The Effect of Industrial Existence on the Environment and Socio-Economy

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Article Info

Abstract

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The purpose of this study is to analyze the influence of industry on the water quality index, air quality index, land cover quality index, population health complaints, and gross domestic product. This study uses quantitative methods with panel data, which is a combination of cross section data from 30 provinces in Indonesia and time series for the period 2013-2017. The analytical method used is structural equation model-partial least squares. The results showed that the industry had a significant negative effect on the water quality index, air quality index, and land cover quality index. While the industry has a significant positive effect on population health complaints and gross domestic product. The conclusion from this study is that the industry is more likely to have a negative impact on the environment and social, while the positive impact is more likely to affect the economy. Advice for the government is the need for industrial development efforts accompanied by improvements in environmental quality to maintain system balance

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INTRODUCTION

Indonesia is one of the developing countries that have various complex problems in realizing its development process. This is very different from developed countries, where the industrial sector is the leading sector in the national economy. This is what triggers and causes why developing countries lag from developed countries.

Concern to the idea of industrial development efforts appeared spearheaded by Perroux (1970) in Lincolin Arsyad (2010), which states the term center of growth (pole of growth). Perroux Assumed that the industry will accelerate economic growth at once being the main mover in development. Perroux theory becomes the basis and reference in various countries nowadays to use industrial development strategies.

The existence of industrial development in developing countries is certainly highly expected as a step in efforts to improve the national economy and accelerate the development process. According to (Arsyad, 2010: 442), stated that Industrialization is a series of activities as a step to improve the welfare of people to ensure a more advanced standard of living and life quality. the process of industrialization is largely determined by the quality of human resources supported by its ability to utilize both natural resources and other available resources optimally.

The industrial development that is carried out certainly can not be separated from the externalities that will be generated, as according to Mangkoesoebroto (1993: 110), that an action or economic activity will provide externalities in the form of both positive and negative to be accepted.

The number of externalities received depends on the industrial scale. Considering that the Indonesian government is aggressively engaged in industrial development and in the future it is targeting to become a resilient industrial country by 2035. The industrial sector is targeted to be able to contribute to reaching 29 % of gross domestic product (GDP).
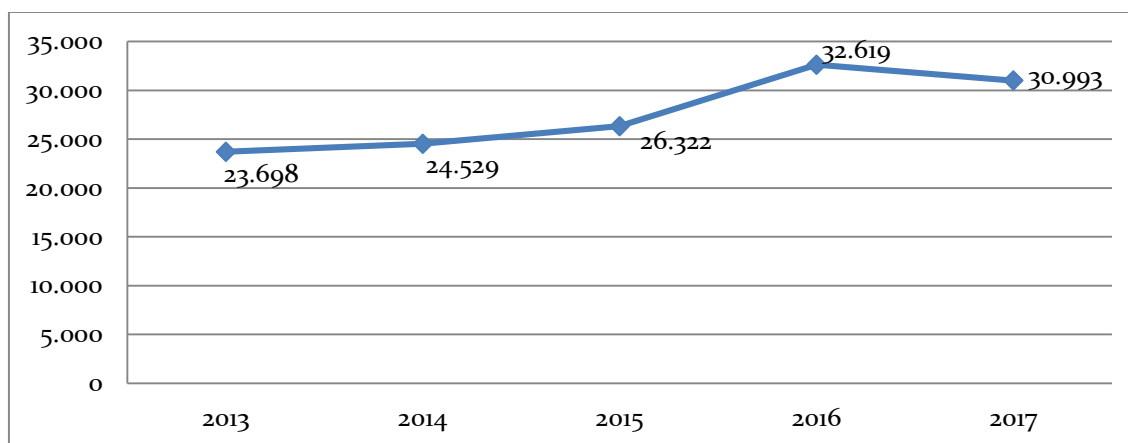
Figure 1. Number of Large and Medium Industries in Indonesia (unit), 2013-2017
Source: Central Bureau of Statistics (processed, 2019)

Figure 1 shows that the number of large and medium-sized industrial companies in 2013-2017 tended to increase. A large number of scale industrial companies will certainly influence economic growth. Where, industrialization is often used as a strategic step in improving the economy, because the industry is seen as an engine of economic growth (Todaro & Smith, 2006: 133). The government designs and develops large and medium industries as a basis to increase the value of the gross domestic product.

