

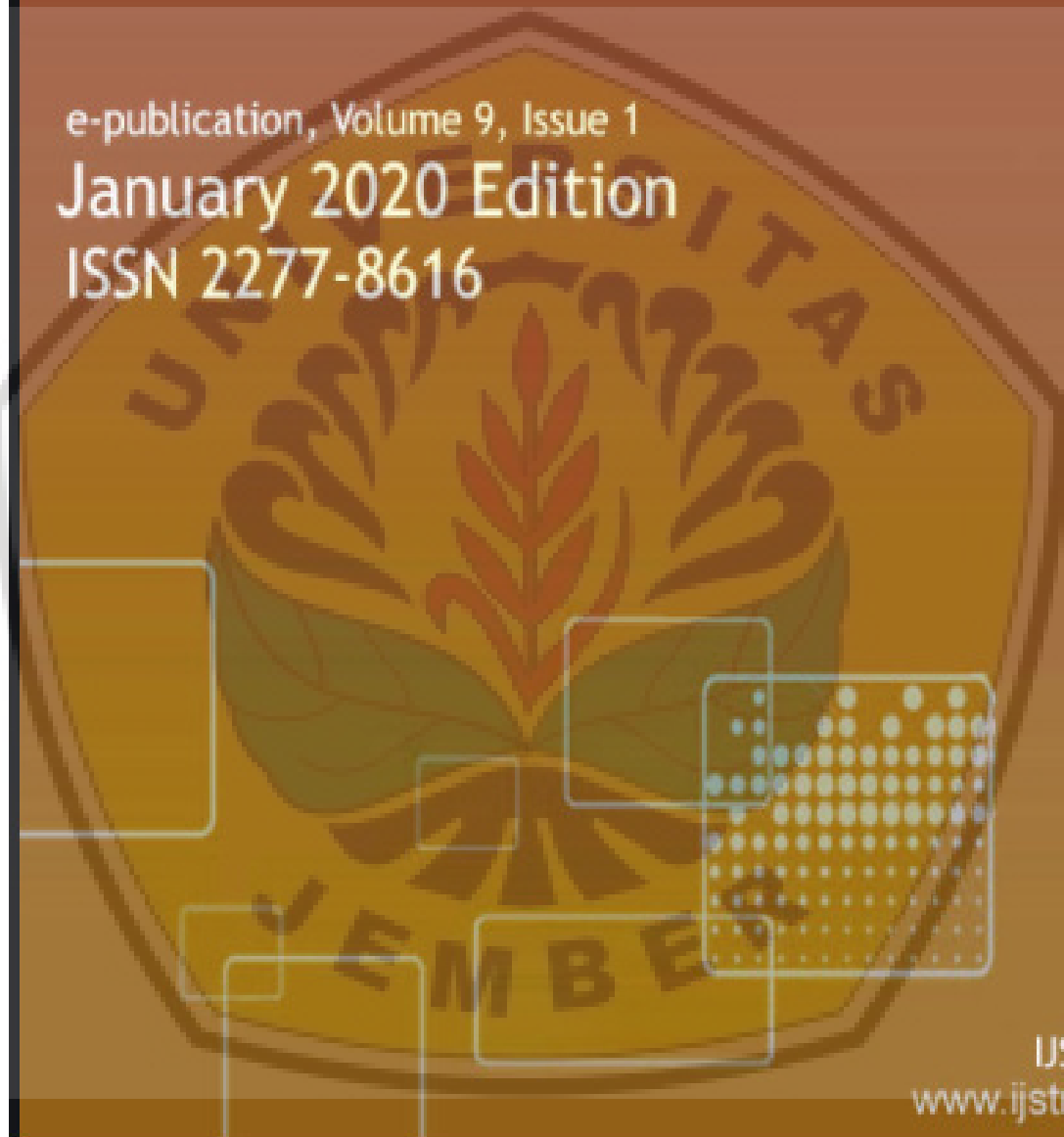
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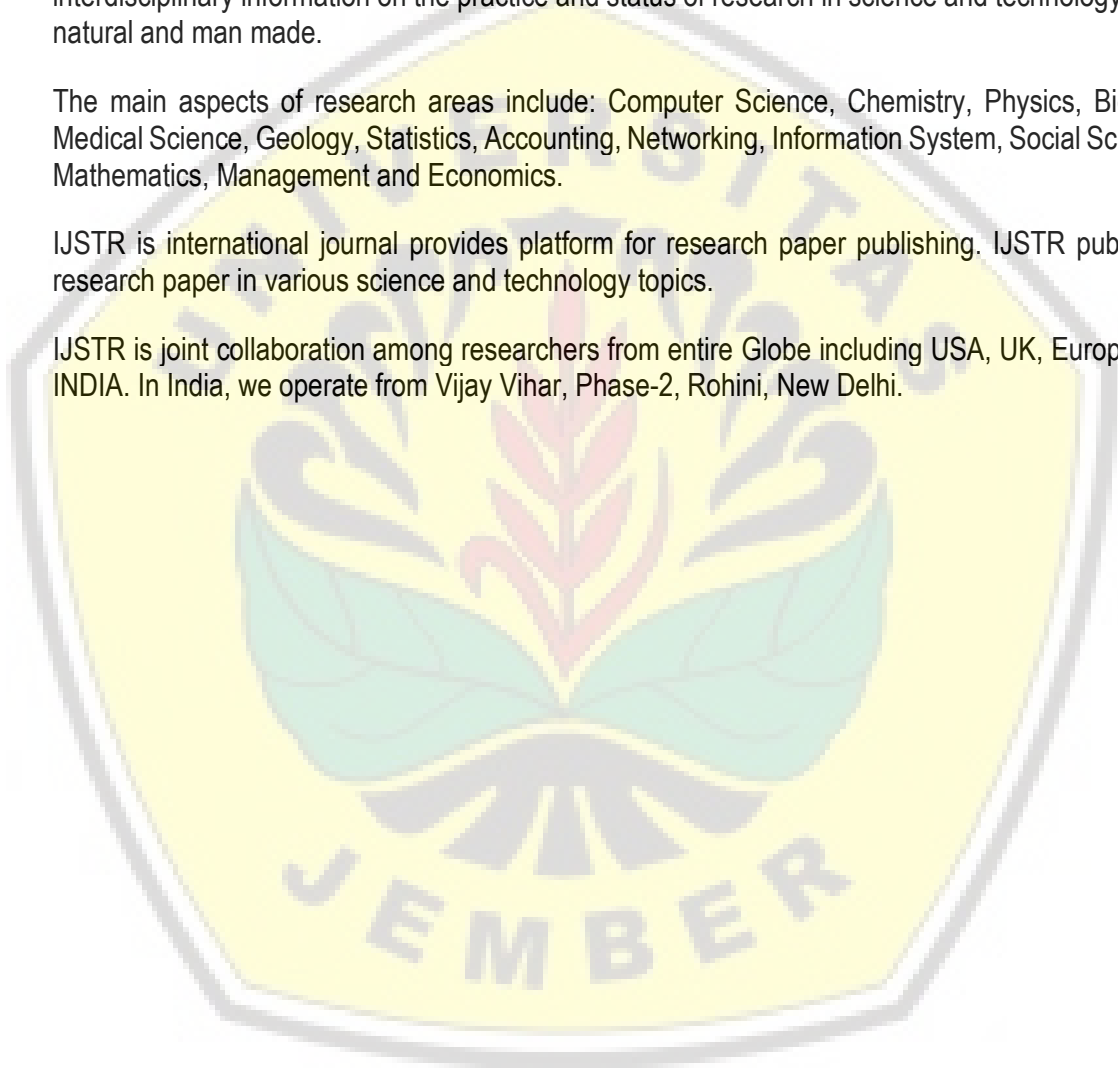
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# The Correlation Of Economic Development Toward Environmental System In Indonesia (Study In East Java Province)

