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## **Environmental Quality and Regional Autonomy in Indonesia**

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**Abstract:** This study aims to explore economic conditions toward environmental quality, before and after the policy of regional autonomy in Indonesia. This paper is analyzed using regression, the influence of per capita income, Gross Domestic Product (GDP) of the agricultural, industrial, and manufacturing sectors on the quality of environment in Indonesia for the period of 1960-2016. The study uses time-series data derived from the publication of World Bank Key Indicators and dummy policy variables before and after regional autonomy, namely the value of 0 before 2001 and the value of 1 after 2001. The results of the study state that per capita income, GDP of the industrial sector, and GDP of the manufacturing sector negatively affect the quality of the environment in Indonesia. The regression of the result of policy variable shows the difference in environmental quality in Indonesia, pre and post the regional implementation of autonomy in Indonesia.

**Keywords:** Gross Domestic Product; Environment Quality; Regional Autonomy; Economic Growth

## INTRODUCTION

Since the reform of the Indonesian economy in the late 1980s, Indonesia has experienced economic progress in Asia. During the period 1990-2016 (except for the Asian financial crisis in 1998-1999), the Indonesian economy was recorded with an average annual economic growth of around 6 percent (Diputra and Baek, 2018). The trends in the industrial, manufacturing and agricultural sectors in Indonesia from 1960 to 2016, before and after regional autonomy were implemented, have increased. Indonesia ranks 16th for the largest economy in the world. However, in the course of the Indonesian economy, Indonesia's environmental quality has decreased due to a drastic increase in industrial activities (Diputra and Baek, 2018). However, sustainable development, which is usually traced to 'Brundtland Report', generally consists of three basic pillars: social equality between generation, environmental management, and economic growth (Harlow, Golub and Allenby, 2013; Kurniawan and Managi, 2018).

This paper examines the quality of Indonesia's environment and economic growth in Indonesia. Indonesia's economic growth is influenced by per capita income, industrial sector GDP, manufacturing sector GDP, agriculture sector GDP, and regional autonomy dummy. This study uses regression analysis using time-series data. In a study of the relationship between environment and economic growth, in the literature it generally relies on an empirical model that measures environmental quality related to measuring GDP per capita as a proxy for growth and other relevant variables - relevant consumption and demographic factors like urbanization (Iwata, Okada and Samreth, 2010; Baek, 2015) .

According to United Nations Statistics Division (2016), Indonesia's GDP per capita has increased from \$ 877 in 1990 to \$ 1973 in 2014 (Basri, Rahardja and Fitriania, 2016). Supported by commodity prices that drive the economy, Indonesia is one of the largest middle-low income countries in the world (United Nations Statistics Division, 2016). The size of GDP that increases every year does not mean that there is an improvement in the quality of the environment in Indonesia. Data from the World Bank states that the increase in GDP in the industrial, manufacturing and agricultural sectors, as well as CO<sub>2</sub> emissions in Indonesia also increased. In

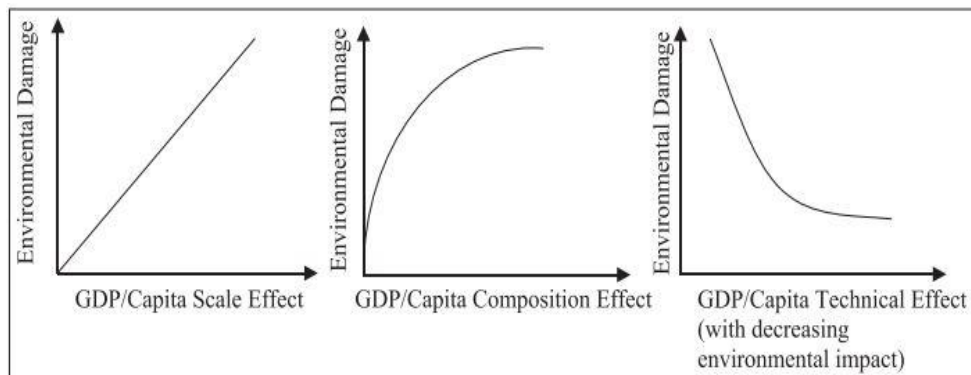
research (Baek, 2015), Indonesia shows a positive growth trend in its inclusive wealth. However, the effect of population dilution is faster than economic growth, so the growth of per capita income becomes negative. Thus, it can be interpreted that GDP per capita growth in Indonesia does not always indicate sustainability.

