The Analysis of Coastal Society Vulnerabilities Against the Spread of Covid-19 in Surabaya Using the Analytical Hierarchy Process (AHP)

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***Abstract*— Coronavirus belongs to the ARI (Acute Respiratory Infection) disease, which has a high level of mortality risk. In 2019, this virus was transformed into Covid-19 with a rapid spread and a more massive impact. This disease has become a worldwide pandemic. Indonesia is a developing country and is included as one of the most densely populated countries affected by the Covid-19 pandemic, which has great potential to fail in overcoming this problem. Approximately 60% of Indonesia's population lives in coastal areas with low levels of welfare in almost all sectors of life such as social, economic, education, and health. This study aims to analyze the level of community vulnerability in the coastal area of Surabaya City by using the Analytical Hierarchy Process method. From the data taken by the survey, the results of the exposure of the Bulak Banteng Village area of Surabaya in the health, socio-cultural, economic, and general fields are 0.0469, 0.0871, 0.1809, and 0.3551, respectively. So the overall vulnerability is 0.67, which is included in the medium vulnerability criteria.**

Keywords— AHP, Covid-19, coastal society, vulnerabilities.

I. INTRODUCTION

Acute respiratory infection (ARI) is a disease that can be transmitted between humans. The level of risk caused depends on the type of pathogen causing it. ARI can occur due to rhinovirus, respiratory syncytial virus, parainfluenza virus, associated coronavirus (SARS-CoV), and so on. Common symptoms include fever, cough, sore throat, shortness of breath, or runny nose. The duration can be in hours or days. Sometimes some sufferers are asymptomatic. However, ARI is classified as a deadly disease [1].

In late 2019, the coronavirus transformed into Covid-19. The impact of Covid-19 as of July 7, 2020, there were 11.4 million people infected, and more than 535,000 people died [1]. On July 9, 2020, there were 70,736 infected people, and 3,417 people died in Indonesia [2]. A throat swab test makes the diagnosis of this virus. It is preceded by general symptoms like fever, cough, difficulty breathing, or physical contact with someone from an infected country [3].

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Approximately 60% of Indonesia's population lives in coastal areas. People living in these areas have common welfare. This is inconsistent with the enormous potential of its natural resources [4]. The spread of covid-19 in Indonesia is rapidly reaching coastal areas. The level of case risk is at medium and high levels. In Figure 1.1, taken as of July 23, 2020, almost all areas are at a moderate level, except Gresik, Demak, Tanah Laut, and West Kotawaringin have a high level of risk [2].

Coastal areas have classic problems, including limited sources of development funds, low-quality of human resources, high levels of poverty, lack of coordination between development actors, and weak law enforcement [5]. Various problems in coastal areas are likely the cause of the rapid spread of the pandemic (Covid-19). The identification of risk factors for environmental-based health problems in the coastal area of Wawatu Village, Konawe Regency found that there were still many problems in landfills, clean water sources, latrines, and the lack of homeownership that could be declared a healthy home [6].

Covid-19, which has become a pandemic, requires exceptional management for the number of infected patients. Surabaya is a metropolitan city that occupies the nearest hospital. If distance considerations are used as a reference, the National Hospital will first experience overcrowding. So, it is necessary to allocate medical personnel and fulfill the fitting isolation room [7].

Communication is an essential factor in solving community problems. Surabaya has provided a service called E-Sapawarga Surabaya. The portal can be accessed using website media, Facebook, SMS, Twitter, print media, e-mail, and letters. However, there is still a lack of utilization of these services by the community. There are external and internal factors. The external factor is the lack of socialization in the community. While internally, namely the limited servers and databases owned by the Surabaya City Communication and Information Office, reducing public interest [8].

The community-based coastal management model is one of the right tools to build the independence of coastal communities. The model is divided into three stages: planning, implementation, and supervision. Community creativity is needed in utilizing existing resources. In addition, government support in the form of capital, information, infrastructure, coaching, training, and counseling can increase the smoothness of the plan and maximize the results to be achieved [9].