Herman Cahyo Diartho, Selly Febriana

**Abstract:** This research aims to know the relationship of economic development focused on the growth rate of agriculture, industrial and transportation index toward environmental quality of life in the East Java. The models is used in this study is Vector Error Correction Models (VECM) and the method selected in this research is the Granger Causality. The research of the method of analysis, the Granger Causality show that a causal relationship or on-both-sides variabels relationship between the growth rate of industrial sector toward Environmental Quality of Life Index with a value of 0.0470 big as the significant level of 5%. Transportation sector has a causal relationship with value as big 0.0000 toward Environmental Quality of Life Index of the significant level of 5%. The Agricultural has a causal relationship with value as big 0.000 toward environmental quality of life index significant level of 5%. Meanwhile, the Environmental Kuznets Curve hypothesis proven in the East Java inverse U-shaped slope.

**Index Terms:** Economic Development, Environmental Kuznets Curve, Environmental Quality of Life Index, Sector Industrials, Agriculture, and Transportation.

## 1 INTRODUCTION

In the early 1970s environmental issues become an important pillar in economic development. In fact, it has become the main objective of development policies, both in the global and national level. One important moment that considers the environment as a destination as well as a framework in the process building - it is contained in the report of the World Commission for Environment and Development, better known as the Brundtland Commission. Demands in the global era with a series of challenges facing the priority issues such as development that emphasizes problems in the future. Succinctly, Environmental degradation has become an important issue in many parts of the region in Indonesia. The emergence of public concern over environmental issues has fueled efforts to understand more clearly and begin to take steps as well as the real reason of the problem and the cause and effect of environmental degradation. The purpose of this study was to determine how much the relationship between the rate of GDP growth in the three sectors are the focus in this study on the Environment Quality Index in East Java. Then, how much impact in the short term and long term.

Kuznets (1995) pays special attention to issues - issues that arise in development and is seeking to criticize a development model alone - the only eye-oriented growth. Kuznets stated that development without regard to the conservation of nature and environment will only create damage to the environment itself. In this study, focuses on three main sectors that have contributed greatly to the economic growth in East Java, among others; Sector Industry, Agriculture and Transport sectors. These three sectors are very interrelated and impact trickel backwash down effect and the effect of the economic activity. GRDP data Sector Industry, Agriculture and Transport, (see Appendix A) shows that the trend of growth of all three sectors showing positive growth trends. However, what happens to the quality of the environment on the three sectors of economic activity? In the page Appendix-C has presented

data on the environmental conditions of East Java province as well as comparative data issues to be addressed in this study. If viewed from the aspect of economy, when the GDP in each type of economic activities is growing then it shows that the development in the region following the positive growth trends. The phenomenon of the GDP growth rate of the agricultural sector in the Appendix-B shows the growth trend is likely to increase from year to year. This indicates that the greater the production activities carried out by the industrial sector, the greater the agricultural sector provides the raw material needed by the industrial sector. That is, the need for utilization of natural resources and the environment will also follow this trend. the GDP of East Java Province. In Appendix C shows the environmental conditions in the province of East Java.

What about the environmental conditions in East Java? If it is associated with the rate of GDP growth in the three sectors; Industry, Agriculture and Transport providing a barometer of economic development indicators contribute substantially to Environmental Quality Index has decreasing from 2016 that amounted 63.98 to 60.70 in 2017. This shows that the index of environmental quality of life of East Java province are in fairly well. This predicate value later as an indicator benchmarks in policy making on issues of processing and protection of the environment. The thresholds established in accordance with the Rule of Law No. 32 of 2009 on the Protection and Processing Environment. The impact of the development process in addition to improving the income of the economic activity itself can also cause negative externalities as a form of social costs arising from economic activity. Indonesian Government Regulation No. 74 of 2001 on the treatment of hazardous and toxic states that the increase in development activities in various fields, particularly in trade and industry there is a tendency of increasing the use of hazardous and toxic materials. On the basis of the regulations above as well as the data and the various problems that exist in the field conditions then do studies on how the effect of development on environmental quality. Environmental Kuznets Curve hypothesis has been widely used to investigate how the activity of economic activity can affect the environment. This

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theory was developed on the basis of the environmental demand which in turn will increase social control and government regulations (Mason and Swanson, in Idris, 2010).

