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## Optimizing Regional Potential in Tangerang Regency: Policy Recommendations Based on Cluster Analysis

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### Abstract

Tangerang Regency in Banten Province has various potential areas in each sub-district. To optimize this potential, appropriate policies are needed so that the region can develop and make a significant contribution to society. This study aims to analyze and group sub-districts in Tangerang Regency based on their regional potential using the cluster lysis analysis method with the Ward method. The results showed that sub-districts can be grouped into 5 clusters, namely Cluster 1 with the potential for rice, crops, and fisheries production; Cluster 2 with the potential for large population; Cluster 3 with the potential of many populations, area, rice, and crop production, and animal husbandry; cluster 4 with the potential of many populations, area, horticulture, and rice field land use; and cluster 5 with the potential for a large population and rice field land use. The originality of this research lies in the use of cluster analysis methods to group sub-districts based on their regional potential. The results of this study can be used as a reference for district governments in formulating appropriate policies to optimize the potential of areas in each sub-district.

**Keywords:** *Local Government; Regional potential, Policy Recommendation, Cluster Analysis*

### Introduction

The potential of the region in an area becomes an important factor in regional development. Tangerang Regency as one of the regions in Banten Province has diverse regional potentials, including many populations, areas, horticulture, plantations, land use, rice and crops, fisheries, animal husbandry, and transportation. Therefore, a study is needed to classify sub-districts in Tangerang Regency based on their potential areas as the basis for formulating effective and efficient regional policies.

The potential of the Tangerang Regency is very large. This is in line with the results of research conducted by the Banten Provincial Tourism and Culture Office (2019), which shows that Tangerang Regency has a variety of potential areas that can be developed, such as the industrial, agricultural, tourism, and infrastructure sectors. In addition, the potential of natural resources such as fisheries and forestry can also be a source of income for the Tangerang Regency.

Tangerang Regency has various kinds of potential areas that can be important resources for regional development. The potential of the region includes the industrial sector, agriculture, fisheries, animal husbandry, transportation, and so on. With an area of 959.6 km<sup>2</sup> and a population of around 2.8 million people, Tangerang Regency is a large enough area and has the potential to be developed. This makes the trade and services sector one of the important sectors in Tangerang Regency. In addition, this region also has potential in the horticulture and

plantation sectors. Several types of crops such as oil palm, coconut, rubber, and cloves thrive in this region and become a source of income for the surrounding community.

Land use in Tangerang Regency is also one of the important potential areas. The agricultural sector in this region includes rice, crops, and animal husbandry. In addition, the fisheries sector is also developing in the coastal areas of Tangerang Regency. Regional accessibility and connectivity are also important potentials, with the existence of Soekarno-Hatta international airport and Tanjung Priok Port around the Tangerang Regency area. The potential of existing areas in Tangerang Regency can be the basis for formulating regional policies to strengthen the regional economy and improve community welfare.

Regional policy is an action or plan made by local governments to improve community welfare and regional development in general (Saragih, 2018). In the context of Tangerang Regency, regional policies have been directed at the vision and mission that has been set, namely realizing a religious, smart, healthy, and prosperous Tangerang Regency community (Tangerang Regency Government, 2021). One of the efforts to achieve the vision and mission is to cluster the region, where the potentials owned by the region are studied to map leading sectors and potentials that can be developed (Taher et al., 2019).

Regional clustering has a major influence on regional policy formulation. Through regional clustering, local governments can map leading sectors and potentials that can be developed, to direct regional policies to these sectors. This can minimize the use of ineffective and efficient budgets, and improve the performance of these sectors (Taher et al., 2019).

There are many examples of regional policies made based on regional clustering in Indonesia, one of which is the regional policy in Tegal City. To develop superior sectors, the Tegal City Government clusters areas to determine existing potentials and map superior sectors. Furthermore, the Tegal City Government made regional policies in the form of business capital assistance and training programs for small and medium enterprises in predetermined leading sectors (Munir, 2018). From this example, it can be seen that regional clustering can be the basis for local governments in making targeted and effective policies.

Cluster analysis is a multiple-variable technique that has the main purpose of grouping objects based on their similar characteristics (Hair et al., 2014). The characteristics of objects in a group have a high level of similarity, while the characteristics of objects in a group with other groups have a low level of similarity (Mattjik and Sumertajaya, 2011). According to Hardle and Simar (2007), *cluster* analysis can be divided into two fundamental steps, namely as follows. First, choice of proximity size. The measure of proximity is checked from each observation pair (object) for the similarity of values. A measure of *similarity* is defined to measure the proximity of objects. The closer the objects are to each other, the more homogeneous they are. Second, the choice of group-building algorithm which is based on proximity measure objects are assigned to groups so that differences between groups become large and observations within groups become as close as possible. The *cluster* formation procedure is divided into 2, namely hierarchical and non-hierarchical. The formation of hierarchical clusters has the nature of developing a hierarchy or branching tree-like structure. Hierarchical methods can be *agglomerative* or *divisive*. *Agglomerative* methods consist of *linkage* methods, *variance* methods, and *centroid methods*. The *linkage method* consists of *single linkage*, *complete linkage*, and *average linkage* (Supranto, 2004).