## LITERATURE REVIEW

### Environmental Quality

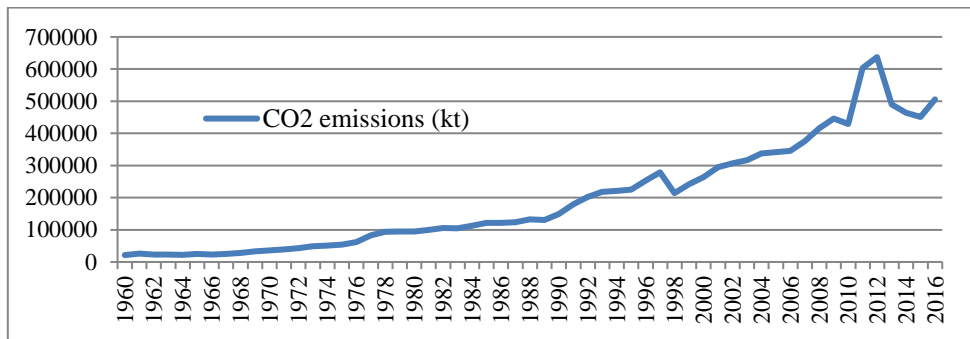
Environmental quality is a measure of the condition of an environment that is relative to the needs of living species. Environmental quality includes the natural environment and artificial environments such as air, water purity or pollution, noise and effects that have the potential to affect mental and physical health. It is difficult to argue the relationship between the quality of the environment and economic growth. As stated by Wilson (2003) that world wealth when measured through Domestic Products and per-capita consumption, increases. However, when measured based on the condition of the biosphere and the environment it decreases. Decreasing natural resource capital can be a significant burden for state performance, especially for countries with a high dependence on natural resources (Kurniawan and Shunsuke, 2017).

As explained by Everett, Ishwaran, Ansaloni and Rubin (2010) that in general, economic growth has three effects on the environment (Figure 1). First, the effects of economies of scale - economic growth has a negative effect on the environment, where increasing production and consumption causes an increase in environmental degradation. Second, the influence of production compositions along the growth path, which initially led to industrialization and a shift from agriculture to industry which led to increased environmental degradation, then shifting the balance of production of finished goods into service production. Third, technical effects - technological developments cause changes in the environmental impact of production, for example, increasing energy efficiency, can also be represented by technological advances that anticipate greater environmental damage (Oktavilia and Firmansyah, 2016).

