DETERMINATION OF CLIMATE AND SOCIAL COMMUNITY FACTORS IN COVID-19 SPREAD DISTRIBUTION

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Abstract

Coronavirus Disease-2019 (COVID-19) is very shocking to the world. Until mid-2020, this virus has not yet found a vaccine that can be produced and can be applied en masse across the country. The spread of COVID-19 differs between regions, which implies that regional characteristics have an influence on the rate of growth. Regional and social climate factors are thought to have a role in the growth rate of COVID-19. This study aims to determine the role of climate and social society on the spread of COVID-19. This research uses OLS Regression Analysis method, then continued with CHAID analysis to determine the segmentation of the role of climate and social factors on the daily growth rate of COVID-19 in positive and deceased patients. The results of this study state that all independent variables of the study have a significant effect on the spread of COVID-19, with R-squared values in positive and deceased patients, respectively 67.1% and 70.3%. Strategic steps are needed in order to carry out policies that are targeted, effective and efficient. The results of this study can be a reference for the government in determining policies to reduce the growth rate of COVID-19, by focusing on areas that have high solar irradiation, are on Java Island, and regions that tend to be advanced.

Keywords : climate change, social behaviour, COVID-19, CHAID

1. INTRODUCTION

Coronavirus Disease-2019 (COVID-19) which occurred at the end of 2019 was very shocking to the world. Until mid-2020, this virus has not yet found a vaccine that can be produced and can be applied en masse across the country. This causes the speed of development of positive cases and death due to COVID-19 uncontrolled in some countries (Leung et all, 2020; Maida et all, 2020). Not yet found the right vaccine and the growth of positive cases that are rising, will disrupt various aspects of people's lives and also the economy of a country (Laing, 2020; Lal et all, 2020; Nghiem et all, 2020; Haleem et all, 2020; Millett, 2020; Kuckertz et all, 2020; Rapaccini et all, 2020; AkzoNobel, 2020; Goofell et all, 2020; Steffen et all, 2020; Sowby, 2020; Hou et all, 2020).

In spreading positive cases of COVID-19, it is necessary to consider factors that are naturally occurring, such as the climate of a region. In early 2020, many people stated that COVID-19 would be difficult to develop in tropical countries (Bashir et all, 2020; Shi et all, 2020). However, it turns out that it is not in accordance with the existing reality. Until mid-2020, the growth of positive cases has not been controlled optimally, for example in Indonesia. Indonesia has a tropical climate, but in regions that have an extreme climate, the spread of COVID-19 is above the provincial average.

Over time, there are regions that have relatively sloping positive case growth. This is due to government efforts and community participation (Lester et all, 2020; Coccia et all, 2020). The focus is on the

community. Because through good behavior control, it certainly will reduce the rate of spread in an area. In Indonesia, there are large provinces that have high growth rates. In fact, it is known from socio-economic indicators, these provinces have a good trend.

In practice, the government issued a number of rules that were intended to restrict the community from interacting. As a statement often made by President Jokowi, that people are asked to worship at home, work from home, and school from home. This is considered appropriate at the beginning of the application (Pradhan et all, 2020; Zhang et all, 2020). However, over time people who depend on social interaction, must leave the house to get a source of income (Hartmann et all, 2020; Shammi et all, 2020; Elavarasan et all, 2020). This caused a number of regions to experience a drastic increase (Wang, 2020). This character and culture has been embedded through the social conditions of the community (Koon et all, 2020; Govindan et all, 2020; Dubey et all, 2020).

Some media always inform how to break the chain of COVID-19 distribution (Kiraly et all, 2020; Chao et all, 2020), but there are still many people who ignore that information. Communities in urban areas that incidentally have better access to information tend to ignore these appeals (Shia et all, 2020). Whereas in urban areas, it is a region that tends to be dense. So if there is an exponential spread of COVID-19, the numbers will be very large, compared to rural communities (Barro et all, 2020).

The synergy of natural factors, which in this study is indicated by climate, and social conditions play a major role in the spread of COVID-19 (Méndez-Arriaga, 2020). There have been many studies reviewing the climate relationship on the spread of COVID-19 at the country level (Tosepu et all, 2020; Ma et all, 2020; Iqbal et all, 2020). However, there is still limited research that analyzes the role of climate and social factors on the spread of COVID-19 using village level data. Therefore, the expected outcome of this research is to find out the role of climate and social community on the spread of COVID-19. The results of this study describe the independent variables together have a significant effect on the daily spread of COVID-19 (for 70 days from March 20 to May 29, 2020) in Indonesia, both in positive patients and deaths due to COVID-19. This study uses 24 independent variables, including: rainfall, temperature, solar radiation, environmental conditions, access to TV broadcasts, cell phone use, ethnic diversity, the existence of public facilities, development programs and empowerment in the community, and a number of control variables that are also affects the spread of COVID-19. This research will also review what indicators need to be the focus of attention so that the spread of COVID-19 can be reduced to a minimum.