## 2 LITELATURE RIVIEW

### 2.1 Economic Development

Economic development in view as a development process that occurs continuously and dynamic. Economic development is also viewed as a process of transformation that is characterized structurally. The changes arising from the economic activities and the factors that influence on the changing role of the economic sector in its efforts to establish national income. Schumpeter defined economic development as changes are spontaneous and disconnected - sums (discontinuous) in the circular flow channel in which a disturbance of the balance that is always changing and replacing the previous equilibrium state. Economic development became a major support on the success of a country, but on the other side it is also a major problem that must be faced, especially the impact of process development activities on environmental quality.

### 2.2 Economic Growth

Simon Kuznets, (Todaro, 2000) states that economic growth is characterized by an increase in capacity in the long term in providing a variety of economic goods to the community and it is manifested by the increase in national output is kept - constant and accompanied by advances in technology. Economic development and economic growth in synergy in achieving national development goals. However, if the two aspects are not consider environmental sustainability side, it will appear new problems in the future. Advances in technology that are not environmentally friendly can harm natural habitats. The activities that are not environmentally friendly production process as an effort of the increase in output, in addition to increasing revenues it will generate substantial social costs.

### 2.3 Environmental Externalities

Environmental damage in Economic Sciences is caused by human activity, specifically called externalities. Losses or profits suffered because the economic behavior of economic agents called externalities. Externalities arise when some of the activities of producers and consumers have an indirect impact and externalities that arise can be positive or negative. Positive externalities occur when the activity carried out by a person or group to provide benefits to individuals or other groups (Sankar, 2008). While the negative externality occurs when a process plant in a region had a negative impact such as dumping waste in the river that results in water pollution or air pollution causing environmental pollution. Residents near the plant will bear the external costs of economic activities in the form of health problems, difficulty accessing clean water, clean air and reduced. Water pollution is not only caused by industrial waste, but also due to the use of chemical-based pesticides and fertilizers in agricultural production. Then, the air pollution is not only caused by a motor vehicle and factory smoke but also from burning granary that is still often done by farmers. Positive externalities occur when the marginal social benefit is greater than the cost of an individual, and therefore the individual output is smaller than the social output. Meanwhile, the negative externality occurs when the marginal

social cost of the large than individual marginal cost. Therefore, the individual output levels greater than the social output (Sankar, 2008).

## 3 RESEARCH ECONOMIC

The model used in this study is an error correction Vector Models (VECM). Where the results of this estimation will be able to see the relationship in the short and long period between the dependent variable and independent variables. Vector Models an error correction (VECM) is a form of the VAR-Trisi tereks used for data that is not stationary at the current level, but there is a possibility of cointegration (Enders, 2004). VECM model specifications in general, as follows (Siregar and Ward, 2000):

$$\Delta Y_t = \sum_{i=1}^{k-1} \Gamma_i \Delta y_{t-1} + \mu_0 \mu_1 \alpha \beta \gamma_{t-1} \varepsilon_t \quad (1)$$

