What are the factors that determine differing levels of environmental quality? Evidence from Java and other islands in Indonesia

by Amin Pujiati

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What are the factors that determine differing levels of environmental quality? Evidence from Java and other islands in Indonesia

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Amin Pujiati, Triani Nurbaeti and Nadia Damayanti
Department of Economics Development, Universitas Negeri Semarang, Semarang, Indonesia

Abstract

Purpose – This paper aims to identify variables that determine the differing levels of environmental quality on Java and other islands in Indonesia.

Design/methodology/approach – Using a quantitative approach, secondary data were sourced from the Central Statistics Agency and the Ministry of Environment and Forestry. The data were obtained through the collection of documentation from 33 provinces in Indonesia. The analytical approach used was discriminant analysis. The research variables are Trade Openness, Foreign Direct Investment (FDI), industry, HDI and population growth.

Findings – The variables that distinguish between the levels of environmental quality in Indonesian provinces on the island of Java and on other islands are Industry, HDI, FDI and population growth. The openness variable is not a differentiating variable for environmental quality. The most powerful variable as a differentiator of environmental quality on Java Island and on other islands is the Industry variable.

Research limitations/implications – This study has not classified the quality of the environment based on the Ministry of Environment and Forestry's categories, namely, the very good, good, quite good, poor, very poor and dangerous. For this reason, further research is needed using multiple discriminant analysis (MDA).

Practical implications – Industry is the variable that most strongly distinguishes between levels of environmental quality on Java and other island, while the industrial sector is the largest contributor to gross regional domestic product (GDRP). Government policy to develop green technology is mandatory so that there is no trade-off between industry and environmental quality.

Originality/value – This study is able to identify the differentiating variables of environmental quality in two different groups, on Java and on the other islands of the Indonesian archipelago.

Keywords Environmental quality, FDI, HDI, Industry, Population, Discriminant analysis

Paper type Research paper

Introduction

The idea behind sustainable development is a concept that balances economic, social and environmental factors. Development in developing countries, in general, sees an imbalance between high economic growth and development in other fields, especially environmental factors. However, implementation development in Indonesia has not been optimal. Its success is seen in terms of economic indicators being out of balance with other development indicators, especially environmental indicators (Fauzi and Oxtavianus, 2014). The imbalance between

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economic and environmental development in Indonesia is visible in the contrast between the island of Java and the other islands (sometimes referred to as non-Java islands). The imbalance between economic, social and environmental development mainly occurs on Java, which can be seen from the interisland environmental quality index or Indeks Kualitas Lingkungan Hidup (IKLH). According to the IKLH in 2010–2019, Java was the lowest ranked island compared to the other islands in Indonesia, with an average of 52 points, while other islands (Papua, Maluku, Sulawesi, Kalimantan, Bali and Nusa Tenggara, and Sumatra) had an average of 82 points. Based on the IKLH's categorization, a score on the index that is above 80 is considered very good, while $50 < IKLH \leq 60$ is considered not good (*Kementerian Lingkungan Hidup dan Kehutanan*, 2020). According to the IKLH categories, the average environmental index on Java is generally good whereas on the other islands the indexes are not too good.

The difference in environmental quality between Java and other islands is an important phenomenon to be researched in the context of the current plan to move the capital city of Indonesia based on Law No. 3 of 2022 concerning the state capital which relates to the capital city of Indonesia being located on the island of Kalimantan (and no longer on Java) whose predicate, based on the IKLH, is very good. Some researchers have explained that the reasons behind relocating the capital are population density, environmental degradation and urban inconvenience (Rachmawati *et al.*, 2021). Relocation of the capital will have its own consequences for environment in the future. A city that has fewer citizens will grow into a metropolitan area. Conflict between economic growth, social and environment will continue to happen (Buchori *et al.*, 2017, 2020; Buchori and Sugiri, 2016; Chen *et al.*, 2017; Sugiri *et al.*, 2011; United Nations, 2014). The outlook is that, by identifying the aspects that distinguish between environmental quality on Java and on islands other than Java, the results can become the basis for making decisions so that the quality of the environment on the other island (Kalimantan) remains very good despite the capital relocation.