2. LITERATURE REVIEW

Based on the introduction above, there are several factors that influence the spread of COVID-19 when viewed from the climate and social aspects. When this aspect can be anticipated and controlled well in all regions, it will produce preliminary information on the acceleration of the spread of COVID-19 which has characteristics in accordance with the research variables.

Climate change is a change in the average weather over a relatively long period. In modern terms, the term climate change is also known as global warming, which causes geothermal heat to increase. The heat conditions tend to be felt by the people in the area crossed by the equator (Kanniah, 2020).

Indonesia is one of the countries in the world that is crossed by the equator. Phenomena that occur around the equator, including sunlight in the equatorial region fell to the ground at an angle of 90 degrees. This angle of falling sunlight makes solar power falling per unit area larger so that the area around the equator is hotter. Sunlight is almost always located above the equator, so temperatures below the equator are always high.

In the coming decades, ecological degradation, rising temperatures, and extreme weather events can intensify threats to human health posed by viruses (Ahmed, 2020). This happened in the previous epidemic, that changes in temperature, rainfall, and humidity can have a profound effect on the spread of infectious diseases. This climate change makes it possible to prolong the transmission season of vector-borne diseases and change their geographical reach (Schwartz, 2020; Sahin, 2020).

In Indonesia, climate change is causing an increase in dengue cases caused by the Dengue Virus which is transmitted through mosquito bites. During the first time there were dengue fever cases in Indonesia, up to March 2020 there had been more than 16,000 cases. Even an Extraordinary Event (KLB) was set in Sikka District because of this outbreak. Climate change contributes to increased rainfall, which causes a large amount of standing water as a breeding ground for mosquitoes. Humidity also affects the flight distance and age of mosquitoes. This is one case of a disease caused by a virus, while many other infectious viral diseases, not least the COVID-19 pandemic that has been taking place since early 2020 (Menebo, 2020; Qi et all, 2020; Shahzad et all, 2020).

It is difficult to predict climate change and the spread of viruses in the future. This is due to the complexity of interactions between climate, nature and human activities. But annual fluctuations in some viral infections, such as seasonal flu, and historical epidemics, such as yellow fever, provide some clues. According to the Intergovernmental Panel on Climate Change, human activity has caused about 1.0 °C global warming above pre-industrial levels. If heating continues at the current rate, temperatures will reach 1.5 °C above this level between 2030 and 2052. As a result, there is likely to be more extreme weather, including more droughts, floods, and heat waves. Climate change will have many knock-on effects on the world's animals and ecosystems. Among the species affected, there are animals that carry viruses that also infect humans, or have the potential to do so. There is no evidence that climate change plays a role in the spread of COVID-19, but there is debate about the possible role of various weather patterns.

According to a report from the World Health Organization (WHO), "Climate change, one of the current changes in the global environment, is estimated to have various impacts on the occurrence of infectious diseases in the human population." On the other hand, a report in Emerging Infectious Diseases states that excess rainfall can indirectly support the spread of enterovirus which affects millions of people around the world every year. Humans send enteroviruses, including the polio virus, coxsackie, and echovirus, to others via the fecal-oral route. For example, climate change can cause flash floods on land and sweep human waste into the sea. When this happens, some of these viruses may contaminate shellfish, for example, causing higher rates of disease in humans (Freeman et all, 2020; Cairncross, 2020).

Centers for Disease Control and Prevention (CDC) estimates that three out of every four newly emerging diseases are of animal origin. Experts have linked the earliest COVID-19 case with the Huanan "wet" market in Wuhan province, China, where people sell wild animals for meat (Mizumoto et all, 2020). A new study published in Nature has confirmed that COVID-19 was not made in a laboratory, as some conspiracy theorists say. In contrast, the genome bears a striking resemblance to the corona virus in bats, and is similar to the corona virus that infects pangolin. This is consistent with the theory that the virus spread to humans from bats through anteaters sold in the Huanan market. Although it is not specific that climate change plays a role in the emergence of COVID-19, it is possible to have a role in human activities that bring wild animals and humans into closer contact (Ribeiro-Dantas, 2020).

The spread of COVID-19 is inseparable from social conditions (Nicola et all, 2020; Buana, 2020). In Indonesia, the Government has issued a state of disaster emergency from 29 February 2020 to 29 May 2020 related to this pandemic virus with a total time of 91 days. Steps have been taken by the government to resolve this extraordinary case, one of which is to socialize the Social Distancing movement (Francis et all, 2020; Katz et all, 2020). This concept explains that to be able to reduce or even break the chain of distribution of COVID-19, one must maintain a safe distance with other humans at least 2 meters, and not make direct contact with others, and avoid mass meetings (Min-Allah et all, 2020; Al-Awlaqi, 2020; Shah et all, 2020; Beaunoyer et all, 2020; Ragavan et all, 2020; Rugania et all, 2020; Paital et all, 2020).