II. METHOD

A. Survey

The survey is collecting information from respondents by using a questionnaire or questionnaire. While survey research uses questionnaires as the primary data collection tool by taking samples from a population. The general form of the questionnaire consists of an introduction, instructions for filling out, the respondent's identity, and content. There are four types of questionnaires as follows [10]:

(1) Closed Direct Questionnaire
(2) Open Direct Questionnaire
(3) Indirectly Closed Questionnaire
(4) Indirect Questionnaire Open

TABLE 1.
RANDOM INDEX

Random Index	
n	RC
1	0.00
2	0.00
3	0.58
4	0.90
5	1.12
6	1.24
7	1.32

B. Analytical Hierarchy Process

Analytical Hierarchy Process (AHP) is a decision-making method developed by Thomas L. Saaty. A flexible way of combining variables and values logic is used as benchmarks. There are three basic principles, among others [11]:

(1) Describe problems and rearrange them hierarchically
(2) Determine the priority of the hierarchical order based on the position in each value. Comparisons between elements are carried out. Then do the weighting and add up as a whole to produce a single number.
(3) In the weighting, use a logical and consistent assessment standard. Similar objects are collected into one so that they are grouped homogeneously. A reference is needed as a basis for comparison.
(4) In using the AHP method, it is necessary to determine priority weights and consistency.

The steps that need to be taken are as follows [12]:

(1) Determine the pairwise comparison matrix
The comparison score for each criterion consists of 1 to 9.
(2) Create a criterion value matrix
This matrix is obtained from the following formula: new column row value = Old column row value / Total of each old column
(3) Create a sum matrix for each row
The calculation of the consistency ratio is carried out sequentially as follows [13]:
   (a) Count the number of criteria rows after normalization
   (b) Looking for priority, the result of a is divided by the number of criteria (n)
   (c) Multiply matrices with the corresponding priority
   (d) Looking for eigenvalues, the result of c is divided by the impact of b in each element which is then divided by the number of criteria (n)
   (e) Calculate max, where max is the eigenvalue of the pairwise comparison matrix
   (f) Consistency index

$$CI = \frac{(\lambda max - n)}{(n-1)} \quad (1)$$

Information:
λmax : The result of the sum of the columns in the matrix the comparison of the respondents multiplied by the eigenvalue)
n : Number of priority criteria

Consistency Ratio (CR) = CI/RI, RI is a random index of consistency. If the consistency ratio ≤ 0,1, then the calculation result is correct.

To get "the vulnerability value", each component from the results of weighting and analysis is overlaid with the following formula [14]:

$$Vi = V1(B1) + V2(B2) + \ldots\ldots + Vn(Bn) \quad (2)$$

C. Disaster Management

Disaster management is an effort to reduce the risk of disproportionate impacts. Disaster management can be carried out by individuals, groups, or communities on a specific scale, depending on the type of disaster being faced. Handling a disaster requires a comprehensive effort, including building awareness of the catastrophe.

These stages are divided into three major groups [15]:

(1) Before the Disaster

This activity is carried out to reduce losses in property and life caused by a disaster. At this stage is mitigation which includes:

(a) Planning the development of warning systems, maintenance, supplies, and human resources training.
(b) Planning anticipatory measures for areas prone to repeated disaster risks. This planning is carried out in detail to the search, rescue, and evacuation steps.
(c) This activity is focused on hazards and threats.

(2) When Disaster Happens

A series of activities is carried out when a disaster occurs. These activities include:

(a) Rescue and evacuation of victims and property
(b) Fulfillment of basic needs
(c) Protection
(d) Refugee management
(e) Rescue and restoration of facilities and infrastructure

(3) Post Disaster

Post-disaster activities include two main actions, namely:

(a) Rehabilitation is the repair and restoration of all aspects of public and community services to the stage of returning to their original state before the disaster occurred.
(b) Reconstruction: Reconstruction: Reconstruction of facilities and infrastructure and institutions affected by the disaster. This includes all elements of both government and non-government. Activities aim to restore social, and economic activities, law enforcement and order, and the rise of the role of society in all aspects of life.

III. Results and Discussion

A. Research Area Condition

The Bulak Banteng village was previously famous for its slums. But as time went on, awareness began to increase. There are villages arranged with ornamental plants lined up in almost every house. However, there are still areas that need attention to catch up. The small road width with the rows of plants and the availability of garbage dumps make the Bulak Banteng Village environment healthier.

Governance for the placement of handwashing facilities is available in all lines, from government agencies to residents. Almost every house provides a place for washing hands in front of the house. A handwashing plate affixed to the back indicates that the provision is intended for the public. Concern arose among the people. Government agencies also provide and require every visitor to comply with health protocols. Office employees are also concerned with constantly reminding and giving advice.