Another reason that distinguishes between the environmental quality in Java and the other islands of Indonesia is the conditions affecting them are very different and unique. The contribution to gross regional domestic product (GDRP) by Java and the other islands and to gross national product (GNP) are distinct. The contribution of the industrial sector to GDRP is very different due to contrasts between the facilities and infrastructure. Java and the other islands are different in terms of population density. The denser the population, the worse the environmental quality (Oktavilia *et al.*, 2019; Pujiati *et al.*, 2018, 2019; Pujiati and Imron, 2020). The increasing population, the need for transportation, land and food cause the quality of the environment to decline (Chowdhury and Hossain, 2018; Malthus, 1798; Musse *et al.*, 2018).

There are some factors that can intervene in terms of environmental quality such as GDRP, energy consumption, population growth, literacy, urbanization rate and foreign direct investment (FDI) (Fakher and Abedi, 2017; Fakher, 2019; Hao *et al.*, 2018). FDI has a positive impact on environmental quality in developing countries but does not apply in developed countries. Trade openness can reduce the impact of carbon emissions in developed countries but does not apply in developing countries (Khan *et al.*, 2021). Economic growth, especially in developing countries, is the reason for the decline in environmental quality (Mukhopadhyay and Pani, 2022). The other influencing factor is human development index (HDI). Environmental performance and HDI are positively correlated in both developed and developing countries (Hickel, 2020; Lai and Chen, 2020).

Trade openness benefits the community and the state in terms of foreign exchange, but if there is no trade restriction regulation, it causes the entry of low-quality and high-emission energy consumption goods, thereby increasing carbon emissions (Acheampong *et al.*, 2019; Coskuner *et al.*, 2020; Kwakwa, 2020). There are different points of view regarding trade and environmental quality (Esmaeilpour Moghadam and Dehbashi, 2018; Fakher and Abedi, 2017; Soylu *et al.*, 2021), where trade can be seen as damaging the environment or as having the effect of improving environmental quality (Chen and Hu, 2020; Xie and Wu, 2021).

The industrial sector's contribution, which dominates the GDRP, on the one hand increases economic development and on the other hand decreases environmental quality. Most of it is generated from the industrial sector's contribution, which harms environmental quality such as water pollution, air pollution, land pollution and land conversion. The industry plays a vital role in environmental and ecosystem damage in an area (Shahabadi *et al.*, 2017). Industry's role in the era of globalization, with increasingly open international trade, cannot be avoided. Vural (2021) states that economic development can increase innovation and produce new inventions to build more environmentally friendly resources. The theory that explains the relationship between the industry and the environment can be explained through the environmental Kuznets curve (EKC) theory.

Lau *et al.* (2018) studied 100 developed and developing countries to examine the EKC hypothesis based on the quality of institutions, resulting in the conclusion that there is an inverse U-relationship with economic growth and carbon dioxide emissions in developed countries which is not found in developing countries. Sarkodie and Strezov (2018) found that the driving factor for carbon emissions in developed and developing countries is the economy based on agriculture, transportation, services, paradigm shifting and structure in industries in Australia, China, Ghana and the USA in 1971–2013.

The population also influences the quality of the environment. The more the population increases, the more needs there are that must be met, including housing, transportation, goods and services (Pujiati *et al.*, 2022a,b). According to Todaro and Smith (2020), population spikes have resulted in environmental degradation or the erosion of minimal natural resources. Exploitation activities that are not guided by environmental management can reduce the availability of limited resources. Population density, energy and mining activity and fossil exploration can increase CO_2 production (Heidari *et al.*, 2015; Jebli *et al.*, 2017; Wang *et al.*, 2018; Yahaya and Hussaini, 2020). The increase in population will increase the demand for land clearing for housing (Ohlan, 2015; Rahman, 2017).

The quality of the population can be seen from the human development index. The ability of human resources to engage in the production process will determine the results, which will later become the endowment factor of a country's comparative advantage. The higher the HDI value in an area, the better the quality of human resources there. Increased knowledge and duration of education, income per capita and health are essential factors in preserving the environment (Shahabadi *et al.*, 2017). Increasing human capabilities can be used as capital in processing resources to be more efficient and produce outputs that are more environmentally friendly.

