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Analysis of the Effect of Infrastructure Development and HDI On Economic Growth in Java Island in 2015 – 2020**Indah Kurniasari^{1*}, Maulidyah Indira Hasmarini¹**¹Universitas Muhammadiyah Surakarta

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Email: b300190047@student.ums.ac.id**ABSTRACT**

Economic growth is a process of the changing economic condition in a region better than before over. To manage economic we need a high human development index so we can take an efficient and right decision. Other than increase and developing the human development index the supporting facility must be increase for supporting economic growth that already plan. There are a few supporting facilities that help the local government among them is how long the road in that region, the distribution of clean water, dan electricity distribution. This research use panel data that include 6 provinces in the java island and the time period is from 2014-2019. The data will be regressed using Random effect model (REM) with eviews application. The goal of this study is to determine the effects of infrastructure and Human development index of each province on the Java island in economic growth in each region.

Keywords: Infrastucture, economic, HDI

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INTRODUCTION

According to the Central Statistics Agency (BPS), Gross Regional Domestic Product at market prices is the sum of the gross added values of all economic sectors in a region. Added value is added value from the combination of production factors and raw materials in the production process. Value added is calculated by subtracting intermediate consumption from production (output). Gross value added includes component income (wages and salaries, interest, rent and profits), depreciation and indirect net taxes. Therefore, adding up the gross added value of each sector and the gross added value of all these sectors gives the region's gross domestic product at market prices.

Gross Regional Domestic Product (GRDP) is an important indicator to determine the economic conditions in a region in a certain period, both at current prices and at constant prices. In this study the authors will use the variable distribution of electricity, HDI, road length, and the amount of water distribution as the independent variable and the GRDP variable as the dependent variable.

According to data in Indonesia itself is still Java centric. This is evidenced by the high contribution of the island of Java to economic growth in Indonesia. Even though in 2020 there was a COVID-19 outbreak, Java Island is still the highest contributor to economic growth compared to other islands. This is because the island of Java is the center of development in Indonesia. More advanced infrastructure compared to other islands and a high HDI score have made Java the center of the economy.

Table 1. Economic Contribution and Growth by Islands in Indonesia (2021)

No	Name	Growth / %	Contribution / %
1	Sumatera	3,18	21,7
2	Jawa	3,66	57,89
3	Kalimantan	3,18	8,25
4	Bali-Nusa Tenggara	0,07	2,78
5	Sulawesi	5,67	6,89
6	Maluku-Papua	10,09	2,49

Table 2. Economic Contribution and Growth by Islands in Indonesia (2022)

No	Name	Growth / %	Contribution / %
1	Jawa	56,55	5,66
2	Sumatra	22,03	4,95
3	Kalimantan	9,09	4,25
4	Sulawesi	7,1	6,47
5	Bali & Nusa Tenggara	2,73	3,94
6	Maluku & Papua	2,51	13,01

Human development index (HDI) is so important for economic Growth because from that we can see how much the people in that country can unleash their maximum potential.

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(Fitrawaty, 2020a) In this study it is proven that HDI has a positive and significant effect on inequality that occurs in Indonesia. HDI can also show health, knowledge or education and skills that will affect economic growth in Indonesia. In this study it is proven that HDI has a positive and significant effect on inequality that occurs in Indonesia. In other cases we also can see that HDI can also indicate health, knowledge or education and skills that will affect economic growth in Indonesia. Therefore it can be concluded that HDI and economic growth have a relationship that influences each other (Saragih, 2018). (Siregar & Pratiwi, 2017) Said that Regional financial independence has a positive effect on Human Development Index. Hope it can be used as a benchmark for maximizing potential government characteristics districts or cities in Indonesia. One way to maximize it is by increasing local revenue to reduce dependence on the central government. Therefore in (Leiwakabessy & Amaluddin, 2020) can conclude that economic growth and human development index really affecting one another.

In other studies it is also proven that HDI is one of the supporting factors for economic growth, like in this cases in (Elistia & Syahzuni, 2018) paper that HDI and GDP have a significant relationship. Economic growth makes it possible to achieve high levels of human development, on the one hand an increase in the level of human development leads to increased opportunities for economic growth. The causal relationship between economic growth and human development becomes a mutually influential relationship. So it is clear that human development in a country is related to the effect of economic growth as seen in per capita income (GDP per capita) which can be an indicator of welfare in that country.