B. Survey by Distributing Questionnaire

In addition to making direct observations of the location, researchers also took data with questions provided. The media used is using a questionnaire. There are five research objects, including sub-district officials, village heads, hamlet officials, neighborhood officials, and residents.

Resource persons are determined based on research needs. The selection of resource persons is carried out from young people to seniors. Among adolescents, more focused on the male gender. Because one of the risk factors for transmission is people who have respiratory problems. The lack of maintenance of the respiratory organs is influenced by excessive cigarette consumption, so the most vulnerable groups consist of young men.

Adults and seniors are susceptible to transmission of Covid-19, and one of the biggest causes is comorbidity. Diseases classified as comorbid include diabetes mellitus, kidney disease, high blood pressure, tuberculosis, tumors, coronary heart disease, lupus, and other chronic diseases. So it is necessary to record the condition of the sources. However, none of the authorities whose data was taken by researchers had a history of being exposed to Covid-19.

Some residents apply health protocols, especially in government agencies. The rules for social distancing, wearing masks, and washing hands before entering the room are strictly enforced. If visitors have not washed their hands, they are told to go back and wash their hands first. Some residents are interested in the implementation of the health protocol. When in front of the house, still wear a mask.

When the researcher took one of the residents, the informant first wore a personal face shield. When adjusted for the data, such people have higher levels of education so that the insight into covid-19 is also fulfilled.

On the other hand, areas have not maximally implemented health protocols in their environment. It was found that there were still residents who gathered to talk without wearing masks.

Researchers adapt to the environment when collecting data. To maintain ethics, the researchers removed their masks for a moment when entering people's homes. Especially when taking data on the elderly. This is done to make it easier for researchers to fill out.

There are people who can't read. In addition, there are also those who ask to just read the questions because of the reduced visual acuity. Therefore, the researcher pocketed the mask for a moment. However, keep a safe distance. In addition, researchers also regularly wash their hands.

In some areas, awareness of masks and social distancing is still lacking, especially among teenagers and seniors. They take the problem lightly. Such an understanding can be influenced by a lack of insight and the confusing propaganda of covid-19 clarity. Education level also matters. Residents who have a history of low education are weaker in implementing health protocols.

When guests arrive, they only pay attention to washing their hands and feet before entering. But when inside the house, many of the residents do not wear masks. Visitors who come are also free to wear masks or not. This has a high chance of causing an increase in the number of exposed to Covid-19 in the Bulak Banteng Village.

C. Questionnaire Data Analysis

After collecting data with questionnaires, an analysis of the results obtained is carried out. Five categories of questions were asked about insight, health, socio-cultural, economic, and general categories. Each category has the same number of questions, namely nine questions. This is done so that each category has an equal comparison. The questions were asked in the form of multiple-choice and filling in the table of response tendencies whether or not the respondents agreed or disagreed with the questionnaire questions. The question table consists of four assessments, namely:

STS : Strongly Disagree
TS : Disagree
S : Agree
SS : Totally Agree

In order to define it more easily, respondents' answers were converted on a scale of 1 – 4.

D. Dredge Volume Calculation

The results of data collection will be tested for reliability. The reliability test is a measure of the extent to which the results of data collection have good trustworthiness, reliability, stability, and consistency. This is necessary so that the research results have a high level of accuracy. The reliability test was carried out with the basic approach of Cronbach Alpha.

In this study, the reliability test used SPSS (Statistical Product and Service Solutions) software. The results obtained are as follows (Table 2):

TABLE 2.
SPSS SOFTWARE RELIABILITY TEST RESULTS

Case Processing Summary		N	%
Cases	Valid	25	100
	Excluded	0	0
	Total	25	100

Reliability Statistics	
Cronbach's Alpha	N of Items
0.847	40

TABLE 3.
EFFECT OF HEALTH VARIABLES

Health			
Obedience		Influence	
IP (%)	IPK (%)	IP (%)	IPK (%)
65.6		34.4	
70.3		29.7	
82.8		17.2	
67.2		32.8	
64.1	74.1	35.9	25.9
79.7		20.3	
81.3		18.8	
68.8		31.3	
87.5		12.5	

TABLE 4.
INFLUENCE OF SOCIO-CULTURAL VARIABLES

Socio-Cultural			
Obedience		Influence	
IP (%)	IPK (%)	IP (%)	IPK (%)
71.9		28.1	
79.7		20.3	
78.1		21.9	
71.9		28.1	
59.4	72.4	40.6	27.6
68.8		31.3	
75.0		25.0	
70.3		29.7	
76.6		23.4	

The overall results of the items can be seen in Cronbach's Alpha column. There are several levels of indicators. If the value of Cronbach's Alpha < 0.6 means that the questionnaire is declared inconsistent. Meanwhile, if Cronbach's Alpha value > 0.6 means that the questionnaire can be stated as a questionnaire. The higher the Cronbach's Alpha value, the higher the level of consistency.