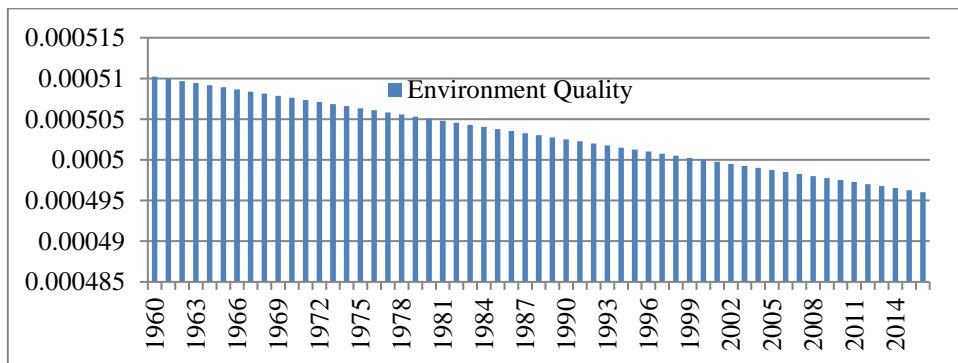


**Figure 1:** The Relationship between Economic Growth and Environmental Degradation (Everett et al., 2010)

Air pollution (smoke and noise), waste problems in areas in Indonesia, loss of land of natural flora and fauna, destruction of habitats, threats of diversity, depletion of natural resources, and problems of global greenhouse effects related to economic growth (Smulders, 2000). The trend of CO2 emissions in Indonesia is increasing every year. Before the implementation of regional autonomy in Indonesia from 1960 to 2000, CO2 emissions in Indonesia had always increased. After the existence of regional autonomy in 2001 to 2016, experienced the highest peak CO2 emissions during the year 1960 to 2016 and experienced a significant decline in the following year. In 2016, CO2 emissions in Indonesia increased again from the previous year. During the years 1990-2016, CO2 emissions have increased by 150 percent and in 2018, Indonesia ranked 8th as the largest CO2 emitter in the world (Diputra and Baek, 2018).



**Figure 2:** CO2 Emissions of Indonesia since 1960 to 2016 (kt) (World Bank, 2019)



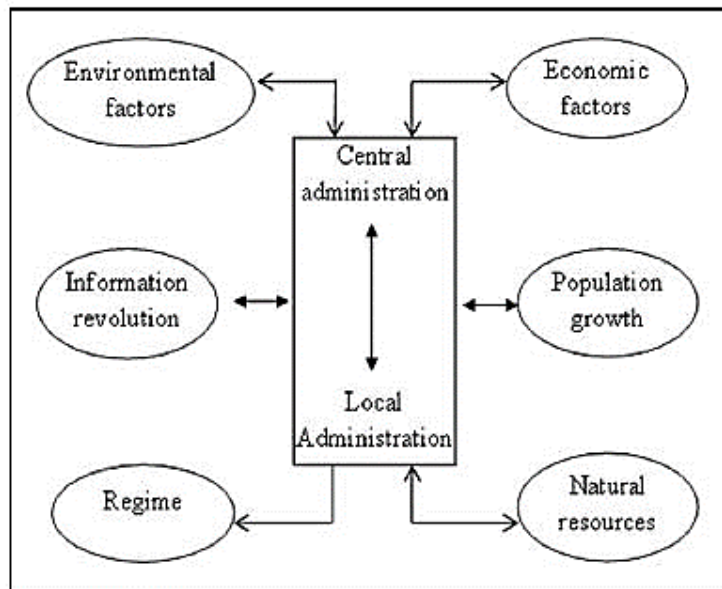
**Figure 3:** Indonesia Environment Quality (Processed Data)

**Regional Autonomy in Indonesia**

Decentralization or regional autonomy is an administrative form in an organization and is used to determine administrative methods for regulating regions, where central authorities provide legislative, judicial, and executive power to the regions (Albehadili, Harjan and Al-Mashahedi, 2016). Decentralization is referred to as the action of the central government to formally give authority and

responsibility to actors and institutions at the lower levels in political, administrative and spatial hierarchies (Ozmen, 2014). This can be interpreted that decentralization is a form of activating the role of local government by establishing the task of administrative planning and development as well as the power that utilizes local communities in the process to make regional development successful (Albehadili et al., 2016; Andreeva and Golovanova, 2003; Ozmen, 2014).