There are still differences between the research results related to factors that affect environmental quality, the openness factor, FDI, the industry, population and HDI which are currently unavoidable by countries globally; it is crucial to research factors that affect environmental quality. The difference between this and previous research is that previous research tends to focus on HDI as the indicator variable. Previous research has examined the HDI indicators separately such as levels of education, health and literacy. Indicators of impact on the environment, such as education (Garnawat *et al.*, 2017; Imamoglu, 2018; Mujan *et al.*, 2019; Vilcekova *et al.*, 2017), health (Alola and Kirikkaleli, 2019; Zomorrodi and Zhou, 2017) as well as literacy rates (Musse *et al.*, 2018) on environmental quality. Arisman (2018) found that HDI reflects the quality of HR by showing the fixed effect model on population and GDP per capita affects HDI rankings in Association of Southeast Asian Nations (ASEAN) countries.

The novelty that the researcher is seeking to present is regarding the views that exist on the island of Java and on the other islands are attached to variables that can affect the ability of the region to be more responsive to the environment related to them using secondary data with coverage throughout Indonesia. The discriminant analysis tool has two categories; the first is the dependent variable, namely, the quality of the environment on Java and on other islands, which can provide a more detailed and helpful discussion for policymaking. Discriminant analysis is used to identify two different groups (Stella, 2019), for example,

based on the category of loyal and non-loyal consumers (Isliko, 2016), and based on economic status (strong or weak) (Egbo and Bartholomew, 2017). This research aims to identify what factors differentiate between the levels of environmental quality of provinces on the island of Java and on the other islands.

Literature review

Impact of trade openness on environmental quality

Trade openness has a connection and will influence FDI (Burange *et al.*, 2019; Djulius, 2017; Makoni, 2018; Rakshit, 2022; Rathnayaka Mudiyanselage *et al.*, 2021). Kumari *et al.* (2021) found that there was a long term causal connection between FDI, trade openness and economic growth in India and FDI and trade openness influenced both ways.

Trade openness and FDI in a country where investment circulates will influence the whole ecosystem (Le *et al.*, 2016; Oktavilia and Firmansyah, 2016; Tran and Do, 2021). This idea leads to the hypotheses of the pollution halo and pollution haven through the EKC. According to Tran and Do (2021), trade openness and FDI caused environmental degradation in Malaysia and Indonesia in the long term but not in Thailand. Le *et al.* (2016) found that trade openness impacted positively in high-income countries, but had a negative impact in low and middle income countries. Ali *et al.* (2020) found that by using trade openness, FDI and institution performance as variables influencing the environment found that there was a positive relationship between trade openness and urbanization in terms of the ecological footprint but found no relationship with institution performance.

Impact of FDI on environmental quality

Simon Kuznets, using his EKC, stated that economic activity will destroy the environment but when the income increases, the demand for environmental treatment will rise with the availability of sources of investment (Isiksal, 2021; Isiksal *et al.*, 2019). The validity of EKC was demonstrated in Indonesia and China (Sarkodie and Strezov, 2019).

In another theory, investment-based economic growth is tested with two hypotheses, namely, the pollution haven hypothesis and the pollution halo hypothesis (Adeel-Farooq *et al.*, 2021). The two hypotheses are still closely related to the EKC: the pollution haven hypothesis states that tighter environmental policies at home and looser ones abroad cause developed countries to move industries that harm the environment to more developed countries, causing developing countries to become "pollution havens" for pollution-intensive industries (Bulus and Koc, 2021; Guzel and Okumus, 2020; Sarkodie and Strezov, 2019; Singhania and Saini, 2021; Ur Rahman *et al.*, 2019). On the other hand, developed countries transfer technological progress, environment-based FDI and better environmental standards to developing countries which are incorporated into the pollution halo hypothesis, so that FDI from developed countries can improve environmental quality in developing countries (Balsalobre-Lorente *et al.*, 2019; Mert and Caglar, 2020; Oktavilia *et al.*, 2019; Pujiati *et al.*, 2020b).