In other cases not only researcher that agreeing in this theory but also the East Java province government is also agreeing that if they are paying more attention to HDI the GDP will grow with it (Wulandari, 2021). As everything else HDI sometimes not only can bring a positive effect in economic growth but sometime there is a negative effect too (Maqin & Sidharta, 2017) Also found that GDP and HDI have a positive correlation. Even though HDI always have positive effect as anything else they also raise negative side such as raise level of inequality in Indonesia. (Fitrawaty, 2020). HDI can effect inequality in different places because HDI will effect how people health, knowledge, and standard of living (Kurniasih, 2017) say that the inequality can be happened from HDI difference in every place. A few factor can effected how high is some places HDI in (Feriyanto, 2016) research found that domestic and foreign investment can effect HDI.

A research that titled "Pengaruh Infrastruktur Terhadap Pertumbuhan Ekonomi Di Jawa Tengah Tahun 2012-2014" is held to know whether health, education and clean water infrastructure had an effect on regional revenues in Central Java. The data used are secondary data and panel data, which is a combination of time series data and cross section data. The result is that these three variables affect economic growth in Central Java (Aminah, n.d.). In research in Sukabumi show that infrastructure development in Sukabumi City tends to increase every year even though there are some declines. The long road infrastructure tends to increase, but it experienced a decline in 2005 and 2006 due to a decline in road quality marked by an increase in the number of damaged road conditions. Electricity infrastructure tends to increase every year due to an increase in population and an increasing number of business centers thereby increasing the amount of electrical energy sold. Clean water

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infrastructure tends to increase every year due to an increase in population and an increase in the amount of clean water needed (Chaerunnisa, 2014).

In other finding healthy water effect GDRP in Central Java province. (Kristinawati & Indira Hasmarini, n.d.). This really show that water distribution is so important for economic growth, in its showed that individually the domestic investment variable, labor, clean water infrastructure had a significant influence on economic growth while foreign investment had no significant effect on economic growth." That tell us how important is water distribution. (Hardianti et al., 2020) said The results showed that economic and social infrastructure simultaneously had a significant effect on economic growth. Partially road infrastructure, electricity infrastructure, health infrastructure have a positive and significant effect on economic growth while education infrastructure has a positive but not significant effect on economic growth in Indonesia.

Other factor that also effected economic growth is infrastructure development because it really help with goods and services transportation and make people can access school, work, health services, and recreational activities. in (Rahim et al., 2019) research showed that infrastructures comprised road, harbor, water and electricity simultaneously and significantly influenced the economic growth in Southeast Sulawesi. Partially, only harbor and electricity significantly affected on the economic growth Southeast Sulawesi. Because of infrastructure development is important for economic growth therefore the government need to give a nice amount of investment in that aspect, in (Pascalia Rista Indah & Istifadah, 2020) research employed a quantitative approach based on time series analysis and Vector Autoregression analysis. Infrastructure investment significantly affected economic growth in Indonesia. In addition, it has a reciprocal correlation with economic growth. Meanwhile, land and sea transportation positively affected economic growth in Indonesia. The assumption that the core of infrastructure is essential to promote economic growth. Furthermore, indirect taxation is not a tool capable of stimulating growth. In particular, new sectors of the core of infrastructure, such as the internet and mobile telephony, are capable of expanding the effect of infrastructure on growth. Originality/value: Based on a sample of 74 countries, we include new infrastructure sectors into the analysis (transportation, fixed telephony, mobile telephony and internet), and verify changes from the 1990s (de Almeida & de Mendonça, 2019).

Based on other research we can also find that variables of road, electricity, education, health and capital expenditure have a positive and significant effect. While the employee expenditure variable has a positive but not significant relationship. In addition, it is known that telephone variables have a negative and insignificant relationship. The results of this study also show that electricity infrastructure has the biggest influence on economic growth (Irawan & Iskandar, 2019).