Where  $\Delta Y_t$  is vector containing the variabels analyzed in the study,  $\mu_0$  is vector intercept, (t) time trend, ( $\alpha$ ) is matrix loading (adjustment), ( $Y_{t-1}$ ) variable in-level, (k-1) is order regression coefficient, and then error term is ( $\varepsilon_t$ ). Then, the method chosen is the Granger Causality, in which a method to determine the dependent variable can be influenced by the independent variable or vice versa. This relationship is called a reciprocal relationship. Granger Causality method specification formulated as follows (Junaidi, 2012):

$$X_t = \sum_{i=1}^m a_i Y_{t-i} + \sum_{j=1}^n \beta_j X_{t-j} + U_{t1} \quad (2)$$

$$Y_t = \sum_{i=1}^m \lambda_i X_{t-i} + \sum_{j=1}^m \delta_j Y_{t-j} + U_{t2}$$

Where  $x_t$  is sector GDP Growth Rate Agriculture, Industry, and Transport in the unit percent. Index of environmental quality, air and water quality index in the show by (yt), and (M) in the show number of lag. Variabel disturbance in the show by (Ut1 and Ut2), it is assumed that disturbances are not correlated Ut1 and Ut2, and coefficient of each or each variable in the show ( $\alpha, \beta, \lambda, \delta$ ).

On the Granger Causality Test There are four hypotheses, among others:

- 1) If and then there is a one-way causality anantara Environmental Quality variable to GDP Agriculture, Industry and Transport Sector  $\sum_{i=1}^m a_i \neq 0 \sum_{i=1}^m \delta_i = 0$
- 2) If and then then there is causality in one direction variable PDRB Agriculture, Industry and Transport Sector to variable Environmental Quality  $\sum_{i=1}^m a_i = 0 \sum_{i=1}^m \delta_i \neq 0$
- 3) If and then there is a causality between the variables X and Y between variables with one another or between two variables is no causality  $\sum_{i=1}^m a_i = 0 \sum_{i=1}^m \delta_i = 0$
- 4) If and hence there is no two-way causality between the variables of the GDP of Environmental Quality and Agriculture, Industrial and Transport sectors  $\sum_{i=1}^m a_i \neq 0 \sum_{i=1}^m \delta_j \neq 0$

The best model obtained from cointegration test, which if the data shows the results of cointegration, VECM model used is, however, if the data is not cointegration, VAR models are used. The results of cointegration test shows all the data cointegrated then the model used is VECM.

#### 4 RESULT

Analysis of the data in this study using the best models that Vector an error correction (VECM). The processed data is the data rate of GDP growth in the industrial sector, Agriculture and Transport in East Java with a span of five years, namely 2013 - 2017. This study, using an alpha value of 0.05, more details will be described below are the result of which has been carried out a series of stages and according to the study design. Granger Causality Test Results in Industry sector ( $X_{t2}$ ) shows that  $\sum_{i=1}^m \alpha_i \neq 0$  and  $\sum_{i=1}^m \delta_i = 0$  that is to say, there is a one-way causal relationship between Environmental Quality Index of the industrial sector amounted to 0.0470% significant level of 5%. The results are consistent with studies of Rizky Adi (2006) on the island of Sumatra, where the results can also indicate that the industrial sector has a significant causal relationship in the level of 5%. VECM estimation results in the short-term negative effect on the industry variables Environmental Quality Index of -7,31E 16%, (see Appendix E) The results indicate that, if there is an increase in the rate of GDP growth in the industrial sector will lead to IKLH decreased by 7,31E -16%. In the long-term impact on the growth rate of the industrial sector amounted -2.56E IKLH 16%. This phenomenon is in line with the increase in revenue in the industrial sector due to higher production, and accompanied by increased population of East Java province from year to year, (see Appendix H). In line with this, the more the population needs to be met and in turn will have an impact on the negative externalities factors of production activities. This indicates that the level of the population also affects the deterioration of environmental quality. This is in line with research Eryan Dwi (2018) in Indonesia, where the results of the research show that population growth was significantly positive effect. In the Agricultural sector ( $X_{t2}$ )  $\sum_{i=1}^m \alpha_i = 0$  and  $\sum_{i=1}^m \delta_i = 0$  that is to say, there is a two-way causal relationship between variables Agriculture sector against the Environment Quality Index and vice versa significant at 0.0000% in the level of 5%. These results are consistent with research Idris (2012) in Indonesia, where in the early phases of moving from agriculture sector to the industrial sector the impact of the use of factors of production are not environmentally friendly, natural resource use excessive and the use of fertilizers made from chemicals in farming activities will result in damage living environment. The transition from the agricultural sector to the industrial sector resulted in the exploration of a large - scale of the use of natural resources and to a certain extent will have an impact on environmental degradation. In the short term, the rate of GDP growth in the agricultural sector -3.86E negative effect of 16%. Meanwhile, in the long term by -6.10E 17%. Each increase of one percent in the long term and short term in the agricultural sector growth rate will decrease Environmental Quality Index. That phenomenon arising from farming activities uses excessive chemical-based fertilizers. The use of chemical fertilizers in the long term can damage soil fertility which directly impact on environmental degradation and loss of quality of production. It is directly proportional to the production and sale of chemical fertilizers in East Java, (see appendix F).