The impact of industry on environmental quality

According to Febriana *et al.* (2019), the production process in the industrial sector produces liquid and solid waste that can pollute the environment. This is endorsed by Shahabadi *et al.* (2017) who explain that industrial activities will increase the use of vehicles that produce emissions in the air, and the disposal of waste that can harm ecosystems in an area. The study was supported by Cui *et al.* (2020) who state that industrial growth causes environmental damage. However, according to Fibrianto (2018), an increase in activity in the industrial sector will increase a country's GDP revenue, and this will affect the increase in financing for environmental management.

The impact of population on environmental quality

According to Han *et al.* (2018) and Pujiati *et al.* (2020a, b), human population plays an important role in increasing Particulate Matter (PM) 2.5 pollution. In his research, Ghanem (2018) found that an increase of 1% of the population led to a 2.4% increase in pollution and an increase in pollution caused a decrease in health which led to a decrease in labor productivity. Population has other impacts besides the environment including poverty and economic growth. Nabi *et al.* (2020) found that there is a positive relationship between poverty levels and carbon emissions in 98 developed and developing countries.

The impact of HDI on environmental quality

Using the HDI is one way to view the quality of human life in a country based on life expectancy, education and health. Several studies have shown that life expectancy, education and health are influenced by the quality of the environment (Ghanem, 2018; Han *et al.*, 2018; Hossain and Chen, 2021; Joof and Isiksal, 2021; Nabi *et al.*, 2020). According to Ladi *et al.* (2021), water quality can have an effect on HDI. Li and Xu (2021) studied the environmental damage index (EDI) and HDI in provinces in China found that environmental damage causes a delay in economic growth and every 0.01% increase in environmental damage reduces GDP by 3.15%.

Methods

Type and source of data

This study uses a quantitative research approach. The data used are secondary data sourced from the Central Statistics Agency and the Ministry of Environment and Forestry. The analytical method is discriminant analysis which is used to build predictive models for each group. In this research, two groups are studied: a group of provinces located on the island of Java and a group of provinces on other islands (outside Java). Discriminant analysis requires a combination of linear derivatives between two or more variables that will discriminate against each other through the groups that have been developed (Keskin *et al.*, 2020). A simple linear discriminant function converts the sample size to the discriminant value (Ismail *et al.*, 2016).

Variables and operational definitions

The variables used are the environmental quality index (IKLH), trade openness (TO), foreign investment (FDI), industrial output (IND), population growth (POP), and Human Development Index (HDI) in 33 provinces in Indonesia. IKLH is measured using three components comprising indexes for water quality, air quality and land cover with units expressed as a percentage. Trade openness (TO) is measured by adding the number of exports and imports divided by GDRP as a percentage. FDI is measured by direct investment by foreign parties in units of US$ millions. IND is measured by the total contribution of the industrial sector to GDRP in billions of rupiah. POP is measured by calculating the change in population compared to the previous year in percentage. HDI is measured from education, health and a decent standard of living in an index expressed as units.

Model and analysis steps

The equation for the estimation of the discriminant function in the two groups in this study uses the discriminant model (Hair, 1998; Vazquez-Brust and Plaza-úbeda, 2021; Wang *et al.*, 2013):

$$Zjk = a + W_1X_{1k} + W_2X_{2k} + \ldots + W_nX_{nk} \quad (1)$$

noted as follows:

Zjk = discriminant Z score of discriminant function j for Object k,

A = intercept,

W*i* = discriminant weight for the independent variable *i and*

X*i*k = the independent variable *i* for the object

or the discriminant function equation can be calculated from the standardized value as follows:

$$Dj = DI1Z1 + DIZz2 + \ldots.. + dipzp \quad (2)$$

An individual's standardized score on the *i*th discriminant function (D*i*) is found by multiplying the standardized score on each predictor (z) by its standardized discriminant function coefficient (d*i*) and then adding the products for all predictors (Stella, 2019).