In other study cases also found that road infrastructure had a positive effect on economic growth of South Sumatra Province "The finding of this study showed that investment, inflation, and road infrastructure development jointly has positive and significant effect on the economic growth. Meanwhile, partially indicating that investment and road infrastructure have positive and significant impact to economic growth, while inflation has positive sign but insignificant effect on economic growth of South Sumatra Province" even though its not only road infrastructure but it is proven that it also had a positive effect on

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economic growth (Yuliana et al., 2019). In other study cases found that "The results reveal that infrastructure had a positive effect on economic growth, whereas direct economic growth harmed income inequality. These findings demonstrate that infrastructure indirectly reduces income inequality. Thus, infrastructure development, especially basic infrastructure and transportation, could reduce income inequality in Indonesia." (Nugraha et al., 2020)

In research that title "Impact of Road Infrastructure, Education, Health And Foreign Direct Investment Towards Indonesia's Economic Growth: Level Of 33 Provinces" say that "This study analyzes the influence of road infrastructure, education, health and foreign direct investment on economic growth of 33 provinces in Indonesia in 2010-2016. This study uses panel data regression method and uses STATA 14 software. The regression estimation results showed that simultaneously road infrastructure, education, health, and foreign direct investment had an effect on economic growth of 33 provinces in Indonesia (Muryani & Amalia, 2019). Therefore because of this study focus on the island of java so infrastructure growth is also effecting economic growth in Java.

From previous research studies it can be concluded that the variables in this study are very interesting to examine. Economic growth, infrastructure growth, and HDI affect one another. This is because these variables are related to each other. So the researchers decided to take these 5 variables and the result of the previous research is not consistent.

METHOD

In this study, we will use the RANDOM Effect Model (REM) as the regression method. The independent variable is GRDP with the dependent variable namely the amount of electricity distribution, HDI, total road length, and total water distribution. The data used in this study is secondary data obtained from the Central Statistics Agency (BPS). In This research operational that researcher going to do is classic assumption which gonna consist normality test, multicollinearity test, autocorrelation test, and heteroscedasticity test. Apart from using classical assumptions, another thing to do is statistical tests that consist t test, f test and adjusted R^2 .

Regression model that going to be use is down below :

$$\text{Log}(\text{GDRP}_{it}) = \beta_0 + \beta_1 \text{Log}(\text{WTR}_{it}) + \beta_2 \text{Log}(\text{JLN}_{it}) + \beta_3 \text{Log}(\text{ELC}_{it}) + \beta_4 \text{IPM}_{it} + e_{it}$$

description :

GRDP _{it}	=	Gross Regional Domestic Product (GRDP)
WTR	=	Total volume of clean water distributed (m ³)
JLN	=	The total length of the road (Km)
ELC	=	the amount of electricity sold (Kwh)
IPM	=	Human development index
β_0	=	Constant
β_{1-4}	=	Partial coefficient of variable X
I	=	The number of districts on the island of Java
T	=	Year
e	=	Error term

RESULTS AND DISSCUSION

Dependent Variable: LOG(GDRP)

Method: Panel EGLS (Cross-section random effects)

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Date: 12/24/22 Time: 16:50

Sample: 2015 2020

Periods included: 6

Cross-sections included: 6

Total panel (balanced) observations: 36

Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.130387	2.022718	-1.547614	0.1319
LOG(ELC)	0.284717	0.110045	2.587267	0.0146
IPM	0.005752	0.013091	0.439404	0.6634
LOG(JLN)	0.126367	0.217925	0.579865	0.5662
LOG(WTR)	0.967706	0.179460	5.392315	0.0000

Effects Specification		S.D.	Rho
Cross-section random		0.366690	0.9128
Idiosyncratic random		0.113302	0.0872

Weighted Statistics			
R-squared	0.758408	Mean dependent var	1.680853
Adjusted R-squared	0.727235	S.D. dependent var	0.231757
S.E. of regression	0.121039	Sum squared resid	0.454166
F-statistic	24.32891	Durbin-Watson stat	0.850875
Prob(F-statistic)	0.000000		

