Available online at https://journal.rescollacomm.com/index.php/ijbesd/index

International Journal of Business, Economics and Social Development

e-ISSN 2722-1156
p-ISSN 27722-1164

Vol. 3, No. 3, pp. 142-149, 2022

The Impact of Ecological Checks on Urban Areas Towards Crime Rates in Indonesia

Ahmad Yani[1*]

[1] *Lecturer in Industrial Engineering, Faculty of Engineering, Megou Pak Tulang Bawang University, Lampung, Indonesia*

**Corresponding author email: ibnu.yunusdh@gmail.co.id*

Abstract

This study was conducted to analyze the impact of ecological checks on urban areas towards crime rates. The research was run at the Laboratory of Earth Information at University of Lampung, while the data acquisition was carried out at Subdit IV Tipidter Ditreskrimsus POLDA Lampung on October 2014 - December 2014. This study applied a modeling approach using secondary data from 36 districts/ cities in Indonesia. The model used in this study was multiple linear regression using multiple dummy variables. The response variables used were the level of criminality such as murder, rape, persecution, kidnapping, destruction, theft, fraud, narcotics, and victims of demonstration anarchism. The explanatory variables include the level of regional urbanism and air pollution (air pollution including CO, HC, and CO2) as the main variables which were equipped with accompaniment variables (recreation areas, places of worship and religious leaders). Based on the results of linear regression using Minitab V.16 software at a confidence interval of 5% and 10%, it is showed that the degree of regional urbanism is one of the variables that can cause an increase in criminal rates. Meanwhile, environmental polluting variables (CO, HC, and CO2) have no real effect.

Keywords: urban areas, air pollution, criminality

1. Introduction

Urban society is social creatures who need other humans in their lives, a group of humans who need each other will form a common life called a society. Society itself can be defined as a unity of human life that interacts in accordance with certain systems of mores that are continuous and bound by a sense of shared identity (Sharma & Das, 2020).

Today's modern society is often distinguished between urban communities and rural communities. The distinction between urban communities and rural communities is inherently gradual, it is rather difficult to provide limits on what is meant by urban because there is a relationship between population concentration and social symptoms called urbanism and not all places with high population density can be called urban (White et al., 2018).

According to Indonesian law No. 26/2007 on spatial arrangement and the phenomenon of RTH provision policy in the region, based on population (reflecting the level of urbanism of a region), cities can be classified into five categories: (1) Megapolitans (above 5 million people),(2) Metropolitan (1 - 5 million people), (3) Large city (500,000 – 1 million people), (4) Medium city (100,000 - 500,000 people), (5) Small city (20,000 – 100,000 people).

According to research by Gordon & Vipond (2005); Moore (2007); Wirth (1938) explains that the level of urbanism in areas of population density, besides increasing productivity in various economic sectors, cities can also cause negative externalities such as noise, traffic jams, and various kinds of urban social deviations such as murder, theft, robbery, and so on. In addition, urbanization of the area also often coincides with an increase in air pollution levels.

Based on research from Karhikeyan et al. (2020); Mao et al., (2012) and Li et al. (2019) said that pollutant materials which are generally an indicator of ecological checks of urban areas including CO, HC and CO2, there has been no finding of research that examines the influence of these three polluting materials on the level of criminality, as well as those associated with the comfort of living in urban areas.

2. Materials and Methods

This research was conducted at the Laboratory of Earth Information of University of Lampung. Data acquisition was carried out at Subdit IV Tipidter Ditreskrimsus POLDA Lampung on October 2014-December 2014. This study implemented a modeling approach using secondary data from 36 districts/cities in Indonesia. The study was conducted using secondary data from 36 regencies/cities in Indonesia by having regional urbanism variables, air pollution variables, regional facility variables and crime rates as the study material. The data analysis was conducted at the Instrumentation and Computing Laboratory of the Faculty of Mathematics and Natural Sciences, University of Lampung.

2.1. Materials

The variables that we use in this study consist of regional urbanism, air pollution, regional facility, and crime.

2.1.1. Regional Urbanism Variables

This variable category consists of population density, total number of vehicles, total number of vehicles per area, and total number of vehicles per population. Statistical descriptive of the data presented in Tables 1, 2, 3, and 4.

Table 1: Statistical descriptive of Population Density Research in 36 Regencies/Cities in Indonesia.

