It is known that the cow test results show a Chi-square value of 227.778 with prob. 0.0000 <0.05 then the model chosen is the Fixed Effect Model. After knowing the results of the Cow Test, the Hausman Test is then carried out using the Random Effect.

Hausman Test

Table 2. Hausman Test Result

Correlated Random Effects - Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	7.177922	3	0.0664

Source: Author Estimation (2023)

The results of the Hausman test using the Randdom Effect Test know the Cross_section Random value of 7.1778 with Prob. 0.0664> 0.005 so it is known that the model used in this study is the Random Effect Model (REM) model, from the results of the cow test and Hausman test, it shows that the model chosen is FEM and REM, so it is necessary to do the LM Test.

LM Test

Table 3. LM Test Result

Lagrange Multiplier Tests for Random Effects

	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	57.54684	2.625254	60.17210
	(0.0000)	(0.1052)	(0.0000)

Source: Author Estimation (2023)

It is known that the LM test shows a cross-section value of 57,647 with a prob. 0.000 <0.05, so the model chosen is REM. From the three test results conducted (Cow, Hausman, and LM test) it is known that the possible model is REM. The decision to choose panel data must be made carefully by considering the theory, statistics, and econometric test results. Gujarati provides alternatives in selecting the Fixed Effect and Randaom Effek models following the rule of thumb as follows; (a) If N> T then choose the Random Effect Model; (b) if T> N then choose the Fixed Effect Model. In the case of this study, T = 5 years x 6 = 30 years and N = 6 then T> N, the suitable model is *Fixed Effect***.** There are now two test results that support choosing the Random Model (Hausman test and LM test), and two that support choosing the Fixed Effect, namely the Chow Test and Gujarati's rule of thumb. In line with the statistical test results, Gujarati advises researchers to be able to choose the best model for their research. The best model has more reliable statistical criteria, for example, F-test, t-value, and minimum Akaike, Schwarz, and Hannan-Quin criteria, and R2 and adjusted R2 indicators. Between the two models FEM and REM, the FEM is better (Asngari, 2014).

From the REM and FEM equations above we can see the value of FEM> REM or 0.9998> 0. 7538 and F-Stas FEM> from F-Stas REM or 16428.90> 26.451. Statistical indicators show that FEM is better, and this is in line with Gujarati's Rule of Thum, so researchers can use FEM as well as REM, due to differences, but when viewed from the Akaike, Schwarz, and Hannan-Quin values, FEM is more ideal. After it is known that the model used in this study is FEM, the classical assumption test is carried out, the FEM model, the classical assumption test carried out is Normality Test, Multicollinearity Test, Heteroscedasticity Test and Auto Correlation Test.

Model Feasibility Test (FEM)

Panel data root test

Table 4. Panel Data Root Test Result

Null Hypothesis: Unit root (common unit root process)

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-10.2013	0.0000

** Probabilities are computed assuming asymptotic normality

Source: Author Estimation (2023)

Based on the probability of the Levin, Lin & Chu t* test = 0.000 <0.05, it can be interpreted that the data above has no unit roots, meaning that all data is stationary at the level of level.

Cointegration Test

Table 5. Cointegration Test Result

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.569270	60.16585	47.85613	0.0023
At most 1 *	0.415676	37.42446	29.79707	0.0055
At most 2 *	0.363608	22.91735	15.49471	0.0032
At most 3 *	0.327565	10.71495	3.841465	0.0011

Source: Author Estimation (2023)

According to Philip-Perron and Dikky-Fuller, all variable data from all provinces throughout the observation have cointegration (long-term relationship) this can be seen from Prob <0.05.

Coefficient of determination

The test of the efficiency of the determinate (R-squared) is carried out to determine how much variation of the dependent variable can be explained by the independent variable.

Table 6. Coefficient of determination Result

Root MSE	0.011089	R-squared	0.999840
Mean dependent var	15.99599	Adjusted R-squared	0.999779
S.D. dependent var	0.892323	S.E. of regression	0.013254
Akaike info criterion	-5.565754	Sum squared resid	0.003689
Schwarz criterion	-5.145395	Log likelihood	92.48631
Hannan-Quinn criter.	-5.431277	F-statistic	16428.90
Durbin-Watson stat	1.679490	Prob(F-statistic)	0.000000

Source: Author Estimation (2023)

It is known that the Adjusted R-squared value is 0.9998, it can be concluded that the variables x1, x2, and x3 can simultaneously explain the variable y by 99.98%. The remaining 0.02% is explained by other variables outside this study.