Unweighted Statistics			
R-squared	0.935736	Mean dependent var	13.43061
Sum squared resid	5.069648	Durbin-Watson stat	0.076226

After doing chow test and hausman test it is determine that regression model that going to be used in this paper is Random Effect Model (REM)

Classic Assumption

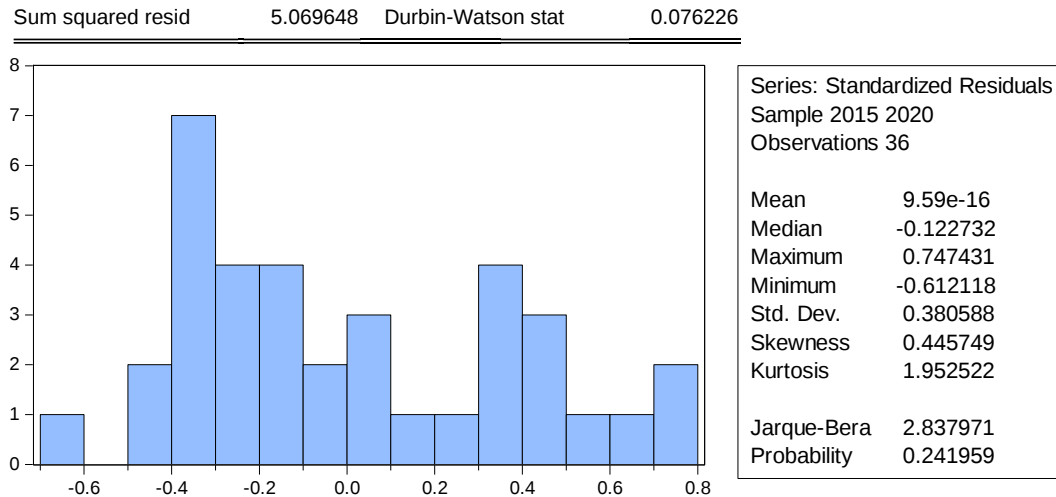
Normality Test

Graphic 1. Normality Test

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The normality test is carried out to measure whether the independent variable and the dependent variable are normally distributed. The normality test shows the Jarque-Bera Prob of 0.241959 which means it is greater than alpha 5%. So it can be concluded that the residual data is normally distributed.

Multicollinear Test

Table 3. multicollinear test

	ELC	IPM	JLN	WTR
ELC	1.000000	-0.321241	0.488632	0.690966
IPM	-0.321241	1.000000	-0.740164	-0.349643
JLN	0.488632	-0.740164	1.000000	0.726425
WTR	0.690966	-0.349643	0.726425	1.000000

multicollinear test is used to determine whether there is a correlation between the independent variables. In this result we can see that the correlation value between the independent variables is <0.85 , so there is no multicollinearity.

Autocorrelation Test

In the autocorrelation test at $n=36$ and $k=4$ with a 95% confidence level or $\alpha 0.05$ it was found that $Dl = 1.2358$ and $Du = 0.0691324$ with $Dw = 1.726536$, so $4-Du = 2.275$ and $4-Dl = 4 - 1.2358 = 2.7642$. So that we will get the results $Dw < Dl < Du < 4-Du < 4-Dl$ which means there is a negative autocorrelation. However, Gujarati (Gujarati & Porter, 2009) says that the problem of heteroscedasticity and autocorrelation of panel data can be solved with the Random effect model. In this study the model chosen was REM, so it can be concluded that the problems of heteroscedasticity and autocorrelation have been resolved.

Heteroscedasticity Test

In this study the HDI, road and water variables had a value greater than the α used, namely 0.05 or 5%, but the electric variable had a value smaller than the α used so that it could be concluded that heteroscedasticity occurred. However, Gujarati (Gujarati & Porter, 2009)

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says that the problem of heteroscedasticity and autocorrelation of panel data can be solved with the Random effect model. In this study the model chosen was REM, so it can be concluded that the problems of heteroscedasticity and autocorrelation have been resolved.

Statistic Test**Coefficient of Determination (Adjusted R^2)**

In the model, it can be seen that the R-squared is 0.758408, which means that 75.84% of GRDP is influenced by distributed clean water, distributed electricity, HDI, and road length. Then 24.16% is influenced by factors outside the model.