Table 1. Gross Domestic Product at 2010 Constant Prices According to Indonesian Business Field (billion rupiah), 2013-2017

	Business field /*Industry*	2013	2014	2015	2016[*]	2017[**]
A	Agriculture, Forestry, and Fisheries	1 083 141,8	1 129 052,7	1 171 445,8	1 210 749,8	1 256 894,3
B	Mining and excavation	791 054,4	794 489,5	767 327,2	774 593,1	779 925,4
C	Mining and Processing Industries	1 771 961,9	1 854 256,7	1 934 533,2	2 016 876,8	2 103 066,4
D	Mining and Industrial Procurement of Electricity and Gas Processing Industries	88 805,1	94 047,2	94 894,8	100 009,9	101 551,3
E	Water Supply, Waste Management, Waste and Recycling	6 539,9	6 882,5	7 369,0	7 634,5	7 986,4
F	Construction	772 719,6	826 615,6	879 163,9	925 062,5	987 883,5
G	Wholesale and retail trade, car and motorcycle repair	1 119 272,1	1 177 297,5	1 207 164,5	1 255 759,4	1 311 463,7
H	Transportation and Warehousing	304 506,2	326 933,0	348 855,9	374 843,4	406 679,4
I	Provision of Accommodation and Food and Drink	243 748,3	257 815,5	268 922,4	282 823,4	298 514,9
J	Information and Communication	349 150,1	384 475,6	421 769,8	459 208,1	504 278,9
K	Financial Services and Insurance	305 515,1	319 825,5	347 269,0	378 193,1	398 919,0
L	Real Estate	244 237,5	256 440,2	266 979,6	279 500,5	289 789,4
M ,N	Company Services	125 490,7	137 795,3	148 395,5	159 321,7	172 763,8
O	Government Administration, Defense and Guarantees are mandatory	289 448,9	296 329,7	310 054,6	319 946,1	326 526,8
P	Educational Services	250 016,2	263 685,0	282 020,1	293 779,7	304 525,0
Q	Health Services and Social Activities	84 621,4	91 357,1	97 465,8	102 487,8	109 448,0
R,S,T	Other services	123 083,1	134 070,1	144 904,2	156 523,4	170 073,7
	Gross Domestic Product (GDB)	8 156 497,8	8 564 866,6	8 982 517,1	9 434 632,3	9 912 749,3

Source: Central Bureau of Statistics 2017-2018

Table 1 shows that in 2013-2017 Indonesia's gross domestic product continued to increase. This shows that the level of Indonesia's prosperity has increased economically. Based on the research results of Nuraeni (2018), industrial development has an impact on economic growth with one indicator, namely the increase in the value of gross regional domestic products. The structure of the Indonesian economy is dominated by 3 (three) main categories and the growth rate is as follows:

Table 2. Growth Rate of Gross Domestic Product Based on 2010 Constant Prices by Indonesian Business Field (%), 2013-2017

|	Business field /*Industry*	2013	2014	2015	2016[*]	2017[**]
A	Agriculture, Forestry, and Fisheries	4,20	4,24	3,75	3,36	3,81
B	Processing industry	4,37	4,64	4,33	4,26	4,27
C	Wholesale and retail trade, car and motorcycle repair	4,81	5,18	2,54	4,03	4,44

Source: Central Bureau of Statistics 2017-2018.