Indonesia is one of the largest archipelagic countries in the world having around 17,491 islands. The Indonesian archipelago spreads around the equator, and tends to have tropical weather. Indonesian territory is limited by administrative areas, which have very strategic functions. Some of its functions are as an administrative division of power, besides that the administrative area also functions as a determinant of all regional development activities. This is stated in "Guidelines for asserting regional boundaries have been established by the government through Permendagri No. 1 of 2006 " (Nugroho, 2011).

3. METODHOLOGY AND DATA

This study uses data from the 2018 PODES (Village Potential) data collection as an independent variable and the average daily increase of the COVID-19 province in Indonesia as the dependent variable. The number of observations used was 83,931 villages and villages. In addition, this study uses data on disadvantaged areas as stipulated in "Presidential Regulation Number 131 Year 2015 Regarding Determination of Underdeveloped Areas in 2015-2019", using climate average data for 2001-2018, information related to areas traversed by the equator, and markers between villages / kelurahan located in Java and outside Java. In addition to climate variables and public facilities, the independent variable uses dummy variables, related to the existence / status of the corresponding conditions. Code "1" if the village has conditions that correspond to the observation variable, and code "0" if vice versa. We used OLS multiple regression analysis tools, and continued with Chi-squared Automatic Interaction Detector (CHAID) analysis to find out climate and social segmentation on the growth of daily spread of COVID-19.

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 +$$
$$\beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \beta_{14} X_{14} + \beta_{15} X_{15} + \beta_{16} X_{16} + \beta_{17} X_{17} +$$
$$\beta_{18} X_{18} + \beta_{19} X_{19} + \beta_{20} X_{20} + \beta_{21} X_{21} + \beta_{22} X_{22} + \beta_{23} X_{23} + \beta_{24} X_{24} + \varepsilon$$

information:

Y	: Positive daily case growth and death due to COVID-19
α	: Konstanta
X_1	: Rainfall
X_2	: Duration of sunshine
X_3	: Temperature
X_4	: Sanitary environment (Poor)
X_5	: Most people use HP
X_6	: National TV broadcast
X_7	: Overseas TV broadcasts
X_8	: Ethnic variety
X_9	: Agricultural production facility shop
X_{10}	: Mini market
X_{11}	: Restaurant
X_{12}	: Government bank
X_{13}	: Private bank
X_{14}	: Development of transportation facilities
X_{15}	: Development of information and communication facilities
X_{16}	: Development of sanitation facilities
X_{17}	: Development of government facilities
X_{18}	: Housing environment empowerment
X_{19}	: Farming empowerment
X_{20}	: Community quality empowerment
X_{21}	: Bordering the sea
X_{22}	: Java island
X_{23}	: Status of underdeveloped areas
X_{24}	: Equator Path (Province)
ε	: *error term*