**Table. 1**  
Results of Granger Causality Analysis

Causality relationships	F-statistic	Probability
$X_{t1}$ does not Granger Cause IKLH	0.11742	0.9010
IKLH does not Granger Cause $X_{t1}$	3.41903	0.0470 *
$X_{t2}$ does not Granger Cause IKLH	-0.78078	0.0000 *
IKLH does not Granger Cause $X_{t2}$	0.00000	0.0000 *
$X_{t3}$ does not Granger Cause IKLH	0.77258	0.0000 *
IKLH does not Granger Cause $X_{t3}$	0.01247	0.0000 *

Transport sector shows causality and  $\sum_{i=1}^m a_i = 0$   $\sum_{i=1}^m \delta_j = 0$  that is to say, there is a reciprocal relationship between the two-way transport sector on Environmental Quality Index of 0.0000% significant level of 5%. These results in line with the revenue increase GDP in this sector which resulted in negative externalities generated factors such as air pollution from motor vehicles and traffic density also causes a negative relationship between the variables of transport with IKLH, (See Appendix G). This relationship is reflected in the dense traffic flow in line with the increase in revenue in the transportation services sector in East Java. Meanwhile, the VECM estimation results, (See Appendix E) transportation variables show a negative effect in the short term and long term, but the impact is very small. In the short term -4.36E 16% whereas in the long term by -8.93E-16. The phenomenon of negative correlation indicates that, if there is an increase in the rate of GDP growth in transport sector will lead to a decrease in the Environment Quality Index in the province of East Java.

## 5 CONCLUSION

The study analyzed over the location of the interrelationships and impacts arising from the economic development of the Environmental Quality in East Java province. The results of the discussion on the study, concluded several conclusions, among others:

1. The growth rate of the industrial sector has causality or reciprocal relation to the Environment Quality Index in the province of East Java significant level of 5%.
2. The growth rate of agriculture sector is showing causality or reciprocal relation to the Environment Quality Index in the province of East Java significant level of 5%.
3. The rate of growth in transport sector indicate a causal relationship or a mutual relationship of the Environment Quality Index in the province of East Java significant level of 5%.
4. The relationship between GDP growth rate sectors of Industry, Agriculture and Transportation on Environmental Quality Index of East Java Province generate negative externalities in the short term and long term significant level of 5%.

For the creation of sustainable development and the preservation of nature sheltered, government as policy makers are expected to pay more attention back to management regulations concerning resources and the environment. Along with it, the government has a top notch above regulations and policies that created the policy in order to formulate a policy that is able to increase incomes.

Later, it will culminate in the ability of people to pay for environmental damage caused by the loss of economic activity and in turn people are starting sacrifice sheltered consumption

for the sake of the environment. The lack of regulation and policy, would need some other incentives like the green movement or development of green spaces in residential areas, environmental ambassador who will be able to provide education about management resources and the environment. The movement did not escape from the supervision of relevant agencies, the Ministry of Environment. This need to be done to help strengthen the regulations and policies that already exist. So as to create sustainable economic development.