Descriptive Statistics		Found in regencies/cities	Population Density (soul)
Metropolitan City	Max	Jakarta Pusat	18,882.8
	Min	Semarang	982.97
	Average		11,140.6
Large City	Max	Bogor	8,479.59
	Min	Yogyakarta	373.02
	Average		3,874.47
Medium City	Max	Mataram	6,740.78
	Min	Kupang	20.27
	Average		1,970.45
Small City		Mamuju	48.74

Source: Central Bureau of Statistics (2014)

Table 2: Statistical descriptive of Total Number of Vehicles in 36 Regencies/ Cities in Indonesia.

Descriptive Statistics		Found in regencies/cities	Total Number of Vehicles (unit)
Metropolitan City	Max	Jakarta Pusat	2,201
	Min	Makassar	1,879
	Average		1,994.77
Large City	Max	Batam	1,825
	Min	Malang	1,512
	Average		2,073.33
Medium City	Max	Bengkulu	2,209
	Min	Tanjung Pinang	1,100
	Average		1,608.60
Small City		Mamuju	1,305

Source: Central Bureau of Statistics (2014)

Table 3: Statistical Descriptive of Total Number of Vehicles/Area in 36 Regencies/Cities in Indonesia.

Descriptive Statistics		Found in regencies/cities	Total Number of Vehicles/Area (unit)
Metropolitan City	Max	Jakarta Pusat	45.73
	Min	Palembang	5.07
	Average		14.90
Large City	Max	Yogyakarta	59.02
	Min	Batam	2.55
	Average		15.47
Medium City	Max	Gorontalo	23.24
	Min	Kupang	0.09
	Average		8.96
Small City		Mamuju	0.26

Source: Central Bureau of Statistics (2014)

Table 4: Statistical Descriptive of Total Number of Vehicles/populations in 36 Regencies/Cities in Indonesia.

Descriptive Statistics		Found in regencies/cities	Total Number of Vehicles/Population (unit)
Metropolitan City	Max	Semarang	0.0338
	Min	Jakarta Timur	0.0007
	Average	Surabaya	0.0007
Large City	Max	Yogyakarta	0.1582
	Min	Malang	0.0018
	Average		0.0160
Medium City	Max	Gorontalo	0.0081
	Min	Jambi	0.0030
	Average		0.0053
Small City		Mamuju	0.0053

Source: Central Bureau of Statistics (2014)

2.1.2. Air Pollution Variables

The air pollution variables used in the study include CO, HC and CO2. Statistical descriptive of the data presented in Tables 5, 6, and 7.

Table 5: Statistical Descriptive of CO Pollution in 36 Regencies/Cities in Indonesia.

Descriptive Statistics		Found in regencies/cities	CO (ppm)
Metropolitan City	Max	Bekasi	26,300
	Min	Jakarta Utara	2,300
	Average		7,300
Large City	Max	Malang	17,400
	Min	Banjarmasin	5,900
	Average		9,200
Medium City	Max	Mataram	18,500
	Min	Gorontalo	1,100
	Average		900
Small City		Mamuju	9,600

Source: Ministry of Environment (2014)

Table 6: Statistical Descriptive of HC Pollution in 36 Regencies/Cities in Indonesia.

Descriptive Statistics		Found in regencies/cities	HC (ppm)
Metropolitan City	Max	Bekasi	146.21
	Min	Jakarta Utara	24.90
	Average		90.03
Large City	Max	Pontianak	248.06
	Min	Banjarmasin	66.52
	Average		129.64
Medium City	Max	Mataram	258.67
	Min	Gorontalo	30.66
	Average		136.99
Small City		Mamuju	129.4

Source: Ministry of Environment (2014)

Table 7: Statistical Descriptive of CO2 Pollution in 36 Regencies/Cities in Indonesia.

Descriptive Statistics		Found in regencies/cities	HC (ppm)
Metropolitan City	Max	Jakarta Pusat	141,300
	Min	Bandung	115,500
	Average		132,300
Large City	Max	Balik Papan	141,200
	Min	Pontianak	126,200
	Average		133,500
Medium City	Max	Gorontalo	141,900
	Min	Jambi	121,500
	Average		132,700
Small City		Mamuju	140,900

Source: Ministry of Environment (2014)

2.1.3. Regional Facility Variables

Variables of regional facilities used in the study include places of worship, recreation places and religious leaders. The statistical description of the data is given in Table 8, 9, and 10.