To test whether there is a significant difference between the two groups in Java and non-Java, it can be done using Wilk's lambda test statistic and can be converted into an F ratio. If the significance of the F ratio < 0.05 then the discriminant variable can be used to form the discriminant model and vice versa. The reason for using Wilk's lambda as a test in discriminant analysis is because the method used is robust (Alrawashdeh and Radwan, 2017).

To test the differences between the two groups of environmental quality in Java and outside Java for all variables, the chi square was used together. If the chi-square significance value is < 0.05, then the discriminant functions for the two groups are significantly different and vice versa. The next step is to test how big and meaningful the difference between the two groups can be seen from the value of the square canonical correlation (CR^2). CR^2 is identical to R^2 in the regression that measures the variation between the two groups of environmental quality in Java and non-Java which can be explained by discriminant variables.

Result and discussion

This section will identify factors that determine the different quality of the environment in provinces of Java and on other islands. There are several stages of analysis, the first being descriptive statistics. According to descriptive statistics, the average trade openness, foreign investment, industrial sector output, population growth and human development index in provinces of Java (Code 1) are higher than those in provinces outside Java (Code 0). These even exceed the average in Indonesia (Table 1). Foreign investment and the output of the industrial sector in the provinces of Java are very different. Foreign investment in Java Island averaged US$ 2,517 million, whereas provinces outside Java averaged US$ 451 million, and provinces in Indonesia averaged US$ 826 million. This shows that better infrastructure and facilities in the provinces of Java are more attractive for foreign investors. The average foreign investment is in line with the average contribution of industrial output to GDRP.

Second, the test of equality of group means all variables FDI, IND, POP and HDI are significant other than the trade openness variable. This test shows that in addition to trade openness, it can be used to form the discriminant variable because the significance value is > 0.05 or 0.493 (Table 2). Wilk's lambda test was used. Based on the CR value of 0.796 or CR^2 of 0.633, it can be concluded that 63.3% of the variation between the groups of provinces in Java and outside Java can be explained by the discriminant variables of trade openness, foreign investment, industrial sector output, population growth and human development index.

Third, compiling the discriminant function estimation equation the equations can be arranged based on the output canonical discriminant function coefficient (Table 3). The discriminant function equations are as follows:

Island		Mean
0	TRADE	50.1516
	FDI	451.0960
	IND	22,507.5365
	POP	2.0526
	HDI	67.1203
1	TRADE	55.1307
	FDI	2,517.0024
	IND	243,102.3479
	POP	1.4357
	HDI	71.8652
Total	TRADE	51.0569
	FDI	826.7154
	IND	62,615.6840
	POP	1.9404
	HDI	67.9830

Table 1. Average trade, FDI, the industry, population growth and the human development index on Java (1) and outside Java (0)

	Wilks' lambda	F	df1	df2	Sig.
TRADE	0.998	0.472	1	229	0.493
FDI	0.591	158.752	1	229	0.000
IND	0.437	295.499	1	229	0.000
POP	0.978	5.263	1	229	0.023
HDI	0.823	49.197	1	229	0.000

Table 2. Tests of equality of group means

$Z = -8.586 + 2.22E\text{-}04\ FDI + 1.00E\text{-}05\ IND - 0.114\ POP + 0.118\ HDI$ or can be written in the form of an equation where the coefficients have been standardized based on the calculation of Equation (2) (as follows):

$$D = 1.35E\text{-}03\ FDI + 6.09E\text{-}05IND - 0.695POP + 0.719HDI$$

The variable of international trade openness is not a differentiating variable for the quality of the environment on Java and outside Java; therefore, it is no longer included in the discriminant equation.

Based on Wilk's lamda value (Table 4) of 0.367 or the same as the chi square of 227.329 with a significance at 0, the average discriminant score in the two groups of provinces of Java is the average discriminant score, and outside Java is significantly different. Although statistically, the difference between the two groups of provinces of Java and outside Java is significant, the difference is not significantly large. The next step is to test how big and meaningful the difference between provinces of Java and outside Java can be seen from the Square Canonical Correlation (CR^2).