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## Appendix A

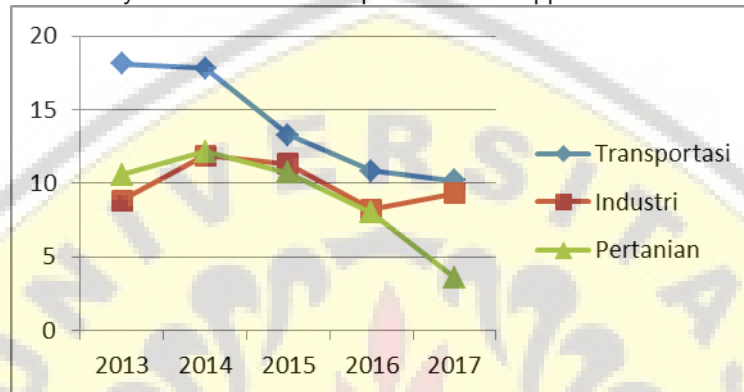
**PDRB Industry Sector, Agriculture and Transport of East Java Province  
by Business Sector Top Price Basic Applicable 2013 - 2017**

	2013	2014	2015	2016	2017
Industry	397.997,7	445.279,8	495.751,8	536.442,9	586.258,6
Agriculture	186.038,3	208.613,6	230.942,5	249.457,2	258.428,1
Transportation	50000,7	56632,8	42435,2	62775,4	69176,4

Source: National Statistics East Java

## Appendix B

**GRDP Growth Rate Industry Sector, Agriculture and Transport Province  
East Java by Business Sector Top Price Basic Applicable 2013 - 2017**



Source: National Statistics East Java (data processing)

## Appendix C

**Index Air Quality, Water and Environmental Quality Index  
East Java Province 2013 - 2017 (percent)**

	2013	2014	2015	2016	2017
Index Air Quality	72.45	73.20	89.21	83.20	85.49
Index Water Quality	49.10	49.11	50.33	49.07	49.17
Environmental Quality Index	56.25	56.48	61.70	63.98	60.70

Source: Environment Agency of East Java Province (data processing)

## Appendix D

**Variable industry on Environmental Quality Index**

Null Hypothesis:	Obs	F-Statistic	Prob.
XT1 does not Granger Cause IKLH	152	0.11742	0.9010
IKLH does not Granger Cause XT1		3.41903	0.0470

**Variable agriculture on Environmental Quality Index**

Null Hypothesis:	Obs	F-Statistic	Prob.
XT2 does not Granger Cause IKLH	64	-0.78078	0.0000
IKLH does not Granger Cause XT2		0.00000	0.0000

**Variable transport on Environmental Quality Index**

Null Hypothesis:	Obs	F-Statistic	Prob.
XT3 does not Granger Cause IKLH	48	0.77258	0.0000