Table 8: Statistical Descriptive of Place of Worship in 36 Regencies/Cities in Indonesia.

Descriptive Statistics		Found in regencies/cities	Place of Worship(unit)
Metropolitan City	Max	Tangerang	5,671
	Min	Jakarta Pusat	939
	Average		2,752
Large City	Max	Bogor	4,123
	Min	Denpasar	413
	Average		1,558
Medium City	Max	Serang	3,215
	Min	Kupang	589
	Average		1,743
Small City		Mamuju	421

Source: Central Bureau of Statistics (2014)

Table 9: Statistical Descriptive of Recreational Places in 36 Regencies/Cities in Indonesia.

Descriptive Statistics		Found in regencies/cities	Recreational Places (unit)
Metropolitan City	Max	Bandung	78
	Min	Jakarta Utara	6
	Average		33
Large City	Max	Denpasar	56
	Min	Pontianak	9
	Average		29
Medium City	Max	Serang	31
	Min	Tanjung Pinang	7
	Average		15
Small City		Mamuju	4

Source: Central Bureau of Statistics (2014)

Table 10: Results of Religious Leaders (PA) in 36 Regencies/Cities in Indonesia.

Descriptive Statistics		Found in regencies/cities	Religious Leaders (soul)
Metropolitan City	Max	Tangerang	2,363
	Min	Makassar	434
	Average		1,242
Large City	Max	Bogor	1,718
	Min	Denpasar	172
	Average		649
Medium City	Max	Serang	1,340
	Min	Kupang	245
	Average		726
Small City		Mamuju	175

Source: Central Bureau of Statistics (2014)

2.2. Crime

Statistical Descriptive of crime rates is given in Table 11.

Table 11: Descriptive Statistics of Crime Rates in 36 Regencies/Cities in Indonesia.

Descriptive Statistics		Found in regencies/cities	Crime Rate (case/1000 population)
Metropolitan City	Max	Medan	13.78
	Min	Tangerang	0.75
	Average		5.04
Large City	Max	Padang	7.25
	Min	Denpasar	0.68
	Average		3.19
Medium City	Max	Mataram	1.26
	Min	Palangkaraya	0.23
	Average		0.63
Small City		Mamuju	0.31

Source: Central Bureau of Statistics (2014)

2.3. Used Model

The model used was multiple linear regression using multiple dummy variables.

2.4. Model Form

The form of the model in this study is expressed by mathematical equations as follows:

$$[Yn]i = \beta_0 + \beta_1[D1\_KMT]i + \beta_2[D1\_KBS]i + \beta_3[D1\_KSD]i + \beta_4[D1\_KKC]i + \beta_5\,[TI]\,i + \beta_6[CO]i + \beta_7\,[HC]\,i + \beta_8[CO2]\,i + \beta_9[TR]\,i + \beta_{10}[TJK\_LW]\,i + \beta_{11}[TJK\_JP]\,i + \beta_{12}[PA]\,i + \beta_{13}[KP]\,i + \beta_{14}[TJK]\,i + €\,i\{1\}$$

2.5. Formal Hypotheses

In this study, the hypotheses are:

$H_0 : \beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = \beta_9 = \beta_{10} = \beta_{11} = \beta_{12} = \beta_{13} = \beta_{14} = 0$
(None of the variables specified in the model above has any real effect on the level of criminality).

$H_1 : \beta_0 \neq \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq \beta_8 \neq \beta_9 \neq \beta_{10} \neq \beta_{11} \neq \beta_{12} \neq \beta_{13} \neq \beta_{14} \neq 0$
(There is at least one variable specified in the model above that has a real effect on the level of criminality).

2.6. Optimization of Model Parameter

Optimization of model parameter was done using Minitab V.16 software at a confidence interval of 5% and 10%.

3. Results and Discussion

3.1. Results

3.1.1. Results of Goodness of Fit Model

The results of the Goodness of Fit model using minitab V.16 are presented in Table 12 and Table 13

Table 12: Analysis of Variance of the Crime Rate Model as a Function of Regional Urbanism, Air Pollution and Area Facilities.