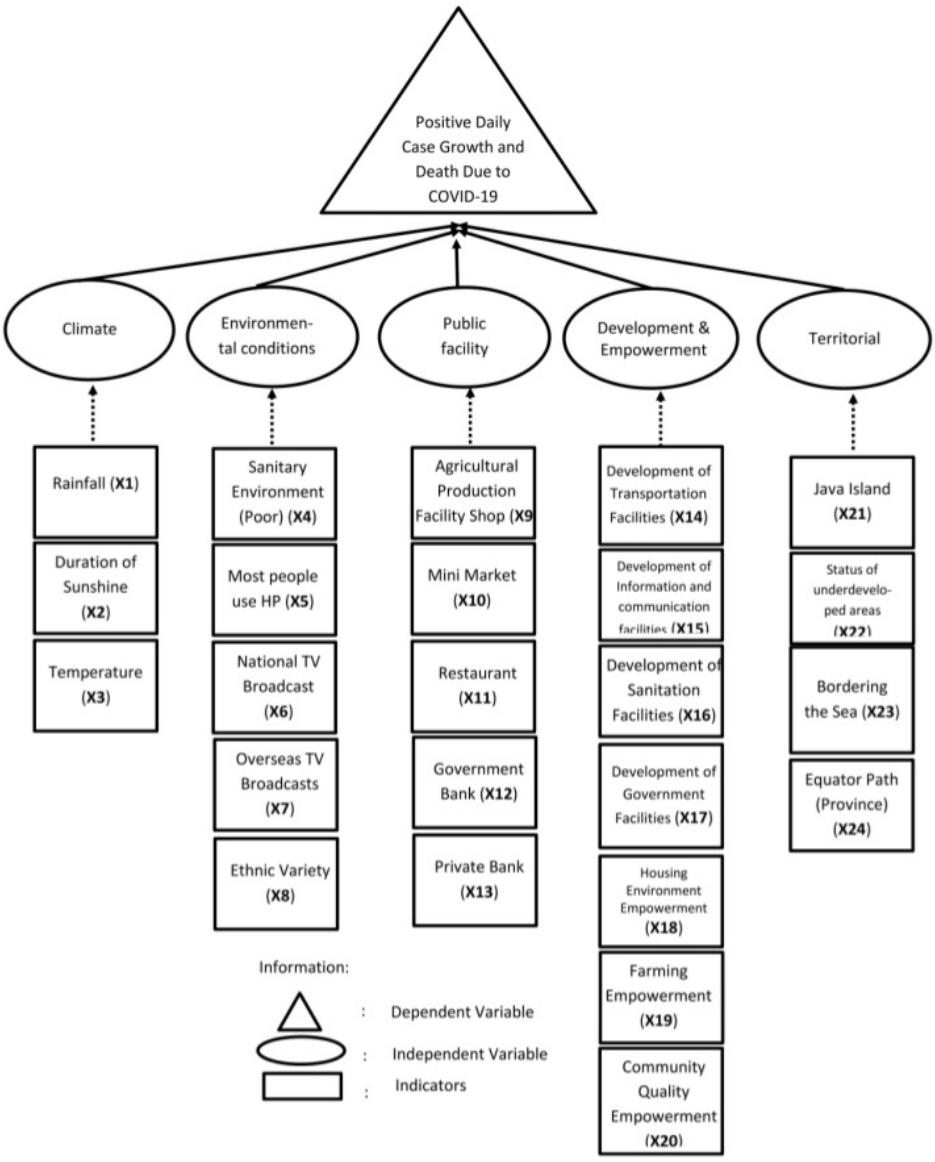

Figure. 1. Research Conceptual Framework

The analysis used next is the Chi-squared Automatic Interaction Detector (CHAID). CHAID generally estimates a single variable, called a dependent variable, which is associated with other variables, called a reressor. CHAID is an iterative technique that tests one by one the regressors used in the classification, and arranges them based on the level of statistical significance of chi square on the dependent variable (Gallagher, 2000 at Kunto et all, 2006). CHAID analysis is expected to be able to provide an indicator of priority priorities to be carried out to reduce the growth rate of COVID-19 daily cases.

This test technique allows us to find out the independence between two variables at each level. For example a first variable has *r* categories and the second variable has *c* categories then n_{ij} is an observation on the first variable at level *i* and the second variable at level *j*, in general the table is presented as follows:

Table 1. Chi-Square Test Data Structure

Row and Column	1	2	.....	c	Total
1	n_{11}	n_{12}	.....	n_{1c}	$n_{1\bullet}$
2	n_{21}	n_{22}	.....	n_{2c}	$n_{2\bullet}$
...	.....	.....	.....	.....	.....
...	.....	.....	.....	.....	.....
...	.....	.....	.....	.....	.....
r	n_{r1}	n_{r2}	.....	n_{rc}	$n_{r\bullet}$
Total	$n_{\bullet 1}$	$n_{\bullet 2}$	.....	$n_{\bullet c}$	n

Table 2. Cell Probabilities

Row and Column	1	2	.....	c	Total
1	p_{11}	p_{12}	.....	p_{1c}	$p_{1\bullet}$
2	p_{21}	p_{22}	.....	p_{2c}	$p_{2\bullet}$
...	.....	.....	.....	.....	.....
...	.....	.....	.....	.....	.....
...	.....	.....	.....	.....	.....
r	p_{r1}	p_{r2}	.....	p_{rc}	$p_{r\bullet}$
Total	$p_{\bullet 1}$	$p_{\bullet 2}$	.....	$p_{\bullet c}$	p

where *pij* is the probability of the occurrence of the slice between *row i* and *column j*
$p_{i\bullet}$ is the total probability on the row *i*
$p_{\bullet j}$ is the total probability on the columns *j*

The hypothesis in chi-square testing is:
$H_0 : p_{ij} = p_{i\bullet}\, p_{\bullet j}$ (no relationship between rows and columns (bebas))
$H_1 : p_{ij} \neq p_{i\bullet}\, p_{\bullet j}$ (there is a relationship between rows and columns (not free))

Whereas the test statistic is:

$$\chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} \frac{(n_{ij} - E_{ij})^2}{E_{ij}} \qquad (1)$$

$$\chi^2 = \frac{n_{i\bullet} \; n_{\bullet j}}{n} \qquad (2)$$

where

n_{ij} = the number of observations in the *row i* and *column j*

E_{ij} = Expectation value of observations in the *row i* and *column j*

$n_{i\bullet}$ = total number of observations in *row i*

$n_{\bullet j}$ = the total number of observations in the *row j*

n = total number of respondents

The decision taken from this chi-square test is rejected H_0 if value of χ^2 *count* > χ^2 *table* or *p-value* < α.

