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The Effect of Regional Expenditure, Population Density, HDI, and ICT-DI Toward Environmental Performance Index of 34 Provinces in Indonesia

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Abstract

This study aims to analyze the effect of Regional Expenditure, population density, HDI, and ICT-DI on the Environmental Performance Index of 34 provinces in Indonesia 2017-2021. The method of this study used panel data regression with Fixed Effects Model approach using Generalized Least Square. Cross sections of this study are 34 provinces in Indonesia with time series from 2017 to 2021 (5 years). Variables in this study consist of independent variables, such as Regional Expenditure, population density, HDI, and Information and Communication Technology Development Index (ICT-DI), and Environmental Performance Index as dependent variable. The results of this study indicate that all variables affect the Environmental Performance Index simultaneously. In partial effect, variables of Regional Expenditure and population density have negative and significant effect on the Environmental Performance Index. While HDI and ICT-DI partially have positive and significant effect on the Environmental Performance Index using significance level of 5%.

Keywords: Environmental Performance Index, Regional Expenditure, Population Density, HDI, ICT-DI

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INTRODUCTION

The industrial revolution kept the economy moving at a fast pace. Advances in industrial technology have led to a wider distribution of wealth. The increase in industrial production capacity has increasingly pushed the trade sector to international territory. Until now, development continues to be carried out in order to meet the needs and demands. Economic development is the main pillar for the

success of a country, but on the other hand, development is also a big problem that must be faced, especially the impact of the development process on environmental quality (Febriana, 2019).

Development which is exploitative and uncontrolled will have a negative impact on the environment. Therefore, through the general assembly of the United Nations (UN) in September 2015, a development agenda was agreed, namely the 2030 Agenda for Sustainable Development Goals (SDGs). SDGs generally aim to meet the needs of the present without compromising meeting the needs of future generations. There are four pillars that underlie the criteria for realizing this agenda, namely the pillars of social development, pillars of economic development, pillars of environmental development, and pillars of legal and governance development. The environmental aspect is very important because it functions as a support for all life. Even though it is divided into four pillars, in practice they are interrelated and mutually supportive.

Sustainable development is in line with the plans of the Indonesian government contained in the 2015-2019 RPJM where the development of natural resources and the environment is directed into two groups, the development of natural resources that support economic development and improving the quality and sustainability of the environment (Wiyekti, 2021).

Starting from the demands of the reform period, Indonesia used the principle of regional autonomy based on Law no. 22 of 1999 regarding Regional Government and Law no. 25 of 1999 regarding Financial Balancing. Until now the implementation of regional autonomy in Indonesia has entered a new era after the enactment of Law No. 32 of 2004 regarding regional government and Law No. 33 of 2004 regarding financial balance between the central and regional governments. Regional governments can manage and utilize the existing resources in their respective regions according to the programs that have been prepared.

All economic activities carried out by the community have positive externalities in fulfilling needs and demands, and impact on increasing welfare. However, these economic activities are inseparable from negative externalities, such as the decline in the quality and quantity of natural resources, damage to ecosystems, and environmental degradation.

The government through the Ministry of Environment and Forestry (KLHK) issues a report on the Environmental Performance Index (EPI) every 1 year. The Environmental Performance Index can reflect the extent to which a region's development relates to the environment and can be used as an evaluation material for sustainable development policies.

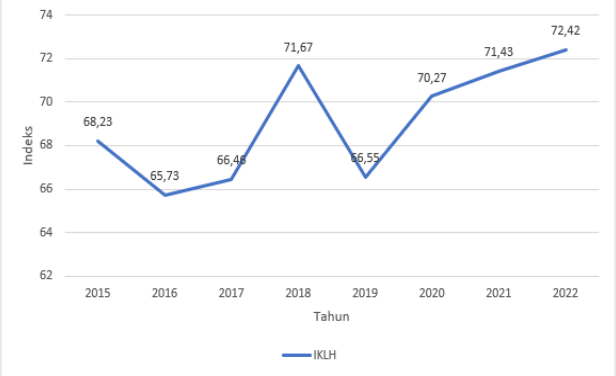

Figure 1. National Environmental Performance Index 2015-2022

Source: Indonesian Ministry of of Environment and Forestry

Based on Figure 1. it can be seen that the EPI trend fluctuates nationally. The national EPI

calculation consists of the calculation of all provincial level EPI according to the formula set by the KLHK. The value of the provincial EPI will affect the value of the national EPI. The more provinces with high EPI scores, the higher EPI scores at the national level will also be.