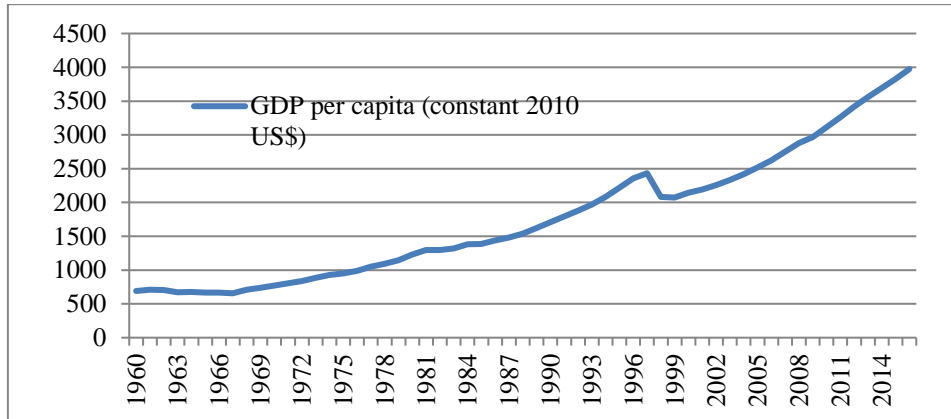
Indonesia applies decentralization or regional autonomy by giving authority to regions in Indonesia. This does not forget to be supported by previous government policies. One of the policies of the Indonesian government to encourage growth is regional autonomy. For decades, the implementation of decentralization has changed the world and lately, devolution is still at the cusp of the policy agenda of several developing and developed countries (United Nations Statistics Division, 2016). With the enactment of regional autonomy, the central government authorized regional governments to spread wealth to the area. Transfer of resources and power to the government at a substantial level to improve economic performance (Rodriguez-Pose and Ezcurra, 2011). As explained by Albehadili et al. (2016) that the need for central and regional administrations to synergize in development with economic factors, environmental factors, information revolution, population growth, and natural resources which will then influence the regime, a natural concept consisting of complex mechanisms, procedural, and institutionally related where residents express their aspirations and rights and obligations as residents.



**Figure 4:** Strategic directions affecting relations between central administration and local administration (Albehadili et al.,2016)

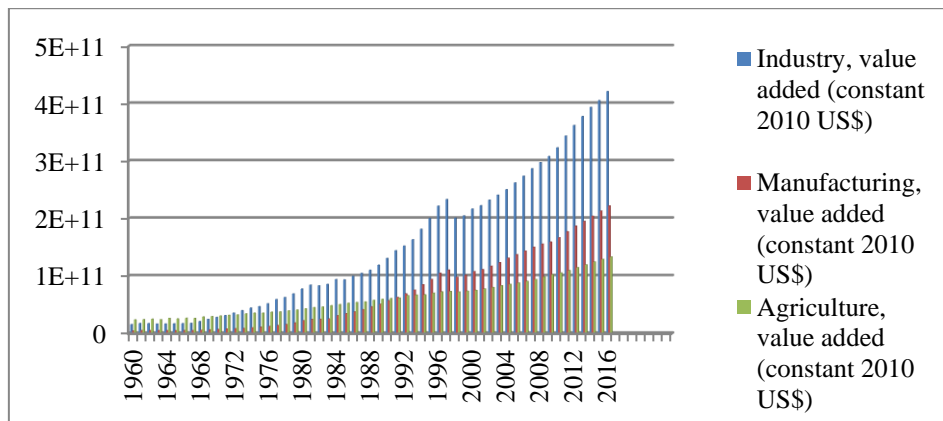
With the existence of regional autonomy policies can create a crucial role in influencing regional economic activities, urban planning and development, and environmental management (Welder, 1995; Rodriguez-Pose and Ezcurra, 2011; Zhang, 2013; Jia, Guo and Zhang, 2014; Leong and Lejano, 2016). Agricultural land

is reduced, because land is used for industrial and manufacturing sector activities. The purpose of this study is to explore the condition of the Indonesian economy based on environmental quality before and after the enactment of regional autonomy in Indonesia. The economic conditions are assessed based on per capita income, GDP of the industrial, manufacturing and agricultural sectors, as well as the dummy of the regional autonomy policy.