4. RESULTS

Table 2. Calculation of Climate Factor Regression and Social Role in the Development of COVID-19 Positive Cases

Indicators	Model 1	Model 2	Model 3	Model 4	Model 5
Rainfall	-0.123***	0.051***	0.050***	0.050***	0.051***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Duration of sunshine	0.214***	0.003	0.006**	0.007**	0.006**
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Temperature	0.049***	0.051***	0.052***	0.051***	0.051***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Sanitary environment (Poor)	0.081***	0.037***	0.036***	0.037***	0.037***
	(0.007)	(0.005)	(0.005)	(0.005)	(0.005)
Most people use HP	0.064***	-0.009***	-0.013***	-0.013***	-0.013***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
National TV broadcast	0.034***	-0.018***	-0.022***	-0.022***	-0.022***
	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)
Overseas TV broadcasts	-0.021***	-0.023***	-0.024***	-0.024***	-0.024***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Ethnic variety	-0.065***	0.026***	0.026***	0.026***	0.026***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Agricultural production facility shop	-0.022***	0.016***	0.015***	0.015***	0.015***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Mini market	0.018***	0.005***	0.005***	0.005***	0.005***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Restaurant	0.006***	0.006***	0.006***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Government bank	0.026***	0.018***	0.018***	0.018***	0.018***
	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
Private bank	0.041***	0.035***	0.035***	0.035***	0.035***
	(0.009)	(0.007)	(0.007)	(0.007)	(0.007)
Development of transportation facilities	0.052***	0.009***	0.008***	0.008***	0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Development of infor. and communication facilities	0.050***	-0.007***	-0.008***	-0.008***	-0.008***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Development of sanitation facilities	-0.014***	-0.016***	-0.015***	-0.015***	-0.015***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Development of government facilities	0.051***	-0.004**	-0.004**	-0.004**	-0.004**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Housing environment empowerment	-0.006*	-0.023***	-0.022***	-0.022***	-0.022***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Farming empowerment	-0.011***	-0.008***	-0.008***	-0.008***	-0.008***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Community quality empowerment	0.019***	-0.004**	-0.004**	-0.004**	-0.004**
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Java island		0.605***	0.601***	0.599***	0.599***
		(0.003)	(0.003)	(0.003)	(0.003)
Status of underdeveloped areas			-0.014***	-0.013***	-0.012***
			(0.001)	(0.001)	(0.002)
Bordering the sea				-0.008***	-0.008***
				(0.001)	(0.001)
Equator path (Province)					-0.002*
					(0.001)
Constant	0.036***	0.029***	0.040***	0.041***	0.042***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	83,931	83,931	83,931	83,931	83,931
R-squared	0.329	0.670	0.670	0.671	0.671

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 3. Calculation of Climate Factor Regression and Social Role in the Development of Cases of Death Due to COVID-19

Incicators	Model 1	Model 2	Model 3	Model 4	Model 5
Rainfall	-0.136***	0.024***	0.022***	0.023***	0.027***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Duration of sunshine	0.188***	-0.006***	-0.002	-0.001	-0.006**
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Temperature	-0.002	0.001	0.002	0.001	-0.000
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Sanitary environment (Poor)	0.082***	0.041***	0.041***	0.041***	0.041***
	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)
Most people use HP	0.064***	-0.003***	-0.008***	-0.008***	-0.011***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
National TV broadcast	0.056***	0.008***	0.003*	0.004**	-0.002*
	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)
Overseas TV broadcasts	-0.016***	-0.017***	-0.019***	-0.019***	-0.020***
	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)
Ethnic variety	-0.052***	0.031***	0.031***	0.031***	0.031***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Agricultural production facility shop	-0.019***	0.015***	0.015***	0.015***	0.014***
	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)
Mini market	0.017***	0.005***	0.005***	0.005***	0.005***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Restaurant	0.005***	0.005***	0.005***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Government bank	0.021***	0.014***	0.014***	0.014***	0.015***
	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
Private bank	0.037***	0.031***	0.031***	0.031***	0.031***
	(0.008)	(0.006)	(0.006)	(0.006)	(0.006)
Development of transportation facilities	0.048***	0.008***	0.007***	0.007***	0.007***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Development of infor. and communication facilities	0.042***	-0.011***	-0.012***	-0.011***	-0.011***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Development of sanitation facilities	-0.011***	-0.012***	-0.012***	-0.012***	-0.012***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Development of government facilities	0.045***	-0.005***	-0.005***	-0.005***	-0.005***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Housing environment empowerment	-0.005*	-0.021***	-0.020***	-0.020***	-0.020***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Farming empowerment	-0.011***	-0.008***	-0.007***	-0.007***	-0.007***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Community quality empowerment	0.015***	-0.006***	-0.007***	-0.007***	-0.006***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Java island		0.555***	0.549***	0.548***	0.547***
		(0.003)	(0.003)	(0.003)	(0.003)
Status of underdeveloped areas			-0.017***	-0.016***	-0.008***
			(0.001)	(0.001)	(0.001)
Bordering the sea				-0.009***	-0.009***
				(0.001)	(0.001)
Equator path (Province)					-0.028***
					(0.001)
Constant	0.023***	0.016***	0.030***	0.031***	0.046***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
Observations	83,931	83,931	83,931	83,931	83,931
R-squared	0.344	0.702	0.702	0.702	0.703