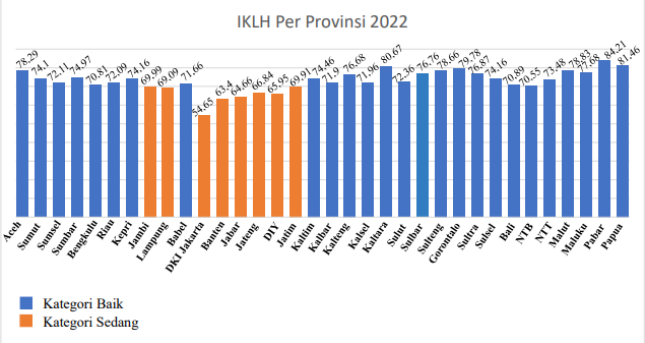

Figure 2. 2022 Provincial IKLH Scores
Source: Ministry of Environment and Forestry

Based on figure 2 in 2022 most provinces in Indonesia have a good EPI category, while the others are in the moderate category. Even though EPI has increased in most provinces, environmental improvements must continue to be carried out because environmental degradation still occurs. A total of 17 provinces has EPI scores below national EPI, as 72,42. Meanwhile, from the index value of each indicator, there is still a significant gap.

In 2022 the value of the Air Quality Index (IKU) for all provinces has an average value of 89.16 where 33 provinces are in the good category and the lowest score is DKI Jakarta with 68,05 points in the moderate category. Meanwhile, the average value of the Water Quality Index (IKA) is 53.72, where most provinces are in the moderate or even low category, DI Yogyakarta is the lowest score with 39,31.

There is a big difference in the Land Quality Index (IKL), North Kalimantan, Papua and West Papua have the highest score of 100, while the province with the lowest IKL is DKI Jakarta with 27,07 points. A total of 22 provinces has an IKL below 70 where 11 provinces are in the moderate category, and 11 provinces are in the low category.

The Sea Water Quality Index (IKAL) in 33 provinces is in the good category with a score of more than 70 and the average score for all provinces is 84,82. While West Kalimantan is the province with the lowest IKAL score 63,3 point. Even though it is categorized as good, coastal areas, beaches and seas are inseparable from the pollution that occurs due to the contamination of various hazardous substances. Based on Insider (2018) Kuta Beach is one of the dirtiest beaches in the world.

In line with the existence of regional autonomy, the regional government has authority in regional development planning, including in tackling environmental degradation. The Regional Revenue and Expenditure Budget is a policy instrument that serves as a guideline for local governments in implementing programs to realize regional development.

Regional Expenditures or Regional Expenditures play an important role in driving economic growth. Differences in potential resources in each region oblige local governments to make policies as well as a challenge to create efficiency and achieve goals in various aspects including the environment.

Java Island in general is an island with a high level of environmental degradation. The ratio of the population of Java is 56.1% of the total 270.2 million population of Indonesia. Population density is also a cause of environmental degradation because demand will increase for both primary needs such as food,

shelter, and other secondary needs. Management of these resources will lead to various wastes such as liquid waste which, if not managed properly, will contaminate soil and water.

Noeraga et al. (2020) in his research stated that population growth and rapid physical development have resulted in very high land conversion in Jatinangor and have affected the quality of household clean water. Waste generated by industry and households will generate waste and leave contaminants because of the use of products to fulfill needs.

The level of welfare also influences people's consumption patterns because households with lower welfare levels will prioritize their primary needs. Meanwhile, people with a higher level of welfare have more opportunities and higher purchasing power for environmentally friendly products.

Improvement in the macro economy will provide opportunities for expanding employment opportunities so that the wheels of the economy in society will also run, thereby increasing people's income. Products with good quality tend to have higher prices, therefore there are cheaper products to meet people's demand. However, the result of this request can cause problems, for example, there are products that do not meet standards so that they are easily damaged and ultimately contribute to waste.

For primary needs such as food, organically managed vegetables tend to be more expensive because the cultivation process takes longer and pays more attention to the quality of each production component, namely land, seeds, water, fertilizer, and pest management by avoiding synthetic chemicals. Meanwhile, agriculture with the use of chemical fertilizers and pesticides in the long term will cause damage to the land and the surrounding environment. Riyanti et al (2022) in their research showed that the use of pesticides had a significant effect on increasing the concentration of mercury in water in the Sumur Beremas River, Jambi Province, with the largest correlation of runoff from agricultural areas to irrigation flows.

Preference of environmentally friendly products is also influenced by the level of awareness of the community. Increasing environmental knowledge and environmental awareness will increase interest in buying environmentally friendly products (Arlanti & Suryanto, 2019). In realizing sustainable development human development is an important factor because good human resources will think more about the positive and negative impacts of each activity carried out.