Regression Equation Analysis

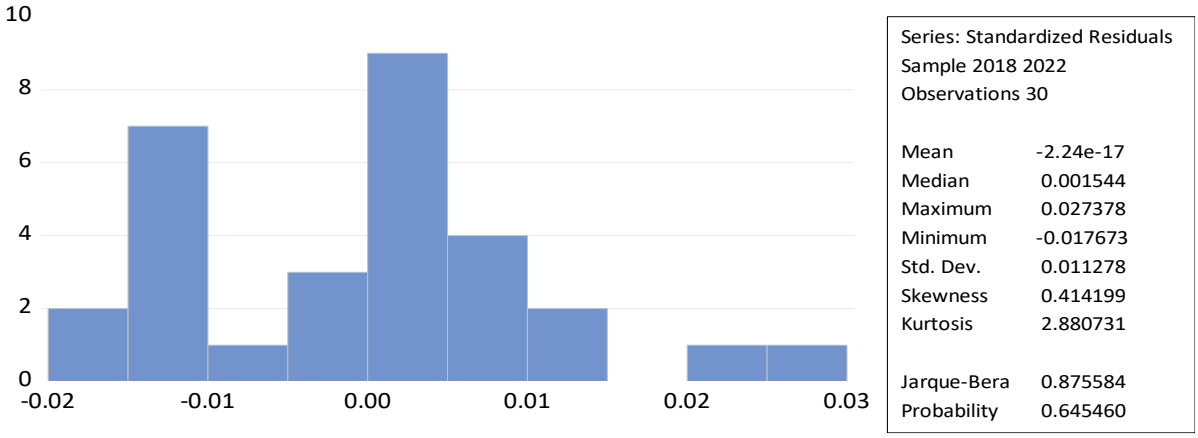
*Y = 15.2458 - 0.0035*X1 + 0.0667*X2 - 0.2884*X3 + [CX=F]*

From this equation it is known that the constant value of Y is 15.24 which means that when the independent variable is constant or 0 evenly it will increase the value of Y by 15.24 if X1 increases by 1% it will decrease Y by 0.35% if X2 increases by 1% it will increase the variable Y by 6.67% but if the X3 variable increases by 1% it will decrease Variable Y by 28.8%.

Classical Assumption Test

Normality Test

Table 7. Normality Test Result



Source: Author Estimation (2023)

From the Normality test, it is known that the Jaque-Bera value is 0.876 with prob. 0.645> 0.05, so it can be concluded that the data is normally distributed.

Multicollinearity Test

Table 8. Multicollinearity Test Result

	X1	X2	X3
X1	1.000000	0.799397	0.420893
X2	0.799397	1.000000	0.567982
X3	0.420893	0.567982	1.000000

Source: Author Estimation (2023)

From the multicorrelation test results, it is known that the values of X1, X2, and X3 <0.85, so it can be concluded that the data above escapes multicollinearity.

Heteroscedasticity Test

A heteroscedasticity test is conducted to determine the presence or absence of inequality of variance of residuals for all observations in the regression model.

Table 9. Heteroscedasticity Test Result

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	0.417332	Prob. F(3,26)	0.7420
Obs*R-squared	1.378242	Prob. Chi-Square(3)	0.7106
Scaled explained SS	0.363563	Prob. Chi-Square(3)	0.9477

Source: Author Estimation (2023)

Based on the results of the heteroscedasticity test using Breusch Pagan Godfrey, the Obs R Square result is 1.378 with Prob. Chi-Square 0.7106> 0.05, means that the data is free from Heteroscedasticity problems.

Autocorrelation Test

Table 10. Autocorrelation Test Result

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	0.112900	Prob. F(2,23)	0.8937
Obs*R-squared	0.281935	Prob. Chi-Square(2)	0.8685

Source: Author Estimation (2023)

From the Breunch-Godfrey autocorrelation test results, the Obs R Square value is 0.2819 with a prob chi-square of 0.8685>0.05 so it can be concluded that the data above is free from autocorrelation.

Hypothesis Test

Partial test (T-test)

From the T-test it is known that X1 with the Prob value. 0.0321 <0.05, then X1 has a significant effect on Y, for X2 with a Prob value. 0.0000 <0.05, then X2 has a significant effect on Y, and X3 with a prob value. 0.0015 < from 0.05 then X3 has a significant effect on Y

Simultaneous Test (F Test)

From the above equation, it is known that the T statistical value is 16428.90 with Prob. F.Statistics of 0.0000 <0.05, it can be concluded that the variables X1, X2 and X3 have a significant effect on variable Y

DISCUSSION

Technology Mastery on Labour Demand

From the results of the panel data multiple linear regression equation, it is known that the development of ICT in society has a significant negative effect on labor demand in Java, what this means is that when the use or mastery of ICT increases by 1%, it will reduce non-ICT labor by 0.035%. this is in line with the research of Filippo Pusterla & Ursula Renold who said that the development of ICT, has implications for reducing the demand for labor with average ICT skills down because companies are more interested in ICT graduate workers with degrees (Pusterla, 2022). In Indonesia in 2023 the number of people working reached 138,632,510 and around 1.23 million worked in the field of ICT. This can also be seen from the results of research conducted by LIPI which shows that mastery of ICT has a positive relationship with income received by 20% of high-income groups and 40% of negative relationships received by groups with low incomes, this indicates that ICT progress is enjoyed more by the rich and highly educated rather than by the poor and low educated (Fuady, 2019). David Ricardo examines the relationship between ICT development and the problem of equity. He shows the effect of technology on three groups involved in production activities, namely landlords, capital owners, and workers. According to him, the use of new technology will replace or reduce the role of capital and labor.