Based on Table 2, the growth rate of the industrial sector in 2013-2017 tended to decline. According to Pujiati (2009), that specialization harms industrial growth. This is due to specialization or can be interpreted as an industry concentration considered unable to create innovations that are needed to increase growth. However, the decline in the growth rate of the manufacturing industry sector continues to provide the largest contribution to the value of

the gross domestic product. The magnitude of the contribution of the manufacturing industry sector to gross domestic product has not been able to

provide welfare to the people, one of which is health, which is illustrated by the number of population health complaints.
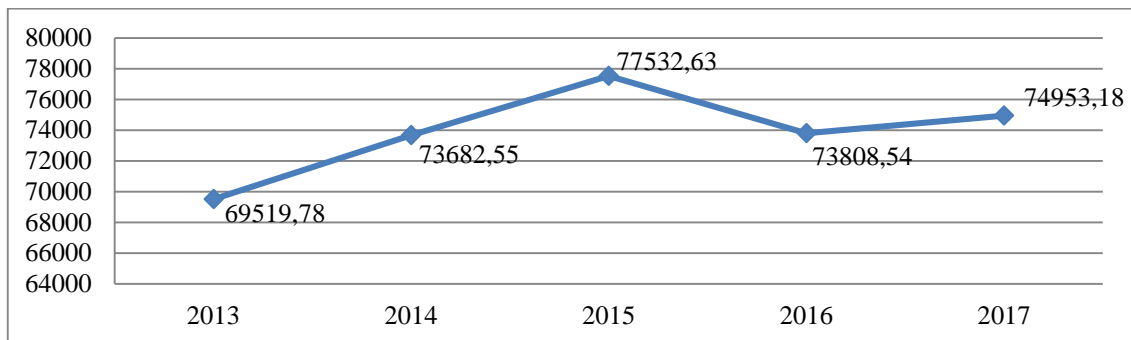

Figure 2. Number of residents who have health complaints during Last month in Indonesia (thousand people), 2013-2017
Source: Central Bureau of Statistics (processed, 2019)

Figure 2 shows that the number of residents who had health complaints over the past month in 2013-2017 tended to increase. The increase in the level of population health complaints is inseparable from the rapid development of the industry both on a large, medium, small or micro scale industry. According to Jerumeh et al. (2015), air pollution generated by industries that contain a lot of emissions of hazardous chemicals and health expenditure has a significant effect on life expectancy in the long run. A greater increase in carbon emissions discharged into the air which occurs continuously will cause health problems.