Based on the CR value of 0.796 (see Table 5) or CR^2 of 0.633, this value correlates with Wilk's lambda where it was obtained by (1-0.633 = 0.367) in Table 4, it can be concluded that 63.3% of the variation between the groups of provinces of Java and outside Java can be explained by the discriminant variables of trade openness, foreign investment, industrial sector output, population growth and development index human.

Fourth, examining the contribution of each variable to form the discriminant function the contribution of each variable in the discriminant function can be seen from standardized canonical discriminant function (Table 6). Standardized coefficients are used to assess the relative importance of discriminator variables in forming discriminant functions. The higher

the standardized coefficient, the more important the variable is to other variables and vice versa. According to Table 6, industrial output has the most significant contribution as a variable that differentiates environmental quality in the provinces of Java and those outside Java at a value of 0.788 followed by a human development index of 0.468, FDI of 0.213, population growth of 0.179 and trade openness of 0.042.

The structure matrix table (Table 7) is another way of indicating the relative importance of the predictors. The loading value of the discriminator variable is the correlation between the discriminant score and the discriminator variable, and the loading value is between +1 and −1. The closer to 1 the absolute value of loading is, the higher the commonality between the discriminant variable and the discriminant function and vice versa. Generally, a factor

Table 3. Canonical discriminant function coefficients unstandardized

Variable	Function
TRADE	−0.001
FDI	2.22E-04
IND	1.00E-05
POP	−0.114
HDI	0.118
Constant	−8.587

Table 4. Wilks' lambda

Test of Function(s)	Wilks' lambda	Chi-square	df	Sig.
1	0.367	227.329	5	0.000

Table 5. Eigenvalues

Function	Eigenvalue	% of variance	Cumulative %	Canonical correlation
1	1.728[a]	100.0	100.0	0.796

Note(s): [a]first 1 canonical discriminant functions were used in the analysis

Table 6. Standardized canonical discriminant function coefficients

Variable	Function
TRADE	−0.042
FDI	0.213
IND	0.788
POP	−0.179
HDI	0.468

Table 7. Structure matrix

	Function 1
TRADE	0.035
FDI	0.633
IND	0.864
POP	−0.115
HDI	0.353

loading of 0.3 is seen as the cut-off between important and less important variables. According to Table 7, industrial output has the most significant contribution as a variable that differentiates environmental quality in the provinces of Java and those outside Java at a value of 0.864 followed by a foreign investment of 0.633, human development index of 0.353, population growth of 0.115 and trade openness of 0.035.

The contributions that differentiate environmental quality on Java and the other islands are industrial output, FDI, HDI and population growth. The variable that does not make a difference is the trade openness of each research area. The variable FDI and industrial output differ between Java and the other islands because the foreign investment that enters Indonesia regarding mining and natural products is diverted to outside Java, while the industrial and manufacturing sector investment tends to enter Java. This finding is consistent with research by, Chandran and Tang (2013) and Zhang *et al.* (2020). In addition, the distribution range of industrial output in Java is much easier due to the relatively more complete infrastructure than what exists outside Java. This is a significant differentiator considering that the order of the highest differentiators is industrial output and FDI.

According to the Investment Coordinating Board, from 2014 to 2015, FDI in Indonesia increased by 20% (Sjöholm, 2016). Several factors driving the increase in FDI in Indonesia were energy consumption, trade openness and the rupiah exchange rate (Djulius, 2017). The convenience is obtained when the regional government and the central government are open economically and to investment, namely, the emergence of new job opportunities that can absorb labor, increased human resource capabilities and broader market access because investment openness opens new markets in the surrounding area.

Furthermore, the HDI variable causes differences in environmental quality between Java and the other islands. The HDI factors are in the aspects of health, education and literacy. Several studies show that the more evenly distributed the facilities and infrastructure for education, health and equitable access to public facilities are in an area, the better the HDI score; furthermore, adequate infrastructure that accommodates the community can rectify damage to the quality of the environment in the area (Dipeolu and Ibem, 2020; Hewitt *et al.*, 2019; Mamirkulova *et al.*, 2020; Shen *et al.*, 2020; Tomson *et al.*, 2021).