Statistical F test

The F statistic value is 24.32 and the value in table F is 2.68. So it can be concluded that the result is F count > F table so that distributed clean water, distributed electricity, HDI, and the length of shared roads have a significant effect on GRDP.

Statistical T test

T table = 2.03951

Electricity 2.587267 > 2.03951

HDI 0.439404 < 2.03951

Street 0.579865 < 2.03951

Water 5.392315 > 2.03951

- The electricity variable has a significant effect on the increase in GRDP
- The HDI variable has no significant effect on the increase in GRDP
 - Road variable has no significant effect on the increase in GRDP
 - The water variable has a significant effect on the increase in GRDP

DISCUSSION**1) Effect of electricity distribution on economic growth in Java**

From the results of panel data research with the Random Effect Model (REM) chosen, we can see that the results of the regression coefficient are 0.284717, the t-statistic is 2.587267, and the probability is 0.0146. To see the effect of electricity distribution on increasing GRDP in Java Island, it can be seen from the probability of 0.0146 which is smaller than the alpha (α) value used, which is 0.05 or 5% and from the t-statistic value, which is 2.59 more the value of the t table is 2.04, so from these results it can be concluded that the level of electricity distribution has a significant effect on economic growth in Java. The coefficient value of the regression is a positive value of 0.285 so that if the electricity distribution value increases by 1%, the GRDP will increase by 0.285%, assuming the HDI, JLN and WTR values are constant. The results of this study are in line with (Parulian & Mahendra, 2022) The more evenly distributed amount of electricity will reduce the gap between villages and cities. The benefits of electrical energy for human life are quite diverse, from lighting sources to meeting the needs of household activities. How not, electrical energy functions to drive electronic devices, such as refrigerators, lights, washing machines, irons, fans, and others. Electricity is not only used for the daily needs of the people, but is also used for economic activities both from a micro and macro perspective. So that the distribution of electricity is very important to increase economic growth.

2) HDI influence on economic growth in Java

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The results of panel data research with the Random Effect Model (REM) chosen, we can see that the results of the regression coefficient are 0.005752, the t-statistic is 0.439404, and the probability is 0.6634. To see the effect of the human development index (HDI) on increasing GRDP in Java, it can be seen from the probability of 0.005752 which is smaller than the alpha (α) value used, which is 0.05 or 5% and from the t-statistic value, namely 0.44 is smaller than the t table value of 2.04, so from these results it can be concluded that the level of electricity distribution has a positive but not significant effect on economic growth in Java. The coefficient value of the regression is a positive value of 0.439. The regression coefficient value is positive so that if the electricity distribution value increases by 1%, the GRDP will increase by 0.439%, assuming the HDI, JLN and WTR values are constant. The HDI has a positive value of 0.006 so that if the HDI value increases by 1%, the GRDP will increase by 0.006%, assuming the ELC, JLN and WTR values are constant.

HDI is an important indicator to measure success in efforts to build the quality of human life (community/population). HDI can determine the rank or level of development of a region/country. So, if a country has a high HDI or human development index, that country automatically has: A longer life expectancy. Indicators of high education duration. High per capita income,

3) The effect of road length on economic growth in Java

From the results of panel data research with the Random Effect Model (REM) chosen, we can see that the results of the regression coefficient are 0.126367, the t-statistic is 0.579865, and the probability is 0.5662. To see the effect of the total road length on increasing GRDP in Java, it can be seen that the F statistic value is 24.32 and the value in table F is 2.68. So it can be concluded that F count > F table and from the t-statistic value, which is 0.579865, is smaller than the t table value, which is 2.04, so from these results it can be concluded that the total road length has a positive but not significant effect on economic growth on the island. Java. The coefficient value of the regression is a positive value of 0.439. The regression coefficient value is positive 0.126 so that if the JLN value increases by 1%, the GRDP will increase by 0.126%, assuming the ELC, HDI and WTR values remain the same. The effect of the distribution of clean water on economic growth in Java.