Environmental statistics explain that industrial development has external impacts in the form of environmental degradation and the health of the people who live around them. The condition of the soil, water, and air around the location, in general, has been polluted by heavy metals and toxic compounds from industrial waste. Based on the Ministry of Environment and Forestry in 2017, showing that in 2015-2016 the quality of river water in Indonesia is generally in a heavily polluted status. This condition is certainly alarming because the river water is the main source of clean water by most residents in meeting their daily needs.
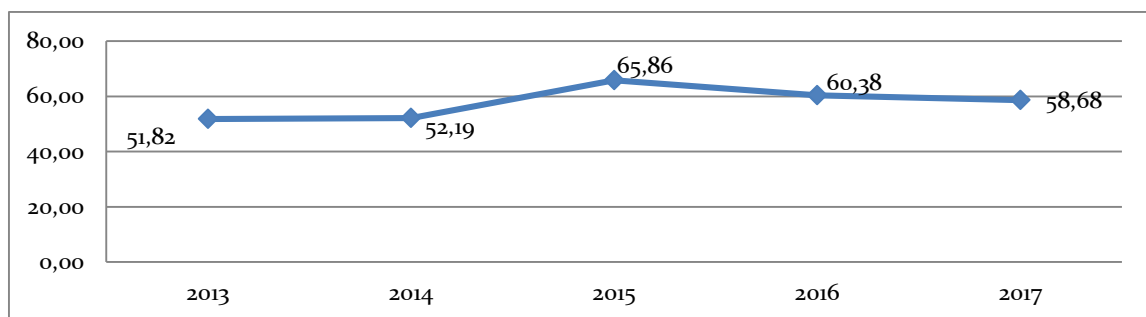
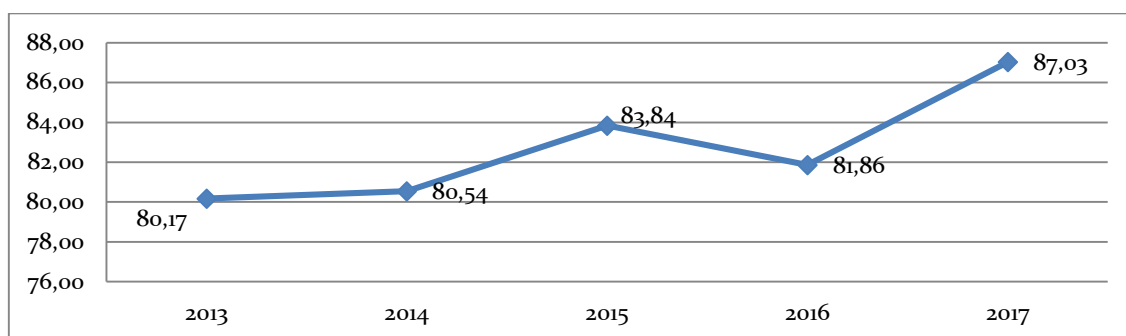**Figure 3.** National Water Quality Index, 2013-2017
Source: Ministry of Environment and Forestry (processed, 2019)

Figure 3 shows that the quality index of national water in 2013-2017 tends to increase but, still in a bad condition because the index number is still far from the number 100. According to the Ministry of Environment and Forestry in the

2017 Environmental Quality Index, shows that the index value national water quality decreased by 1.70. The decline is inseparable from the utilization of greater environmental resources compared to efforts to improve environmental

quality. This result is reinforced by the research of Yongkun et al. (2013), stating that large industries, the construction industry and the service industry all lead to an increase in the amount of wastewater disposal and discharged wastewater without any processing first then causes water pollution. Besides, industries that do not have standard equipment in their efforts to protect the environment will increase exhaust emissions which cause air pollution, especially in the construction industry.

Figure 4. National Air Quality Index, 2013-2017
Source: Ministry of Environment and Forestry (processed, 2019)

Based on Figure 4 above shows that the national air quality in 2013-2017 tends to increase. Air quality in Indonesia is in good condition because the average index number is close to 100. According to the Ministry of Environment and Forestry in the 2017 Environmental Quality Index, shows that the national air quality index value increased by 5.42. The increase of air quality index is inseparable from the switch of utilizing facilities that use less environmentally friendly technologies to switch to more environmentally friendly technologies.

According to Patnaik (2017), it stated that air quality is getting worse because it is influenced by industrialization. Emissions generated from industry are still very large, even after implementing sophisticated air pollution control devices such as filtering bags, multiplier scrubbers, and some cyclones. This result is reinforced by the research of Muktiali and Fatikawati (2015), who stated that the existence of industry causes air pollution, both smelly and noisy. This odor is caused by the decay of wastewater and noise caused by the sound of industrial machinery that operates for 24 hours so that it will disturb public health. In addition, the presence of industry will cause changes in land use.

Based on Figure 5 shows that the index of the quality of national land cover in 2013-2017 tends to decrease. According to the Ministry of Environment and Forestry in the 2017 Environmental Quality Index, shows that the national land covers quality index value down by 0.95. This decline is inseparable from the increasing demand for wood, energy, food needs, clothing and medicines to meet the high demand for exports and the supply of main industrial raw materials sourced from forests, thus causing the pressure on forests to exceed the provisions previously set.