In SPSS, it is also necessary to look at N of items. The column describes the consistency of each questionnaire item. The value of each item should be > 0.4 so that it can be said to have internal consistency.

Between items have a correlation. In the consistency test of the questionnaire in this study, all things related to the test indicators have been met. Cronbach's Alpha is worth 0.847, and N of items is 0.4, which means that the questionnaire can be declared consistent so that the internals of each item has a good correlation.

E. The Influence of 4 Fields on The Transmission of Covid 19

The four areas that have been analyzed for their level of influence on the dangers of Covid-19 transmission are as follows.

Based on (Table 3), it can be seen that the level of community compliance with the transmission of covid 19 in terms of health is 74.1%, so it has a level of influence on the transmission of covid 19 by 25.9%.

Based on (Table 4), it can be seen that the level of community compliance with the transmission of covid 19 in terms of the sociocultural field is 7.4%, so it has an influence on the transmission of covid 19 by 27.6%.

TABLE 5.
EFFECT OF ECONOMIC VARIABLES

Economy			
Obedience		Influence	
IP (%)	IPK (%)	IP (%)	IPK (%)
79.7		20.3	
60.9		39.1	
65.6		34.4	
73.4		26.6	
59.4	67.5	40.6	32.5
67.2		32.8	
62.5		37.5	
70.3		29.7	
68.8		31.3	

TABLE 6.
INFLUENCE OF SOCIO-CULTURAL VARIABLES

General			
Obedience		Influence	
IP (%)	IPK (%)	IP (%)	IPK (%)
54.7		45.3	
70.3		29.7	
70.3		29.7	
50.0		50.0	
57.8	61.8	42.2	38.2
65.6		34.4	
62.5		37.5	
48.4		51.6	
76.6		23.4	

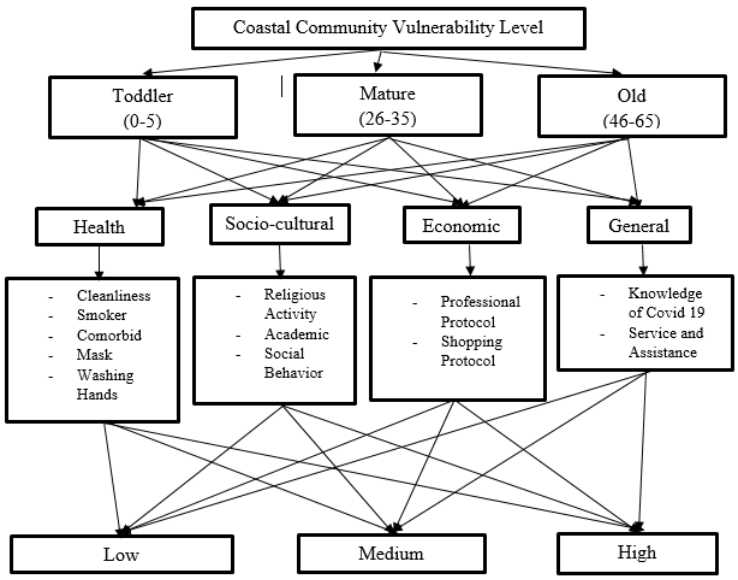

Figure. 1. AHP Hierarchy Structure

Based on (Table 5), it can be seen that the level of community compliance with the transmission of Covid-19 in terms of the economy is 67.5%. So it has an effect of 32.5%.

Based on (Table 6), it can be seen that the level of community compliance with the transmission of covid 19 in the general field is 61.8%. So it has an effect of 38.2%.

From the results obtained, the field that is the biggest factor in influencing the transmission of covid 19 in the community in the Bulak Banteng Village, Surabaya City, is the general field with a vulnerability level of 38.2%. This field includes public knowledge of the dangers of Covid 19 and public services to prevent the transmission of Covid-19.

F. AHP Analysis

Analysis using the AHP method is an effective and efficient way. AHP helps in determining the best choice as a problem solver.