Source	DF	SS	MS	F	P
Regression	13.00	173439359.00	13341489.00	2.19	0.05
Residual (Error)	22.00	134244805.00	6102037.00		
Total	35.00	307684164.00			

S = 2470.23 R-Sq = 56.4% R-Sq(adj)= 30.6%

The results of the study in Table 12 show the anova model level (Y) as a function of the degree of regional urbanism, air pollution, and regional facilities. The godness of the model proposed from this study can be examined through the results of anova as in Table 12 of the table $P = 0.05$ (5% < 10%) which means that the proposed model can be viewed quite well, as if there are 100 urban areas in which the crime rates are predicted using the 13 explanatory variables as listed in Table 13 then there will only be 5 regions that miss the prediction with the exist validity. Even so, it seems that it is still necessary to do research with other variables to complete the variables that have not been included in this research model. This argument is obtained from the results of R-Sq of this study which is only 30.6%.

Based on these results, the model of alleged crime rates of urban areas can be expressed by the computation:

$$Yi = 9001 + 467\{D1\_KSD\} + 2495\{D1\_KBS\} + 6272\{D1\_KMT\} - 0,105\{KP\} + 1.36\{TJK\} - 39.5\{TJK\_LW\} + 29371\{TJK\_JP\} - 301\{CO\} + 13.1\{HC\} - 835\{CO2\} - 301\{CO\} + 13.1\{HC\} - 835\{CO2\} - 2.51\{TI\} + 6.2\{TR\} + 4.43\{PA\}$$

Results of Optimization of Parameter Model of the Variable of Regional Urbanism Degree (medium city dummy, large city dummy, metropolitan city dummy, total intensity of vehicle number, and population density); Variable Group of Air Pollution (CO, HC, CO2); Variable Group of Regional Facilities (places of worship, recreation, religious leaders) are presented in Table 13.

Table 13: Results of Optimization of Parameter Model of Variable Group of Regional Urbanism Degree, Air Pollution, and Regional Facilities.

Predictor	**Coef**	**Symbol**	**SE Coef**	**T**	**P**
Constant	9001.00	$\beta 0$	14365.00	0.63	0.54
Variable Group of Regional Urbanism					
D1_KSD (dummy medium city)	467.00	β_1	2903.00	0.16	0.87
D1_KBS (dummy large city)	2495.00	β_2	3219.00	0.78	0.45
D1_KMT (dummy metropolitan city)	6272.00	β_3	3451.00	1.82	0.08
KP	-0.11	β_4	0.16	-0.67	0.51
TJK	1.36	β_5	1.96	0.70	0.49
TJK_LW	-39.50	β_6	29856.00	0.98	0.34
TJK_JP	29371.00	β_7	29856.00	0.98	0.34
Variable Group of Air Pollution					
CO	-301.00	β_8	1441.00	-0.21	0.84
HC	13.15	β_9	13.14	1.00	0.33
CO2	-835.30	β_{10}	978.90	-0.85	0.40
Variable Group of Region Facility					
TI	-2.51	β_{11}	2155.00	-1.17	0.26
TR	6.17	β_{12}	33.04	0.19	0.85
PA	4.43	β_{13}	5.45	0.81	0.43

Source: Results of Statistical Analysis (2014)

3.2. Discussions

To examine the interpretation of the optimization results of 13 parameters as stated in Table 13, it is necessary to observe through the discussion below.

3.2.1. Impact of Variable Degree Group of Regional Urbanism

The influence of variable degree groups of regional urbanism on crime rates which include city classification (medium city dummy, large city dummy, metropolitan city dummy), population density, intensity of total number of vehicle can be explained as follows.

1. The coefficient of each of the classes shows that a medium city dummy produced alleged parameter value of $\beta_1 = 467$ with $P = 0.87$ (87%). Thus in this study, H_0 (reject H_1) should be accepted especially for paramter β_1.
2. A large city dummy produced alleged parameter value of $\beta_2 = 2495$ with P = 0.45 (45%). Thus in this study, H_0 (reject H_1) must be accepted especially for paramter β_2.
3. A metropolitan dummy produced alleged parameter value of $\beta_3 = 6272$ with $P = 0.08$ (8%). Thus in this study H_1 (reject H_0) must be accepted especially for paramter β_3.
4. The population density coefficient resulted in the alleged parameter value of $\beta_4 = -0.11$ with $P = 0.51$ (51%). Thus in this study, H_0 (reject H_1) must be accepted especially for paramter β_4.
5. The total coefficient of the number of vehicles produced alleged parameter value of $\beta_5 = 1.36$ with $P = 0.49$ (49%). Thus in this study, H_0 (reject H_1) must be accepted especially for paramter β_5.
6. The total coefficient of vehicle number/area produced alleged parameter value of $\beta_6 = -39.50$ with $P = 0.57$ (57%). Thus in this study H_0 (reject H_1) must be accepted especially for paramter β_6.
7. The coefficient of the total number of vehicles/population resulted in alleged value of parameter $\beta_7 = 29371$ with $P = 0.34$ (34%). Thus in this study H_0 (reject H_1) must be accepted especially for paramter β_7.