According to Rahayu and Aprilia (2014), that the existence of industry tends to harm physical conditions (changes in land use) and environmental conditions. Changes in land use usually occur on forest land, dry fields, and swamps to be converted into residential and industrial functions. This will encourage and result in the high use of open land being built land to meet the needs of settlements and industry. On the other hand, the existence of industry will increase land prices along the main road close to the industry because it has easy access.
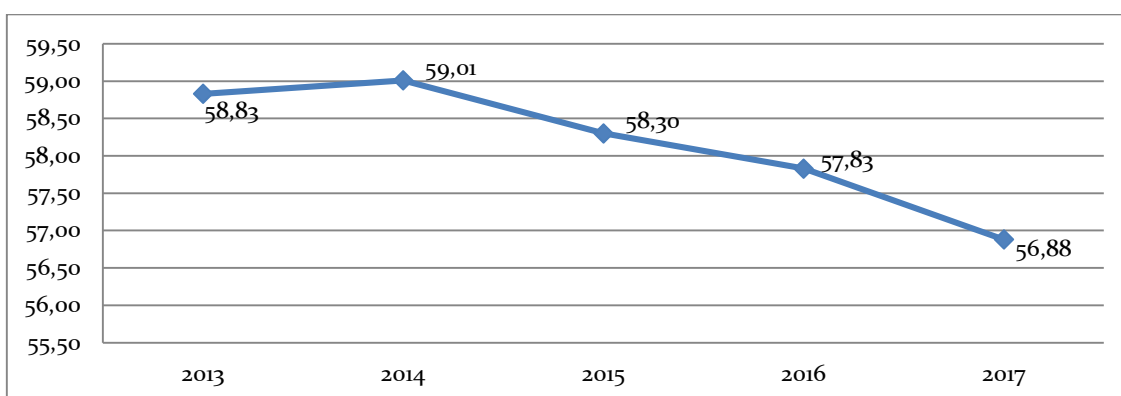
Figure 5. National Land Cover Quality Index, 2013-2017
Source: Ministry of Environment and Forestry (processed, 2019)

RESEARCH METHODS

The type of this research is descriptive quantitative research using data in the form of numbers which are processed using analytical tools. The output results of the research will be explained using numerical analysis which is then described both according to theory and deviate from existing theories.

This research used panel data, which is a combination of annual time series data, from 2013 to 2017 and cross-section data from 30 provinces in Indonesia except for North Kalimantan, Maluku, North Maluku, and Papua. The data used are water quality index, air quality index, land cover quality index, population health complaints, and gross domestic product sourced from the Central Bureau of Statistics and the Ministry of Environment and Forestry. The data analysis method used structural equation modeling-partial least squares (SEM-PLS) analysis with WarpPLS 6.0 software.

The variables in this research used consisted of independent and dependent variables. The independent variable (X) is industry and the dependent variable (Y) consists of water quality index, air quality index, quality cover land cover index, population health complaints, and gross domestic product. The shape of the model is as follows:

$$IKA = \beta_{0a} + \beta_{1a}IND + \varepsilon_a \dots\dots\dots\dots\dots\dots (1)$$
$$IKU = \beta_{0b} + \beta_{1b}IND + \varepsilon_b \dots\dots\dots\dots\dots\dots (2)$$
$$IKTL = \beta_{0c} + \beta_{1c}IND + \varepsilon_c \dots\dots\dots\dots\dots\dots (3)$$
$$KKP = \beta_{0d} + \beta_{1d}IND + \varepsilon_d \dots\dots\dots\dots\dots\dots (4)$$
$$PDB = \beta_{0e} + \beta_{1e}IND + \varepsilon_e \dots\dots\dots\dots\dots\dots (5)$$

Where IND is industry; IKA is Water Quality Index; IKU is Air Quality Index; IKTL is Land Cover Quality Index; KKP is Population Health Complaints; GDP is Gross Domestic Product; β_1 is Koefisien; β_0 is Konstanta; ε_a is Error Tern.