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

From Table 2 the information is obtained, that before entering the control variable the R-squared value of 32.90 percent and increased to 67.10 percent when interacting with four control variables. From the models formed, it is known that the more control variables involved, the better the strength of the model. Similar to regression in positive cases, the Java Island indicator has the greatest impact when included in the model. There are 8 indicators that have the same direction, when before and after the control variable is entered. The solar irradiation indicator has the greatest value when compared to other indicators. While the construction of transportation facilities is an indicator that has the smallest value on the model. Of all the models and indicators, there is only 1 variable that is declared insignificant, namely solar radiation in model 2. When viewed through climate variables, it is known that on average, temperature has the greatest role in the daily growth rate of COVID-19, followed duraton of sunshine and rainfall. When viewed through social variables, it is known that the indicator of the existence of private banks has the greatest positive impact.

From Table 3 the information is obtained, that before entering the control variable R-squared value of 34.40 percent and increased to 70.30 percent when interacting with four control variables. This figure is greater than the regression results in positive cases. From the models formed, it is known that the more control variables involved, the better the strength of the model. The Java Island indicator has the biggest impact when it is included in the model. There are 5 indicators that have the same direction, when before and after the control variable is entered. Where the indicator is the same as the selected indicator in a positive case. Similar to the results of calculations in positive cases, duration of sunshine indicators have the greatest value when compared to other indicators. While the existence of a restaurant is an indicator that has the smallest value on the model. Of all the models and indicators, there is only 1 indicator that is declared insignificant, namely temperature and duration of sunshine. When viewed through climate variables, it is known that only rainfall has a significant role in the daily growth rate of cases dying from COVID-19 in all models. When viewed through social variables, it is known that the indicator of the existence of private banks has the greatest positive impact.

Through the CHAID analysis it was found that the highest ranking of the 5 models included indicators of rainfall, duration of sunshine, temperature, ethnic diversity, development of government support facilities, empowerment of community quality, Java Island, and status of disadvantaged areas. The condition is the same between positive cases and cases of death due to COVID-19. Java and solar radiation have a very big role in the model, because it always occupies the top position compared to other observational indicators.

When viewed as a whole climate variables always contribute high to the daily growth rate of COVID-19. This can be seen from Figure 2 and Figure 3, climate indicators indicate a significant role in the priority cluster. Where priority clusters are the clusters that have the greatest impact if they only pay attention to the most important indicators to suppress the daily growth rate of COVID-19.