The general criteria, namely knowledge of the dangers of covid 19 and health services, are the main priority in determining solutions to overcome the problem of transmission of covid 19 in Bulak Banteng Village, Surabaya, with a weight of 0.53 or 53%.

The next focus is on the economy, socio-culture, and health with respective weights of 27%, 13%, and 7%. Health is the last priority.

The weighting process has been carried out. Next, a scoring process will be carried out with low, medium, and high vulnerability outputs as follows (Table 7):

TABLE 7.
AREA VULNERABILITY WEIGHT

Parameters	Weight	Score		
		Low (0.33)	Middle (0.67)	Hight (1)
Health	0.07			
Social Culture	0.13	IPK Questionnaire Unfavorable < 1	IPK Questionnaire unfavorable 1-2	IPK Questionnaire unfavorable 2-3
Economy	0.27			
General	0.53			

So that the vulnerability of the community in the Bulak Banteng Village, Surabaya to the transmission of Covid-19 as a whole is reviewed in four areas, namely:

VI Tot = 0.0393 + 0.07109 + 0.17586 + 0.3876

VI Tot = 0.67

The vulnerability of the Bulak Banteng Village area of Surabaya is 0.67, which is included in the medium vulnerability.

G. Vulnerability Reduction Strategy

Residents of Bulak Banteng Village Surabaya have the highest vulnerability in the public sector. This field relates to public knowledge of the dangers of Covid-19 and services to prevent transmission. Strategies that can be applied are as follows:

(1) Monitoring

Monitoring is carried out to read any progress of the current condition. In this way, the level of vulnerability can be known earlier. So that it can anticipate at any time if there is an indication of non-compliance, which causes a higher level of vulnerability. The steps to save the transmission of covid 19 are getting better with intensive monitoring.

(2) Insight Spread

Dissemination of knowledge can be done by attaching posters and pamphlets. In addition, to be more massive, it is necessary to disseminate information through electronic media. With the condition of the COVID-19 outbreak, which is easily transmitted, electronic distribution can maximize results. Coordination between government agencies is also very necessary to facilitate the handling of any problems.

(3) Socialization and Counseling

Socialization and counseling regarding various aspects of disaster to the Disaster Management Implementing Unit (SATLAK PB) at the Regency/City level and the community. It aims to increase awareness and readiness to deal with more serious disasters. The most important thing to know is about living in harmony with understanding how to save or protect yourself.

(4) Training or Education

The training is carried out to provide disaster education to the community. The activity is carried out as a medium for delivering information and increasing resilience by increasing a sense of alertness. With this training, the community is more prepared in dealing with disasters.

(5) Early Warning

Early warning is an activity to deliver the results of observations on a regular basis regarding the condition of the vulnerability of an area. This activity is intended as a step to consider the plan to be carried out. Early warning is disseminated to the community through the local government. It is hoped that this activity will build public awareness.

In more detail, the steps that will be taken in dealing with the disease outbreak disaster are as follows:

(a) Prepare related elements such as the community, government, health ranks, and related sectors to understand the risks in the event of an outbreak.
(b) Prepare legal products that accommodate supporting prevention efforts.
(c) Prepare infrastructures such as professional human resources, health service facilities, communication facilities, transportation, logistics, and operational financing.
(d) Strengthen surveillance or observation systematically and intensely about the incidence of disease to identify risks. Then determine intervention and treatment strategies.
(e) Control of risk factors.

(f) Early detection of outbreaks that occur.
(g) Respond quickly and accurately to plants lined up in almost every house.

IV. CONCLUSION

The dominant variable that has an effective influence on the transmission of covid 19 in the Bulak Banteng Village, Surabaya City, is Knowledge and Services in the Public Sector, with an influence level of 38.2%. This variable is higher than other variables such as health, socio-culture, and economy with the level of influence of each field, namely 25.9%, 27.6%, and 32.5%. The vulnerabilities of the Bulak Banteng Village area of Surabaya in the health, socio-cultural, economic, and general fields are 0.0469, 0.0871, 0.1809, and 0.3551, respectively. So, the overall vulnerability is 0.67, which is included in the medium vulnerability criteria. Community-Based Disaster Risk Reduction is a suitable method for responding to the covid 19 outbreak. The results obtained from CBDRM are that the community can respond quickly and accurately in dealing with the risk of covid 19 transmission. So that the level of community vulnerability decreases due to high preparedness in dealing with the risk of covid 19 transmission, this can be realized with well-planned strategies and good coordination between the community and the government.

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