RESULTS AND DISCUSSION

To find out the results of the influence of industry variables on water quality index, air quality index, land cover quality index, population health complaints, and gross domestic product in Indonesia in 2013-2017, it can be seen through the results of the analysis test as follows:
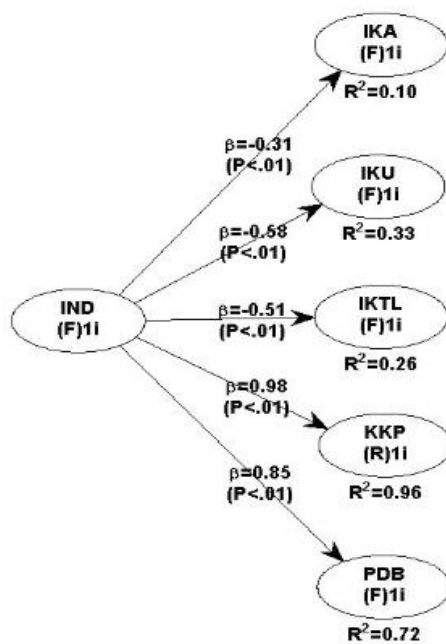
Figure 6. Testing result of Direct Effect Model

Based on the results of testing the analysis conducted showed that the industry had a significant negative effect on the water quality index as indicated by a path coefficient of -31 and p-value <0.01 or smaller than 0.05. Thus, when each industry unit increases, it will cause the water quality index to decrease by 0.31.

This condition can be seen in 2015-2016 according to the Ministry of Environment and Forestry in conducting an evaluation of water pollution in rivers at 471 river points being monitored. The results show there are 17 rivers whose conditions are relatively changing, 211 rivers are in improved condition, and 343 rivers have deteriorated quality. These results indicated that river water conditions are generally in a heavily polluted status. Thus, most of the river water is not suitable for use as water recreation infrastructure/facilities, raising freshwater fish, livestock, irrigating crops or the like let alone for drinking water. Where river water in Indonesia is used for the community to meet their daily needs. In 2017 the water quality index value decreased by 1.70. This decrease is inseparable from the amount of utilization of environmental resources without being balanced by efforts in improving environmental quality. The greatest decrease in

the water quality index was experienced by Banten Province.

The results of this research support the research results conducted by Widiyanto et al. (2015), which stated that the rapid development of the eyelash industry caused the number and volume of the migrant population to increase. This causes the population to become even denser and the addition of industrial and household waste will increase the pollution of citizens' water sources around the industrial area. Meanwhile, according to Yudo and Setiyono's research (2008), it explained that industrial activities cause changes in the surrounding environmental conditions. One of them is a decrease in the quality of river water and seawater which has a quality below the surface water quality standard, this happens because the waste disposal generated by industry exceeds the capacity.

The results of the research are following existing theories. According to Fauzi (2004), economic activities, especially industry, will be in line with the waste produced which will give negative externalities to natural resources, which is water, namely the occurrence of water pollution. Meanwhile, according to Suparmoko (2000), the source of water pollution that occurs due to household and factory (industrial) waste is usually through pipelines or discharged directly into rivers, in general, this happens in countries developing

However, this is different from the results of research conducted by Pradani et al. (2017), explained that industrial activities that produce liquid waste and waste treatment are following standards set by the government before being discharged into drains, the quality of water resources around residential areas that live close to industrial sites will be well maintained and will not cause odor and color.

Based on the results of the analysis shows that the industry has a significant negative effect on the air quality index which is indicated by the value of the path coefficients of -0.58 and p-values <0.01 or smaller than 0.05. Therefore, every an increasing happened in the one-unit

industry, will cause the air quality index to decrease to 0.58.