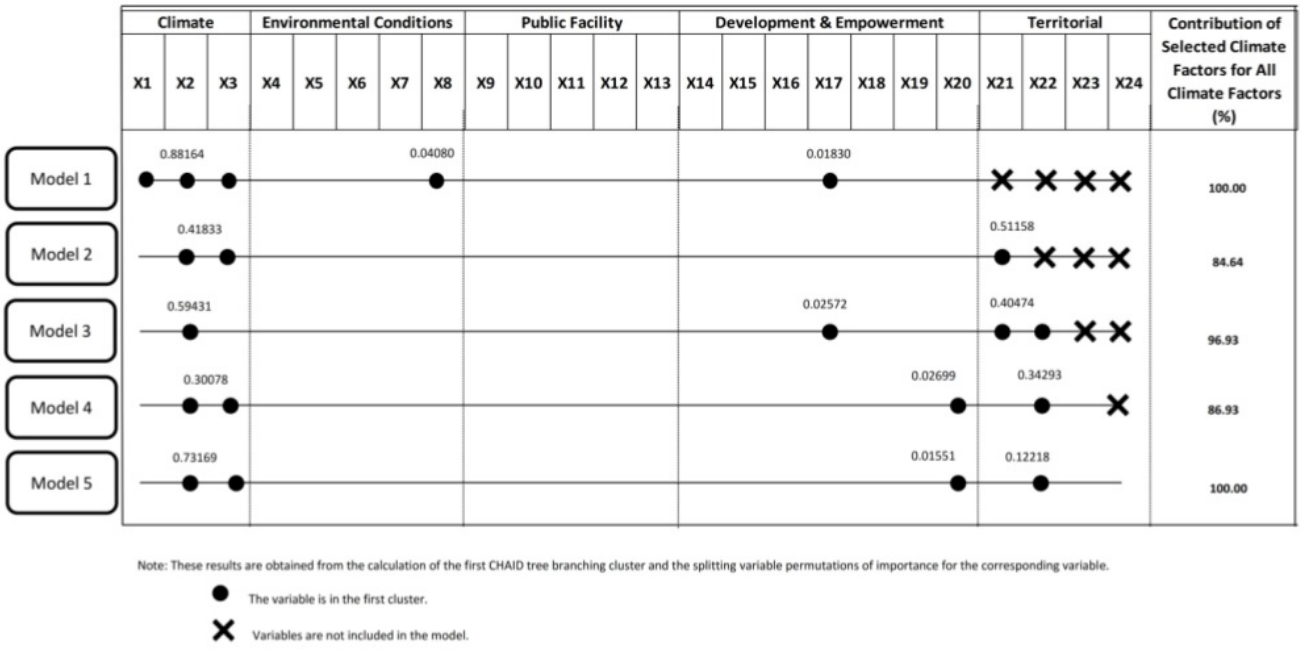

Figure 2. Calculation of Priority Clusters in the Distribution of COVID-19 Positive Cases

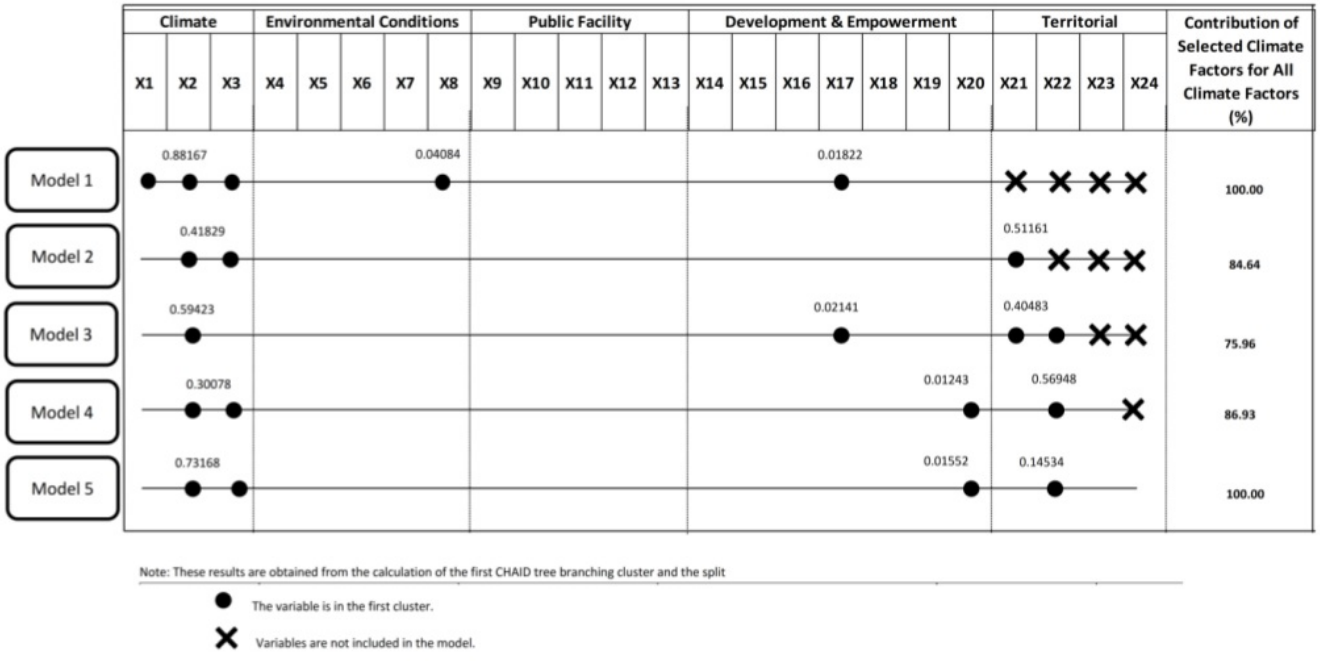

Figure. 3. Calculation of Priority Clusters in Patients Died Due to COVID-19

In Figure 2, when viewed from the role of selected climate factors in cluster 1 for all indicators of climate factors, information is obtained that selected climate indicators have a role in the range of 86.64-100.00 percent in the whole model. Where in models 1 and 4 seen a very large role of selected climate indicators for overall climate factors. This indicates that in models 1 and 5, collaboration of 2 to 3 climate indicators can make a major contribution to the model formed. In Figure 3, by considering priority clusters, information is obtained that selected climate indicators have a role in the range of 75.96 - 100.00 percent in the whole model. Where in models 1 and 5 seen a very large role of selected climate indicators for overall climate factors. This indicates that in models 1 and 5, collaboration of 2 to 3 climate indicators can make a major contribution to the model formed.