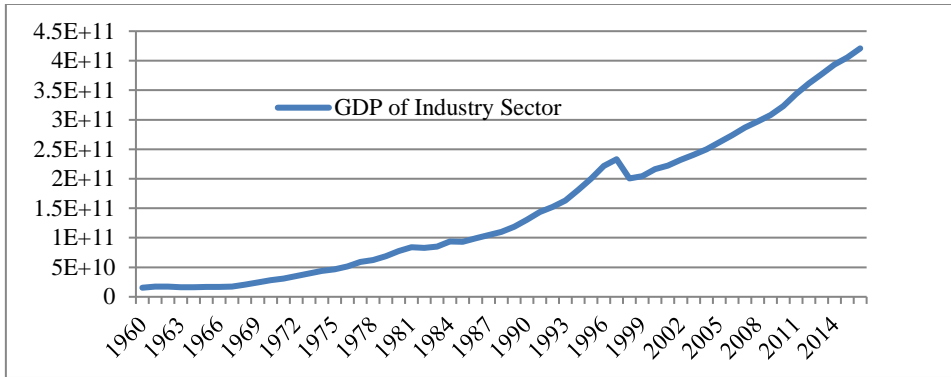


**Figure 4:** Indonesia’s GDP per capita (constants 2010 US\$) (World Bank, 2019)

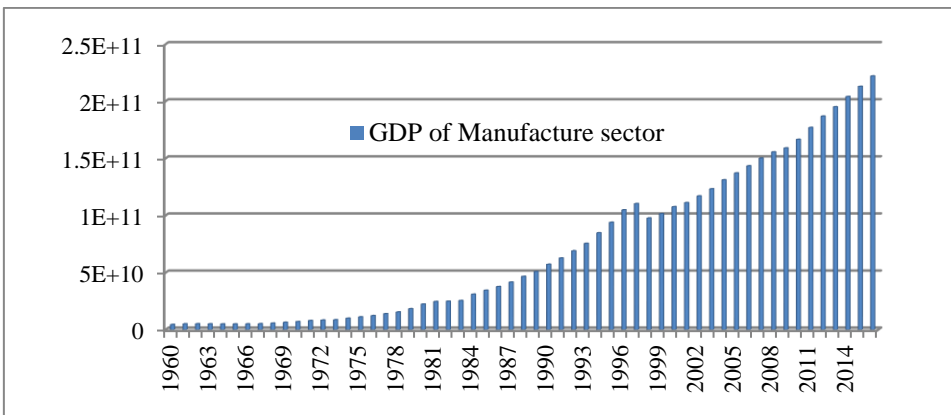
Indonesia as a country with economic strength that continues to grow from all fields. Indonesia relies on all sectors to grow with the increasing trend every year. With the increasing trend from the industrial, manufacturing and agricultural sectors, Indonesia's environmental conditions have become a national and international concern. However, Indonesia's industrial expansion is not accompanied by environmental concerns. Industrial expansion causes uncontrolled waste and pollution. During the years 1990-2016, CO2 emissions have increased by 150 percent and in 2018, Indonesia ranked 8th as the largest CO2 emitter in the world (Diputra and Baek, 2018).



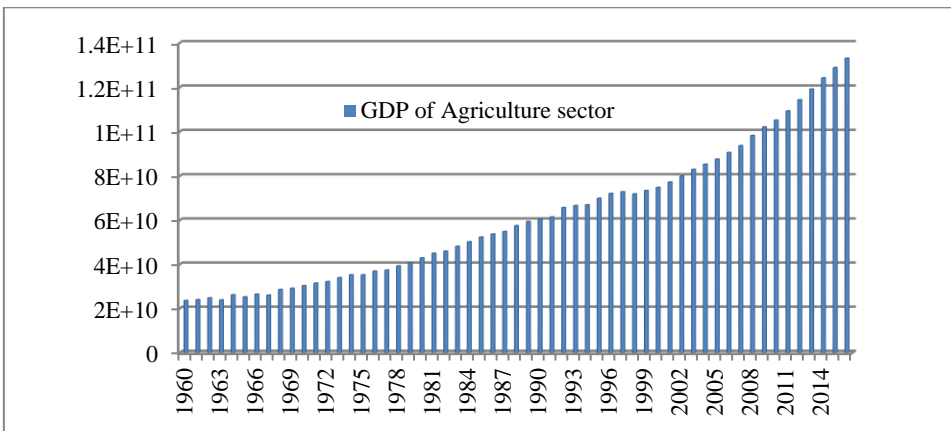
**Figure 5:** Indonesia’s GDP of industry, manufacturing, and agriculture sectors (constants 2010 US\$) (Processed Data)