The monitoring results by the Ministry of Environment and Forestry and *Badan Meteorologi, Klimatologi, dan Geofisika* (BMKG) through their observations in community centers such as industry, settling, and transportation that in some big cities in Indonesia air quality conditions tend to decrease that has been seen in several last decades is evidenced by the data from the results of particle monitoring (PM10, PM2.5) and oxidants/ozone which is increasing. On the other hand, an increase in population will encourage an increase in the needs of transportation users and also increase energy consumption which will cause increased air pollution which has an impact on human health and the environment.

The results of this research support the research conducted by Patnaik (2017), the existence of industrialization will worsen air quality because the industry produces large emissions and can exceed the limits, even though sophisticated air pollution control devices such as chimney air filtering, multiplying scrubbers and the use of cyclones. According to Suparmoko M. and Suparmoko R. (2000), the use of fuels in both households, factories (industries) and motor vehicles contain many particles and gases that are dangerous and not environmentally friendly which will affect the conditions of air quality.

The results of the research are following existing theories. According to Fauzi (2004), increasing economic activity will be in line with the increase in waste or residuals produced which will affect the quality of the surrounding environment, which is air condition. However, based on the publication of the Ministry of Environment and Forestry entitled the environmental quality index in 2017, explained that the improved air quality index is inseparable from the shift in the use of facilities that use less environmentally friendly technologies to switch to technologies that are more environmentally friendly.

Based on the results of the analysis, the analysis showed that the industry had a significant negative effect on the quality index of

land cover as indicated by the path coefficients of -0.51 and p-values <0.01 or smaller than 0.05. Thus, when each increase occurs in the one-unit industry, it will cause the index of land cover quality to decrease by 0.51.

This condition can be seen based on the publication of the Ministry of Environment and Forestry explained that exploitation of forest areas causes land in forests to become critical. From 2006 to 2013 the land area was reduced by 6 million hectares from 30 million hectares to 24.2 million hectares. The decline in the area of degraded land contributes to the reduction in the area of Indonesia's land cover, or often called deforestation.

In 2014-2015, the largest deforestation occurred in forest areas, amounting to 815.6 thousand hectares or 74.7 %. This deforestation mainly occurs in permanent production forests and the rest is in other use areas with 276.6 thousand hectares area. When viewed according to land cover class, 75 % area that has been deforested or 911.5 thousand hectares is left open land and 9.5 % into shrubs. In 2015 there was the most change in land cover to open land originating from plantations of 441.9 thousand hectares (36.1 %), secondary swamp forests of 267.9 thousand hectares (21.9 %), and secondary dryland forests 156.6 thousand hectares (12.8 %) area. Changes in forest areas and the high level of deforestation that occur due to mining, industry, forest and land fires, plantations, land clearing, population growth and so on.

The results support the research conducted by Sholihah et al. (2018), that the development of industrial agglomeration supported by industrial use policies will trigger changes in the spatial conditions of the surrounding area. Some consequences arising from the development of industrial agglomeration include the addition of a road network to improve the accessibility of activities, the road quality will decrease faster because of the high circulation and mobility, the conversion of the undeveloped land into industrial land, residential land, trading land and the reduction of paddy fields / dry fields. The results of the research were also supported by a Ministry of Environment and Forestry

publication entitled the index of environmental quality in 2017, showing that there has been a decrease in the quality index of land cover by 0.95. This decline is inseparable from the increased demand for exports and the supply of raw materials for industrial activities sourced from forests, causing pressure on forests to exceed the stipulated provisions.

The results of the research are following existing theories. According to Arifin (2001), an increase in the forestry industry will provide an increase in state revenue from the forestry sector which will have an impact on environmental damage one of them is forest destruction. Meanwhile, according to Fauzi (2004), forests as one of the natural resources that have a use-value, one of them is to increase economic added value, where when economic activities, especially industries whose raw materials are sourced from the forest, exploitation, and pressure will occur in the future.

Based on the results of the analysis shows that the industry has a significant positive effect on population health complaints as indicated by the path coefficients value of 0.98 and p-value <0.01 or smaller than 0.05. Thus, when each industry unit increases, it will cause a population health complaint to rise by 0.98.