3.2.2. Impact of Variable Group of Air Pollution

The influence of variable groups of air pollution on crime rates that include CO, HC, CO2 can be explained as follows.

1. The CO coefficient produced alleged parameter value of $\beta_8 = -301$ with $P = 0.84$ (84%). Thus in this study H_0 (reject H_1) must be accepted especially for paramter β_8.
2. The HC coefficient produced alleged parameter value of $\beta_9 = 13.15$ with $P = 0.33$ (33%). Thus in this study H_0 (reject H_1) must be accepted especially for paramter β_9.
3. The CO2 coefficient produced alleged parameter value of $\beta_{10} = -835.3$ with $P = 0.40$ (40%). Thus in this study, H_0 (reject H_1) must be accepted especially for paramter β_{10}.

3.2.3. Impact of Variable Group of Regional Facilities

The influence of variable groups of regional facilities on the level of criminality that includes places of worship, recreation places and religious leaders can be explained as follows.

1. The coefficient of places of worship produced alleged parameter value of $\beta_{11} = -2.51$ with $P = 0.26$ (26%). Thus in this study, H_0 (reject H_1) must be accepted especially for paramter β_{11}.
2. The coefficient of recreation places produced alleged parameter value of $\beta_{12} = 6.17$ with $P = 0.85$ (85%). Thus in this study, H_0 (reject H_1) must be accepted especially for paramter β_{12}.
3. The coefficient of religious leaders produced alleged parameter value of $\beta_{13} = 4.43$ with $P = 0.43$ (43%). Thus in this study H_0 (reject H_1) should be accepted especially for paramter β_{13}.

4. Conclussion

From the research above, we can concluded that air pollution in one region does not have a significant effect on the rate of increase in crime rates in the region.

References

Duan, N., Fan, W., Changbo, Z., Chunlei, Z., & Hongbing, Y. (2010). Analysis of pollution materials generated from electrolytic manganese industries in China. *Resources, Conservation and Recycling*, *54*(8), 506-511.

Gordon, D., & Vipond, S. (2005). Gross density and new urbanism: Comparing conventional and new urbanist suburbs in Markham, Ontario. *American Planning Association. Journal of the American Planning Association*, *71*(1), 41.

Karthikeyan, S., Periyasamy, M., & Mahendran, G. (2020). The measure of the pollution behaviour and the lambda factor of an injected engine system. *Materials Today: Proceedings*.

Li, X., Xiong, J., Gao, X., Huang, J., Feng, Z., Chen, Z., & Zhu, Y. (2019). Recent advances in 3D g-C3N4 composite photocatalysts for photocatalytic water splitting, degradation of pollutants and CO2 reduction. *Journal of Alloys and Compounds*, *802*, 196-209.

Mao, X., Yang, S., Liu, Q., Tu, J., & Jaccard, M. (2012). Achieving CO2 emission reduction and the co-benefits of local air pollution abatement in the transportation sector of China. *Environmental science & policy*, *21*, 1-13.

Moore, T. (2017). Beyond Iron Age 'towns': Examining oppida as examples of low-density urbanism. *Oxford Journal of Archaeology*, *36*(3), 287-305.

Sharma, E., & Das, S. (2020). Measuring impact of Indian ports on environment and effectiveness of remedial measures towards environmental pollution. *International Journal of Environment and Waste Management*, *25*(3), 356-380.

White, R. L., Eberstein, K., & Scott, D. M. (2018). Birds in the playground: Evaluating the effectiveness of an urban environmental education project in enhancing school children's awareness, knowledge and attitudes towards local wildlife. *PloS one*, *13*(3).

Wirth, L. (1938). Urbanism as a Way of Life. *American journal of sociology*, *44*(1), 1-24.