**Figure 6:** Indonesia’s GDP of industry sector (constants 2010 US\$) (World Bank, 2019)



**Figure 7:** Indonesia’s GDP of manufacture sector (constants 2010 US\$) (World Bank, 2019)



**Figure 8:** Indonesia’s GDP of agriculture sector (constants 2010 US\$) (World Bank, 2019)



## METHODOLOGY

This study uses regression analysis. The data used are environmental quality data in the form of carbon dioxide emissions in Indonesia and Indonesia's environmental quality data, as well as data on GDP per capita, GDP in the agricultural, industrial and manufacturing sectors, as well as the dummy for regional autonomy in Indonesia. Some data is obtained through the World Bank and some are processed by themselves. The use of these data is used to conduct regression analysis for research. Regression is done using Eviews. The model for the regression analysis is:

$$EQ = f(\text{GDP\_INDS}, \text{GDP\_MANU}, \text{GDP\_AGRI}, \text{GDPCAP})$$

GDPCap = GDP per capita

GDP\_agri = GDP in Agriculture sector

GDP\_inds = GDP in Industry sector

GDP\_Manu = GDP in Manufacture sector

D\_Otda = Dummy of Regional Autonomy in Indonesia

By calculating the log on each variable, hence, the equation model of Ordinary Least Square (OLS) can be written down as such:

$$\text{LOG}(EQ)_t = \beta_0 + \beta_1 \text{LOG}(\text{GDP\_INDS})_t + \beta_2 \text{LOG}(\text{GDP\_MANU})_t + \beta_3 \text{LOG}(\text{GDP\_AGRI})_t + \beta_4 \text{LOG}(\text{GDPCAP})_t + \beta_5 \text{D\_OTDA}_t + u_t \quad (1)$$

(LOG) shows that the logarithm, the  $\beta_0$ , is constant in the equation (1) and  $\beta_1$ ,  $\beta_2$ ,  $\beta_3$ ,  $\beta_4$ ,  $\beta_5$  are the regression coefficients and  $u_t$ , is the error term for equation (1) successively in year  $t$ . With this model, it can be explained that the quality of the environment in Indonesia is influenced by several variables. These variables are GDP per capita in Indonesia, GDP in agriculture, industry, and manufacturing, and the dummy variable of regional autonomy in Indonesia. All data are time-series data for empirical analysis. Data used from 1960 to 2016. Empirical model is being treated by observing the classical assumptions.

## RESULTS AND DISCUSSION

Ordinary Least Square (OLS) is the main empirical model of this research and to operate it, it requires testing to identify the feasibility of the model. Multicollinearity test is the first classical assumption result from this research shows that there is no multicollinearity to each of independent variable of the model. Multicollinearity is done by identifying correlation value which can be tolerated as long as it is not more than 0.8. Correlation matrix test result on table 1 shows that the empirical model does not contain any multicollinearity.

**Table 1:** Correlation matrix for research model

Variables	LOG GDPCAP	LOG GDP_INDS	LOG GDP_MANU	LOG GDP_AGRI	D_OTDA
LOGGDPCAP	1.000	0.697	0.691	0.696	0.708
LOGGDP_INDS	0.697	1.000	0.797	0.695	0.734
LOGGDP_MANU	0.691	0.797	1.000	0.790	0.654
LOGGDP_AGRI	0.696	0.695	0.790	1.000	0.628
D_OTDA	0.708	0.734	0.654	0.628	1.000

The second test is called autocorrelation test. Autocorrelation test is done using Breusch-Godfrey test, in which case if the probability value shows less than 0.05, autocorrelation symptom is likely to happen whereas, when the probability value shows more than 0.05, then, autocorrelation do not occur. This research shows that by using Breusch-Godfrey test to test the autocorrelation, it shows that the score is  $0.6249 > 0.05$ , thus can be concluded that autocorrelation do not occur in this research.