5. DISSCUSION

Climate and social factors are important factors in the spread of COVID-19 cases. Climate is a natural phenomenon that cannot be denied by living things. However, climate phenomena can be controlled before worse impacts will occur. This condition of climate change has been felt by all countries in various parts of the world, and will have a negative impact on human life if it is not accompanied by good mitigation.

From the results of the calculation of regression analysis, with or without control variables, it is known that all variables have a significant effect. Climate variables have a major role in the growth rate of COVID-19, especially in solar irradiation indicators. In positive cases and dying from COVID-19, solar radiation has the greatest coefficient, before entering the control indivator. High irradiation of the sun, which was previously said to inhibit the growth rate of COVID-19, actually growth is relatively fast. Other things that can be taken into consideration, include areas that are at the center of development and the economy tends to be in urban areas, the climate tends to be extreme due to the production process and population mobility. From this phenomenon it can be concluded that the spread of COVID-19 tends to be slow when it is in an area far from the center of development and the economy, and has no extreme duration of sunshine.

Another thing can also be seen from the environmental conditions of the community. In positive and dead cases, poor sanitary conditions will have a positive impact on the spread of COVID-19. The condition is quite sad when an area is inhabited by people who mostly use cellphones and their territory is available on a national TV network, instead the region has a positive impact on the rate of growth, but this is different when an area has an international TV network. Logically, a region that has good sources of information will have a good impact on the rate of spread, but that has not happened in Indonesia. Ethnic diversity, which indicates urban areas also has a positive effect when added to the control variable.

Public facilities can be used as indicators of social interaction. More and more public facilities are being built, indicating that the region has high social interaction. In positive cases and death, it is known that the existence of minimarkets, restaurants, private banks and government banks has a positive influence on the growth rate of COVID-19 in an area. Public facilities will invite people to gather, so that it can cause the spread of viruses with high risk. However, this condition is contrary to the existence of shops

that sell agricultural production facilities, which have a negative effect. Stores of agricultural production facilities are more often found in rural areas. Even that shop doesn't invite crowds of people. The intensity of consumers to come to the store, less often than other public facilities on observation.

In the development program and community empowerment, it will indicate how the interaction created as social capital. On the one hand, this interaction will have a good effect to reduce the growth rate of COVID-19, for example a positive response from the community to remind each other. However, on the other hand these interactions turned out to have a bad impact. Habits of people to meet and gather with each other will cause negative effects. In areas that carry out community-based development and empowerment programs, only indicators for the construction of transportation facilities have an impact on increasing the COVID-19 growth rate.

Java Island as control variables have a major role in the growth rate of COVID-19. This is evident in the growth of COVID-19 since it first appeared in Indonesia. Java Island is an island that has a high population density. Besides that, as the center of the economy and development, the existence of a number of economic activities triggers the interaction of a number of people. In the calculation results it is known that, the area around the equator has a negative impact on the growth of COVID-19. This is also shown by indicators of disadvantaged areas and areas bordering the sea. The area with the status of underdeveloped area and the area bordering the sea, is far from the center of the economy and development. So that the region will avoid the rapid growth rate of COVID-19.

The segmentation of the spread of COVID-19 can be seen from Figure 2 and Figure 3. The growth rate can be reduced through efforts that focus on areas that have high rainfall, high sun exposure, high temperatures, ethnic diversity, government facility development programs, community quality empowerment programs, located on the island of Java, and the area is not a backward area. Through this analysis policy makers can determine effective and efficient ways according to the characteristics of the region and existing resources.

This study indicates that community and government participation is needed in controlling the growth rate of COVID-19. The community needs to implement the government's appeal. If all people obey the government's call, surely the growth rate of COVID-19 can be suppressed. This study uses climate data at the provincial level, for that in future studies climate data at the village level are needed in order to obtain more representative results.

6. CONCLUSION

COVID-19 is a big challenge for a number of scientists in the world. Until mid-2020 a vaccine against the virus has not been found. Some experts have hypotheses related to climate effects at the country level. By adding social data, we tried to combine climate variables and the daily growth rate of COVID-19 in positive and deceased patients. From the climate side, the temperature indicator has a major role on the growth rate. The higher the temperature, the faster the growth rate. This is in contrast to some statements that, the more tropical a region is, it will inhibit the spread of COVID-19. Public facilities frequented by the community have a positive role in the rate of spread, especially facilities in urban areas. Territorial status is very important to consider when analyzing growth rates. Java as a center of

growth and economy has a large share in the spread of COVID-19 growth rates. Through further analysis, it can be seen that the growth rate of COVID-19 can be suppressed through areas that have high solar irradiance, are in Java, and are not underdeveloped areas (developed areas).

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