IKLH does not Granger Cause XT3

0.01247

0.0000

## Appendix E

## The result of an error correction Estimates Vector Models (VECM)

Cointegrating Eq:	CointEq1			
IKLH (-1)	1.000000			
XT1 (-1)	-2.56E-16 (3.8E-09) [6.8e-08]			
XT2 (-1)	-6.10E-17 (4.2E-09) [-1.4e-08]			
XT3 (-1)	-8.93E-16 (2.9E-09) [3.1e-07]			
C	-60.72000			
Error Correction:	D (IKLH)	D (XT1)	D (XT2)	D (XT3)
CointEq1	-1.361623 (2.3e-09) [-5.8e + 08]	0.297318 (0.03919) [7.58566]	-0.331812 (0.03601) [-9.21528]	0.201572 (0.04408) [4.57333]
D (IKLH (-1))	0.835204 (1.6E-16) [5.1e + 15]	-0.321510 (0.06545) [-4.91201]	0.207200 (0.06013) [3.44586]	-0.108283 (0.07360) [-1.47114]
D (XT1 (-1))	-7.31E-16 (1.7E-16) [-4.29187]	-0.339813 (0.06822) [-4.98133]	-0.038916 (0.06267) [-0.62098]	0.118092 (0.07671) [1.53941]
D (XT2 (-1))	-3.86E-16 (1.8E-16) [-2.08884]	0.023995 (0.07403) [0.32410]	-0.273264 (0.06801) [-4.01782]	0.105867 (0.08325) [1.27160]
D (XT3 (-1))	-4.36E-16 (1.5E-16) [-2.97651]	-0.050784 (0.05869) [-0.86524]	-0.057616 (0.05392) [-1.06856]	-0.251762 (0.06600) [-3.81443]
C	-0.745376 (4.9E-16) [-1.5e + 15]	0.674471 (0.19597) [3.44174]	-1.211213 (0.18003) [-6.72790]	0.191195 (0.22037) [0.86760]

## Appendix F

## Production and Sales of Chemical Fertilizer in East Java 2013 - 201 (tonnes)

Fertilizer products	2013	2014	2015	2016	2017
Urea fertilizer	482.148	416.635	434.220	424.004	460.015
ZA	827.225	816.001	694.570	755.330	798.782
SP-36 fertilizer	517.757	400.508	281.579	464.982	480.131
fertilizer Phonska	1,800,198	2,110,996	2,534,155	2,118,530	2,434,476
NPK fertilizer	449.864	363.574	155.360	296.067	378.456
Kebonmas & DAP					

ZK fertilizer (K <sub>2</sub> SO <sub>4</sub> )	8.440	8.326	7.842	10.681	15.184
fertilizer Petroganik	-	-	681.673	485.300	606.527
sale					
Domestic-subsidy	4,829,166	4,777,896	5,005,901	5,014,507	4,965,528
Non Domestik-Subsidy	349.559	603.896	528.071	213.479	242.711

Source: Condensed Statements PT Petronika East Java

#### Appendix G

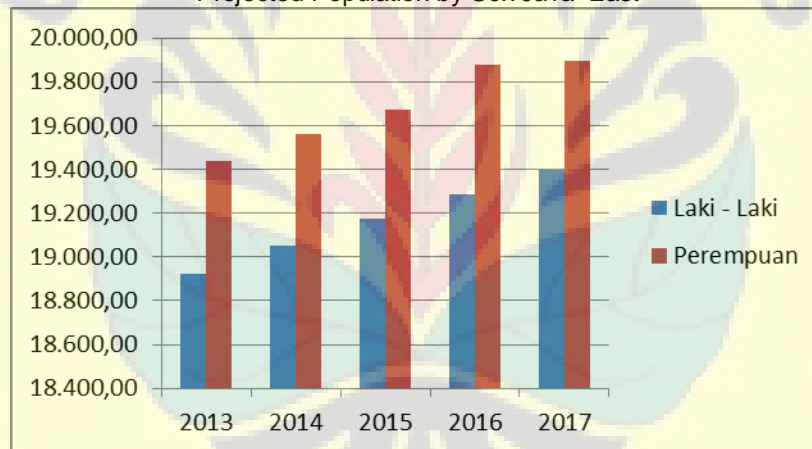
The ratio of Total Vehicle Length of road  
in East Java Province 2013 – 2017

Description	Long Way Province and District / City (km)	Total Vehicles motor (million)	Ratio (km / 1000 vehicles)	Ratio (Vehicles / 1km road)
(1)	(2)	(3)	(4)	(5)
2013	40 806.90	12,16	3.36	298
2014	45 093,14	14.90	3.03	330
2015	47 732.41	14.81	3.20	310
2016	47 392.00	16.65	2.89	346
2017	47 392.00	17.83	2,66	376

Source: Office of Public Works Highways East Java

#### Appendix H

Projected Population by Sex Java East



Source: Books Indonesian Population Projections 2010 - 2035 (Data processed)