Human capital quality on labor demand in Java

The quality of human resources, in this case, is in the form of HDI, HDI is measured using indicators that include education, health, and livability, this study shows that the quality of human resources influences labor demand, where every 1% increase will increase labor demand by 6.67%,

this is rational because people who work in various industrial and non-industrial sectors mostly require a level of education and health. According to human capital theory, health and labor force participation are positively related. The theory predicts that improved health will lead to greater labor force participation as well as labor supply and demand factors are important in shaping the relationship between education and labor participation so health and education are important influences on labor demand, but labor demand will not be met if workers perceive a job as making their education useless or the job as worsening their health (Laplagne, 2007).
If we focus on education then the data below will explain.

Table 11. Open Unemployment Rate By Education

Tingkat Pendidikan 2	Tingkat Pengangguran Terbuka Berdasarkan Tingkat Pendidikan		
	2020	2021	2022
Tidak/Belum Pernah Sekolah/Belum Tamat & Tamat SD	3,61	3,61	3,59
SMP	6,46	6,45	5,95
SMA umum	9,86	9,09	8,57
SMA Kejuruan	13,55	11,13	9,42
Diploma I/II/III	8,08	5,87	4,59
Universitas	7,35	5,98	4,80

Source: BPS, 2023

From the BPS data above we can see a decrease in the unemployment rate based on the level of education at various levels, from the data we see that the levels of vocational high school, diploma, and university have decreased significantly, meaning that these three levels are widely absorbed by employers, which illustrates that the level of education affects the demand for labor. The average person working in Java is a high school graduate because it is the minimum education requirement for labor demand, for example in February 2022 in DKI Jakarta 48% or 2.3 million workers were high school graduates, and 20.5% or 968 thousand university graduates. This is also followed by what happened in Central Java where the demand for high school labor reached 4,744,778 people, high school workers in East Java 6,007,656 people, and high school workers in Java reached 4,202,581, from these data we can conclude that the demand for labor at the high school level is the highest than other levels of education. The increase in HDI on labor demand in Utomo's research has a positive influence where the higher the HDI, the more labor absorption. (Utomo, 2022). This is also in line with the research of Syera et al. In the results of the study, it was stated that the increase in HDI that occurred in Medan City in 2023 had reduced open unemployment in Medan, so the higher the level of HDI, the smaller the level of open unemployment (Syera. et.al., 2023).

Wages and Labour Demand in Java

The results of this study showed that the level of wages has a significant influence on labor demand in other words this wage has a negative influence, where when wages increase by 1% it will reduce the demand for labor by 28.8% this is because, with the increase in employee wages, it will increase production costs so that employers limit the demand for labor. This is evidenced by the move made by several companies from JABODETABEK to the coastal areas of JABAR and JATENG, the high cost of employee wages makes companies have to maximize employee performance by increasing working hours without having to recruit new employees. Bergstrom's research revealed that what the Swedish government did to increase labor demand was to provide grants from the government budget to businesses but this still could not increase labor demand,

the position of labor demand which tends to decline due to wage increases cannot be overcome by providing grants from the government. (Bergstrom, 2004). The decline in labour demand when the increase in wages is not proportional to the increase in production profits so companies have to spend higher costs for the same product.

According to Atiyatna & N.T Muhyidin, the minimum wage in South Sumatra has a positive effect on labor absorption where any increase in the minimum will increase the demand for labor, but in this case, a significant increase applies to elementary and junior high school graduates, this does not apply to high school and university graduates, which is not significant. (Atiyatna, 2016). The increase in wages in Java Island which causes a decrease in labor demand, occurs in areas with high wage levels such as JAGODETABEK while areas with low wage levels will still increase labour demand such as in Central Java, and West Java Pantura. It should be noted that this increase will certainly have a positive effect as long as the profit from each production is above the wage increase and will decrease when the production profit is smaller than the wage level.

CONCLUSION

Labor demand is needed to increase production and economic growth if it is considered by the employer to provide maximum profit and vice versa. Labor that masters the field of technology is increasingly needed to save production costs, this is in line with the development of increasingly sophisticated technology so that competent labor is needed, but this will reduce the demand for labor with low competence or rough because some of the work can be done by machine operators. HDI has a positive impact on labor demand because companies need resources that can compete and are more productive. The wage level has a significant negative effect on labor demand, high wages while labor productivity is limited cannot boost company growth, so this applies to regions with high wages and does not apply to regions with low wages. To equalize the demand for labor in Java, the government must equalize the development of good public facilities, easy access, and superior training, so that entrepreneurs are interested in building new economic sectors in areas in Java. thus the demand for labour will occur evenly not only in big cities but also in other regions.

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