In BPS data, the local literacy rate in Java Island was above 90 in 2020, with the lowest rate found in East Java Province at 92.5 and the other islands having an average score above 92 except for Papua and West Nusa Tenggara Provinces (*Badan Pusat Statistik*, 2021). However, policymakers should note that infrastructure that does not pay attention to the AMDAL assessment will result in environmental damage. This means that not all excessive infrastructure will have a positive impact on society and the environment, such as initiating road infrastructure, which reduces land and forests as environmental ecosystems of flora and fauna (Bebbington *et al.*, 2018; Erbaugh *et al.*, 2020; Sloan *et al.*, 2018).

Unequal access and availability of facilities will exacerbate poverty, inequality and reduce government revenues. The population growth variable is the last differentiating factor between Java and outside Java. This is because the growth and population density on Java is much faster than that on other islands. The increasing population growth will have an impact on the carbon footprint and the amount of CO_2. Natural resources, energy consumption and population are several factors that can affect environmental quality (Aslan *et al.*, 2018; Bildirici, 2017; Destek *et al.*, 2018).

According to Muryani and Pamungkas (2018), unemployment is a factor that affects national development and the level of social welfare. Unemployment has a relationship with the low capacity of human resources. This is also mentioned by Fahrika *et al.* (2020) who state that the causes of the low quality of human resources include the poor conditions and quality of education. In a comparison between Java and other islands, there will be inequality that occurs, and it does not mean that this inequality cannot be anticipated with the indigenous values and culture of the community to continue to preserve the surrounding environment.

An example of this happening was when the indigenous local values of the tribes outside Java (Tobelo and Sariga) and on the island of Java (Baduy) still uphold the values of environmental conservation (Arifin *et al.*, 2021; Asteria *et al.*, 2021; Saidiman *et al.*, 2020).

The population is the weakest factor in influencing differences in environmental quality on Java and outside Java. It is the lowest on a numerical scale and has a negative symbol, which means that it does not have a differentiating impact on the environment on Java and outside Java. Meanwhile, if you look at previous research, an increasing population in one area will also worsen the quality of the environment in that area (Adams and Acheampong, 2019; Ohlan, 2015; Rahman, 2017; Rahman *et al.*, 2017). The quality of the environment is determined by carbon emissions, and one way to look at the factors driving the production of carbon emissions is population growth which includes urbanization, the age structure of the community and the rate of population growth (Abdelfattah *et al.*, 2018; Chekouri *et al.*, 2020; Dimnwobi *et al.*, 2021; Li *et al.*, 2019; Wang *et al.*, 2013). With this anomaly in the results, it is necessary to examine it through future research on population growth and urbanization and their relationship with the quality of life.

Conclusion

This research examines the factors that differentiate between Java and the other islands in terms of environmental quality in 33 provinces in Indonesia during the 2011–2017 period. This test is done by determining the variables that affect the environmental quality index – trade openness, industrial output, FDI, HDI and population growth. The decisions about variable selection are based on the environmental quality index issued by the Indonesian Ministry of Environment and Forestry and from previous research. This research indicates that trade openness implemented in Java and on other islands does not make a difference in environmental quality in the two research areas. Other variables are factors that differentiate the environmental quality between Java and other islands.

Practical implications

Although the difference between Java and the other islands can be reduced, it will take quite a long time to make changes on a massive scale, especially in the variables of industrial output, FDI, HDI and population growth. There is a need for schemes and planning to determine environmentally friendly economic strategies to create equality between regions. Industry is the strongest variable that distinguishes between the environmental quality on Java and the other islands while GDRP is the largest contributor. Government policy needs to develop the industry so that it uses green technology innovation in order not to make trade-off between the industry and environmental quality (Vural, 2021 dan Kalayci, 2021) (Beşe and Kalayci, 2021; Vural, 2021).

Limitations and future research agenda

This study only identified the differentiators of environmental quality based on two categories for Java and the other islands of Indonesia. Subsequent research could examine more than two categories, especially the environmental quality categorization based very good, good, moderately good, poor and dangerous by using multiple discriminant analysis (MDA).

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Corresponding author
Amin Pujiati can be contacted at: amin.pujiati@mail.unnes.ac.id

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