Roads have an important role in regional development, namely to reduce disparities/gaps between regions, equitable distribution of development results through the distribution of goods/services, vital infrastructure supporting all community activities. The direct benefit of the construction of roads and bridges is to increase the smooth flow of traffic or the transportation of goods and people, especially in connecting one region to another. With the smooth flow of traffic means more time and cost efficiency.

4) The effect of clean water distribution on economic growth in Java Island

From the results of panel data research with the Random Effect Model (REM) chosen, we can see that the results of the regression coefficient are 0.967706, the t-statistic is 5.392315, and the probability is 0.0000. To see the effect of water distribution on increasing GRDP in Java, it can be seen from the F statistic value of 24.32 and the value in table F is 2.68. So it can be concluded that F count > F table and from the t-statistic value, which is 5.392315, is greater than the t table value, which is 2.04, so from these results it can be concluded that the total distribution of water has a positive and significant effect on economic growth in Java. The coefficient value of the regression is a positive WTR value

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is positive 0.968 so that if the WTR value increases by 1%, the GRDP will increase by 0.968%, assuming the ELC, HDI and JLN values are fixed.

The distribution of drinking water is very important for the community because it is not only used for daily activities but can also be used for macro and micro economic needs. With an increase in the amount of water distribution, it is hoped that the HDI will also increase. Water supply is the provision of water by public facilities, commercial organizations, community efforts or individuals, which is usually carried out through a system of pumps and pipes.

IMPLICATIONS

Based on the results of the research, the implications that can be given are:

- a) It can be seen that in order to increase overall economic growth, what needs to be considered is developments in the economic and social sectors because they have been proven to be able to increase national income.
- b) Electricity distribution is an important component for economic development because with electricity, people can use existing technology to make people's lives easier.
- c) HDI (human development index) for a region is vital because with a high level of human development, economic development will be carried out more quickly. The way to increase the HDI is by increasing the means of community mobility, improving the quality of education, and ensuring public health by increasing the number of health facilities.
- d) The increase in the length of roads in Java should not only increase the total length, but must also be accompanied by an increase in road quality. In addition to increasing the length of roads, the government also has to repair existing roads but are in a bad condition by re-paving them. Water is one of the essential needs for humans not only for household needs but also for economic needs. It is hoped that this will become a concern in terms of its availability, accessibility and equity.

CONCLUSION

Economic growth is an indication of a country's economic success. Economic growth is a process of changing economic conditions that occur in a country on an ongoing basis towards a condition that is considered better for a certain period of time. According to existing data in Indonesia itself, it is still centered on the island of Java (Java centric) so that it can be ascertained that the center of the Indonesian economy is centered on the island of Java. Many factors affect economic growth in a country including infrastructure development (water distribution, road length, and electricity distribution) and also the HDI (Human Development Index).

The country's economic growth rate is described by Gross Regional Domestic Product (GRDP). It can be concluded that with an increasing number and increasing quality of existing infrastructure and also increasing HDI, economic growth will also increase and if economic growth occurs, there will be infrastructure growth and HDI in the country. This explains that there is a causal relationship between the GRDP variables, total water distribution, HDI, total road length, and total water distribution. As previously explained, Indonesia's economic growth is centered on the island of Java, which has 6 provinces, namely DKI Jakarta, Banten, the Special Region of Jogjakarta (DIY), Central Java, West

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Java and East Java. This can be caused by several factors, but the most prominent factor is the very rapid development of infrastructure on the island of Java compared to other islands in Indonesia. An increase in the number of infrastructure will be accompanied by an increase in HDI due to the high mobility of the community, the ease of doing activities and the accessibility of vital facilities.

In this study it can be concluded that total water distribution has a positive and significant effect on economic growth, HDI has a positive but not significant effect on economic growth, road length has a positive but not significant effect on economic growth, and total water distribution has a positive and significant effect on economic growth. Through the F test it is known that the variables of total electricity distribution, HDI, road length, and total water distribution together affect economic development in Java. With this conclusion, things that can be done to increase economic income are increasing the quality and length of roads, increasing the distribution of water and electricity, and increasing the HDI by improving the quality of education and facilitating the accessibility of health facilities.

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