The government issues the Human Development Index (HDI) every year based on the index established by the United Nations Development Program (UNDP) in 1990. HDI is an indicator of a country in measuring development achievements in the quality of human life which consists of aspects of education/knowledge, health aspects, and decent standard of living. Wiyekti (2021) in his research on 33 provinces in Indonesia in 2011-2015 shows that the HDI and the EPI have a negative influence relationship.

Meanwhile Ramadhantie et al (2021)'s research regarding the effect of HDI on EPI in 34 provinces in Indonesia in 2016-2018 had the result that HDI had a significant effect on EPI with a positive relationship. Meanwhile, Pujiati et al (2023) in their research suggested that education level did not have a significant effect on the Environmental Performance Index with a positive relationship.

Beside of government programs, environmental awareness by the community can also become a driving agent to preserve the environment and reduce the level of environmental degradation, such as the Pandawara Group, which is an environmental activist and is able to influence public to participate in environmental activities. The participation of the local community in activities initiated by the Pandawara Group is inseparable from the influence of the internet or social media. The Internet has become an important necessity in everyday life. People use the internet to work, study, access various digital platforms, and socialize with one another (Statistics Indonesia). The role of information and communication technology in improvement of environment is to spread the information on environmental issues to increase environmental awareness among the public.

The government issues an Information and Communication Technology Development Index (ICT-DI) as an illustration of ICT development in a region and can be compared with other regions. The ICT-DI trend from 2017 to 2021 is positive. Increasing ICT-DI can have a positive influence toward the environment. The role of ICT in the environmental awareness education can be seen from the emergence of various e-learning platforms that cover distance learning about environmental science to sustainable practices and social media including activists and influencers who also provide environmental campaigns that have an impact on increasing environmental activist communities.

Utilization of technology in environmental monitoring in real time with sensors in various areas that can detect several environmental parameters, such as temperature, humidity, air quality, and others. The open data of information regarding the environment and easy access to it make the public easier to understand the latest environmental conditions and can be used as material for formulating more effective solutions in environmental preservation programs by government. Improvement in ICT-DI helps develop start-ups or application-based start-ups engaged in waste management.

Based on the explanation above, this study aims to find out how the influence of Regional Expenditure, population density, HDI and ICT-DI toward EPI of 34 Provinces in Indonesia in the period 2017 to 2021.

RESEARCH METHODS

This study uses a quantitative research approach and uses statistical formulas to help analyze the data and facts that have been obtained. Quantitative data is processed with determinant analysis in the form of regression. Determinant analysis is an analysis carried out to find out which independent variables have the most influence on the research problem or the dependent variable.

This research uses panel data regression run on Eviews 12 software. This study uses time series data for 5 years, from 2017 to 2021, and cross section data of 34 provinces in Indonesia. In this study EPI became the dependent variable while there were 4 independent variables used, those are Regional Expenditures, population density, HDI and ICT-DI. The panel data regression analysis model in this study is as follows:

$$LOGYit = \alpha + \beta 1LOGX1it + \beta 2LOGX2it + \beta 3LOGX3it + \beta 4X4it + eit$$

Where LOGY is Logarithm of Y (EPI), α is Constanta, β is Coefficient of each independent

variable, LOGX1 is Logarithm of X1 (Regional Expenditure), LOGX2 is Logarithm of X2 (population density), LOGX3 is Logarithm of X3 (HDI), X4 is ICT-DI, e is Error term, i is Cross section 34 provinces and t is research period (2017-2021)

RESULTS AND DISCUSSION

Table 1. Result of Fixed Effect Model Generalized Least Square

Variable	Coefficient	Probability	Information
C	1,213907	0,0015	Significant
LOGX1	-0,099929	0,0115	Significant
LOGX2	-0,147831	0,0321	Significant
LOGX3	0,507925	0,0119	Significant
X4	0,015690	0,0055	Significant

Source: Output Eviews 12, processed data

Table 1 shows the estimation results used in this study is the Fixed Effect Model with cross section weight and white covariance coefficient. The fixed effect model with the GLS method is used to overcome autocorrelation and heteroscedasticity problems (Reed & Ye, 2011). The regression coefficient values for each research variable are as follows:

LOGY = 1,213907 - 0,099929(LOGX1) - 0,147831(LOGX2) + 0,507925(LOGX3) + 0,507925(LOGX3) + 0,015690(X4) + e

The regression results in this study state that the Regional Expenditure variables have a negative and significant relationship to the Environmental Quality Index (IKLH) of 34 provinces in Indonesia in the 2017-2021 period with a regression coefficient of -0.099929 with a probability value of 0,015 < 0,05. If Regional Expenditure increases by 1%, it will reduce the IKLH index in 34 provinces in Indonesia by 0.099929 in the 2017-2021 period assuming ceteris paribus.