This condition can be seen based on the publication of the Central Bureau of Statistics that the number of population health complaints in 2013-2017 tends to increase. In 2016 the number of population health complaints in Indonesia reached 73808.54 (thousand inhabitants) and increased to 74953.18 (thousand inhabitants) in 2017. Where the largest number of population health complaints in 2017 which included the West Java Province (13417.85 thousand population), East Java (11675.70 thousand population), Central Java (11358.98 thousand population), Banten (3453.48 thousand population) and DKI Jakarta (3129.53 thousand population).

A large number of health complaints experienced by residents is inseparable from the surrounding health conditions. One of the conditions of environmental health can be seen from the arrangement of healthy areas through the implementation of healthy Regencies / Cities which consists of indicators: 1. Residential areas, facilities, and public infrastructure; 2. The area of orderly traffic facilities and transportation services; 3. Healthy mining area; 4. Healthy forest area; 5. Healthy industrial and office areas; 6. Healthy tourism area; 7. Food and nutrition areas; 8. Independent community life; and 9. A healthy social life.

Based on the publication of the Ministry of Health in 2017, the results show that from a total of 514 regencies/cities in Indonesia that have implemented the PSC program only realized as many as 355 regencies/cities and have not met the 2017 strategic plan target of 366 regencies/cities. Failure to achieve targets has been set because of limited resources such as manpower, budget, place/office of the secretariat in forming a forum as one of the requirements for a healthy Regency/City organizer.

The results of this research support research conducted by Muktiali and Fatikawati (2015), that the existence of industry causes air pollution, both in the form of odors and noise that is caused. The odor that is produced is due to the decay of wastewater and noise caused by the industrial machinery operation which ultimately results in disruption to public health. cause health problems. Meanwhile, according to Jerumeh et al. (2015), in the long run, air pollution generated by industry and containing many emissions of hazardous chemicals that are wasted on a large scale continuously will cause health problems.

Based on the results of the analysis, the analysis shows that the industry has a significant positive effect on the gross domestic product as indicated by the value of the path coefficients of 0.85 and p-values <0.01 or smaller than 0.05. Thus, when each industry unit increases, it will cause gross domestic product (GDP) to rise by 0.85.

This condition can be seen based on the publication of the Central Bureau of Statistics in 2013-2017 the national gross domestic product has been continuously increasing. A national gross domestic product based on constant prices in 2016 amounted to 9,434,632.3 (billion

rupiahs) and increased to 9,912,749.3 (billion rupiahs) in 2017. The processing/manufacturing sector has the biggest contribution to the increase in the value of gross domestic product national. This means that the industrial sector has an important role in increasing the value of the gross domestic product which is then to improve the economy. The results of this study are also supported by existing theories. According to Arsyad (2010), that large and medium industries have an important role in terms of contributing to increasing the value of the gross domestic product (GDP), while small industries have a role in terms of creating employment opportunities

This research supports the research of Kustanto et al. (2012), which explained that the industrial sector can increase the value of a country's gross domestic product much higher. This is inseparable from the increasing investment in the industrial sector, increasing exports of products produced by industry and increasing household consumption.

CONCLUSION

Based on the results of the research it can be concluded that the Industry has a significant negative effect on the water quality index, air quality index, and land cover quality index in Indonesia, so that if the industry increases, the water quality index, air quality index, and land cover quality index will decrease.

The industry has a significant positive effect on population health complaints and gross domestic product so that if the industry increases, there will be an increase in population health complaints and gross domestic product.

The industrial development undertaken by the government as a step in encouraging the creation of high economic growth in achieving economic development must be in line with improving the quality of the environment to maintain the balance of the ecosystem as a step/process to achieve sustainable development. Besides, the government must act decisively and give a green tax to every industry that has the

potential to damage the environment, if found violating must be given sanctions, fines or even revoked business licenses..

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