**Table 2:** Breusch-Godfrey serial correlation LM test

F-statistic	0.343467	Prob. F (2,49)	0.7166
Obs*R-squared	0.940446	Prob. Chi-Square (2)	0.6246

The third test is heteroskedasticity that is used to knowing the presence and absence of classical assumption deviation when there is an unequal variance of the residuals for all observations in the regression model. Prerequisites that must be met in the regression model is that there is no heteroskedasticity symptom. The research is using White test to identify the heteroskedasticity. When the probability value is less than 0.05, then heteroskedasticity occurs in the research model, however, when the probability value shows more than 0.05, then, heteroskedasticity do not occur in the research. The result of White test in this research shows that the probability value is  $0.597 > 0.05$  so that can be concluded that heteroskedasticity symptom do not happen in the research model.

**Table 3:** Heteroskedasticity test: White

F-statistic	0.5955779	Prob. F (15,41)	0.7046
Obs*R-squared	3.6722722	Prob. Chi-Square (15)	0.5975
Scaled explained SS	3.5506677	Prob. Chi-Square (15)	0.6157

The results of the study found that an increase in aggregate output in the manufacturing industry sector had a negative and significant effect on the quality of the environment in Indonesia. The increase in aggregate output in the industrial sector amounted to 1 percent decreasing environmental quality by 0.91 percent. The aggregate output of the manufacturing industry has a negative effect but is not significant for environmental quality. The relationship of the aggregate output of the agricultural sector has a positive effect. Although not significant, this study shows a positive relationship between increasing agricultural production to environmental quality.

**Table 4:** Regression result for research model

Variable	Coefficient	t-Statistic	Probability
LOG(GDP_INDS)	-0.916881	-8.732946	0.0000
LOG(GDP_MANU)	-0.020204	-0.225331	0.8226
LOG(GDP_AGRI)	0.383233	1.323220	0.1917
LOG(GDPCAP)	-0.338049	-1.313134	0.1950
D_OTDA	-0.172874	-3.644942	0.0006
C	5.004594	1.008578	0.3179

Per capita income in Indonesia has a negative effect on environmental quality. The empirical model shows that this relationship is not significant, but is able to prove that Indonesia is still in accordance with the characteristics of developing countries, namely increasing income actually decreases the quality of the environment. This is consistent with the influence of the manufacturing industry and manufacturing industries which signifies an increase in production activities, which in turn increases revenue. Increased production activities in developing countries are accompanied by a decrease in environmental quality. When economic growth provides many benefits for humans, it also results in a decrease in natural resources and ecosystem damage (Everett et al., 2010). This is a debate over whether it is possible to achieve optimal economic growth without continuing to damage the environment.

Government policy dummy variables before and after regional autonomy significantly influence the quality of the environment in Indonesia. Because the more decentralized a regional autonomy system is based on pillars that understand ecological conditions, the greater the chance to succeed, and vice versa. The more the government does not care about environmental conditions when designing a decentralized system, the more likely the system will be tossed around and lead to a crisis (Albehadili et al., 2016).

## CONCLUSION

Indonesia is still faced with the choice to maintain environmental quality and the output growth of the Industrial sector as a way of increasing economic growth. Indonesia must pay attention to international standards if it wants to develop its industry, then the need for the role of local government and central government in enforcing industrial and environmental regulations. The need for central and regional administrations that synergize in development with economic factors, environmental factors, information revolution, population growth, and natural resources which will then influence regional development and Indonesia's aggregate economic growth. Control from the central and regional government and the community, as well as regular organizational regulation can have a good impact on economic growth and environmental sustainability in Indonesia. Every sector must be ready with every change that the world offers including the environment impact they will give to the society.

## LIMITATION OF THE RESEARCH

This research is using data dated since 57 years ago, which the time span before and after the decentralization are imbalance, therefore, it can interfere to the research results. Longer time span data of regional autonomy to see the difference and influence of dummy variables from decentralization policy. In this paper, Environment Quality Index is obtained from combination of air quality, water quality, and land cover index, so, to identify the impact of aggregate output sectorally perhaps, need more specific Environment Quality Index in accordance with each sector available.

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