This shows that the increase in Regional Expenditure in 34 provinces in Indonesia in 2017-2021 has not resulted in improving environmental quality. This research is in line with research from Mohammed et al (2019) that government spending has a positive impact on environmental degradation.

Based on the Environment Kuznets Curve (EKC) hypothesis, it shows that currently Indonesia has not reached a point where an increase in welfare, which is proxied by the amount of regional expenditure, will lead to an improvement in the environment. Indonesia is currently still in a condition where increased welfare still has an impact on increasing environmental degradation.

Budget allocation in Regional Expenditure need to be encouraged to apply more sustainable principles and support efforts of environmental improvement so that the government's goals on sustainable development can be achieved and have a positive impact on society not only in the present but also in the future.

The regression results in this study stated that the population density variable had a significant effect negatively to EPI in 34 provinces in Indonesia in the 2017-2021 period. The probability value of the population density variable is 0,0321 less than an alpha of 0,05 and the coefficient value is -0.147831, it means that an increase in population density by 1% will reduce the EPI by 0,14781 assuming ceteris paribus.

The increase of population in an area will increase the burden on the environment in that area due to demands for goods and services to fulfill the needs of society. With the excessive exploitation of natural resources in the area, the

quality of the environment decreases. This is reflected in data showing that the province with the highest population density, that is DKI Jakarta, has the lowest EPI.

The results of this study are in line with other studies that have been conducted by Pujiati et al (2023), and Wiyekti (2021) which explain that population density has a significant effect on environmental quality with a negative relationship. However, in research conducted by Orchidea et al (2016) explained that population density has a significant effect on environmental quality with a positive relationship.

Meanwhile, the results of research by Yuda & Idris (2022) explain that population density has a positive and insignificant effect on environmental quality in Indonesia. Population policies need to be formulated carefully to stabilize population growth and urban decentralization to achieve sustainable development (Rahman, 2017).

Cities with low levels of development and high population density have few green open spaces (Bille et al, 2023). Green open space is one of the environmental indicators in the Land Quality Index. The ecological function of green open space is as the lungs of the city produce oxygen and absorb pollution and becomes a water catchment area.

The results in this study stated that the HDI variables had a significant positive effect on EPI in 34 provinces in Indonesia in the 2017-2021 period. The probability value of the HDI variable is 0,0119 which is less than the alpha of 0,05 and the coefficient value is 0,507925. If there is an increase in HDI by 1%, the EPI will increase by 0,507925 assuming ceteris paribus.

An increase in the HDI in 34 provinces in Indonesia can have an impact on improving the environment. This study differs from the findings of Wiyekti (2021) and Ramadhantie et al (2021) in their research that the HDI has a significant negative effect on the EPI in Indonesia. Bille et al (2023) in his research suggested that HDI has a significant effect on green open space.

Increasing public knowledge and awareness of the importance of environmental quality can make demand to government to provide public services to fulfill the needs of green open spaces in realizing a sustainable city. The results of this study state that the ICT-DI variable has a positive and significant influence on EPI.

The probability value of the ICT-DI variable is 0.0014, less than alpha 0.05 and has a coefficient of 0.115610, which means that if ICT-DI increases by 1%, it will increase EPI by 0.115610 assuming ceteris paribus. This research is in line with the results of research by Higon et al (2017) which explain that increasing ICT development has an impact on reducing carbon emissions.

By reducing the level of carbon emissions, the quality of the environment will increase. Increasing the ICT-DI must be carried out because the use of technology in this case is information and communication technology (ICT) has a positive impact on improving environmental quality. Utilization of ICT in monitoring environmental indicators can make environmental improvement programs more efficient.

CONCLUSION

Based on the description that has been disclosed, it can be concluded that: Regional Expenditures have a negative and significant impact on the EPI of 34 provinces in Indonesia in 2017-2021. When Regional Expenditure

increases, the EPI will decrease, this is because regional development has not placed environmental aspects as a priority.

Population density has a significant and negative relationship to EPI of 34 provinces in Indonesia in 2017-2021. When the population density increases, the Environmental Performance Index will decrease, this is because along with the increase in human needs, the exploitation of resources also increases. The Human Development Index has a positive and significant effect on the Environmental Performance Index of 34 provinces in Indonesia in 2017-2021.

Increasing HDI values impact on environment because a high level of human resources demands a high standard of living including environmental quality. 4) The Information and Communication Technology Development Index has a positive and significant influence on the Environmental Performance Index of 34 provinces in Indonesia in 2017-2021. With the widespread use of technology, monitoring of environmental indicators becomes more efficient and facilitates public access to environmental quality status and encourages efforts to preserve the environment.

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