Clustering or grouping is a statistical analysis method that divides data into several homogeneous groups based on the characteristics possessed by the data object. This method is often used in development planning to map the potential of the region and identify sectors that have the potential to be developed in an area. Cluster analysis has also been widely used in

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various studies, such as clustering disaster-prone areas (Dewi et al., 2021) and clustering tourist areas (Kurniasari et al., 2020). Similar research has been carried out before, for example, research by Supriyadi et al. (2018) which clustered sub-districts in Bogor Regency based on their regional potential. However, this research is still very relevant to be carried out in Tangerang Regency considering the differences in regional characteristics and potential possessed by the two districts.

The method used in this study is the clustering method using the k-means algorithm. The data used is secondary data obtained from the Central Bureau of Statistics of Tangerang Regency and is considered valid and reliable. The variables used in clustering are population, area, horticulture, plantations, land use, rice and crops, fisheries, animal husbandry, and transportation. The purpose of the study is to classify sub-districts in Tangerang Regency based on their regional potential as the basis for effective and efficient regional policy formulation. The results of this research are expected to help local governments in formulating data-based and measurable policies.

This research is expected to contribute to local governments in formulating data-based and measurable policies and can provide useful information for the community and investors in obtaining an overview of the potential of the area in Tangerang Regency. The results of sub-district clustering can also help in mapping regional development programs in the future. In addition, it is hoped that the results of this study can also inspire similar studies in other regions that face similar development challenges. Thus, this research can have a positive impact on regional development in Indonesia.

## Methods

This study uses a quantitative approach to collecting and analyzing data. A quantitative approach is a research method that uses numerical data and utilizes statistics as an analytical tool to draw conclusions related to the problem under study (Watson, 2015). The data used in this study is secondary data obtained from the Central Statistics Agency related to the potential of areas in 29 sub-districts in the Tangerang Regency.

In analyzing data, cluster analysis methods are used. This method is a multivariate technique that aims to group objects based on the similarity of characteristics they have (Hair et al., 2014). Objects that have similar characteristics are grouped, while the characteristics between groups are different. This is supported by an explanation from Mattjik and Sumertajaya (2011) that the characteristics of objects in groups have a high degree of similarity, while the characteristics of objects in different groups have a low level of similarity. In this study, the objects grouped are sub-districts in Tangerang Regency, with characteristics in the form of regional potential. The variables used are as follows:

- X1 : Multiple Inhabitants
- X2 : Area Size
- X3 : Horticulture
- X4 : Land Use
- X5 : Rice and Palawija
- X6 : Fishing
- X8 : Farm

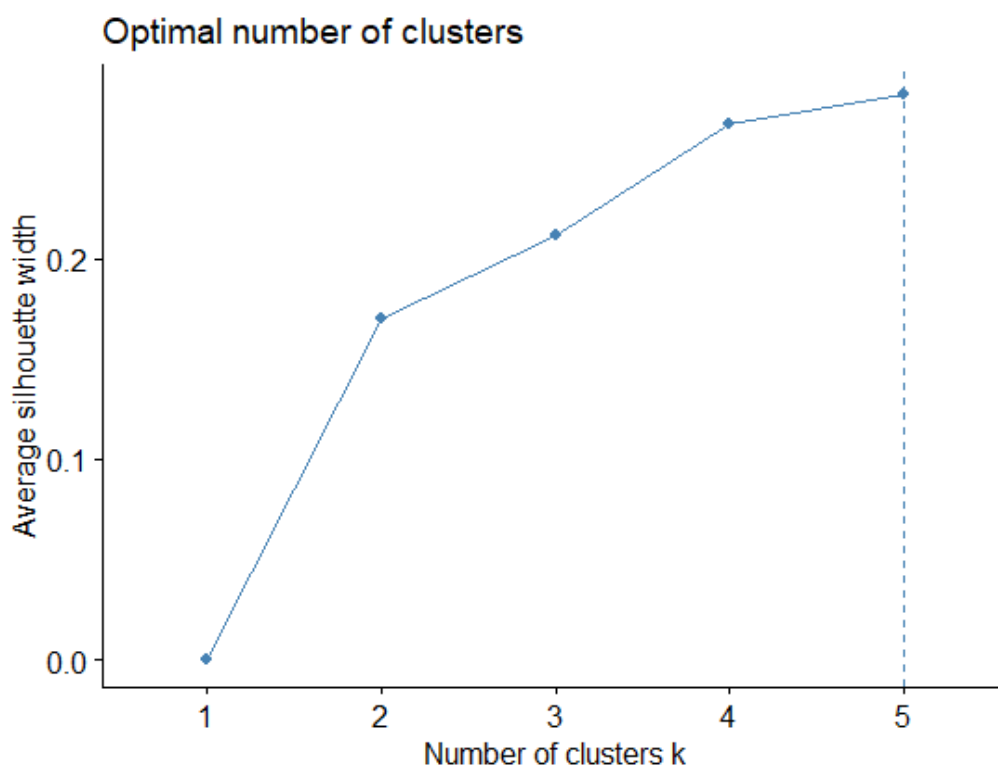
The data used in this study was obtained from the publication of the Central Statistics Agency entitled "Tangerang Regency in 2023 Figures". Each data has different units so it is necessary to transform the data before analysis.

## Results and Discussion

### Cluster Validation

The study used *cluster* analysis for sub-district grouping in Tangerang Regency. Before the analysis, the data is standardized first because the unit of each variable is different. In this study the determination of the optimal *cluster* using the Silhouette index. The following is a plot of selecting the best number of *clusters* using the Silhouette Index.

**Figure 2**  
**Optimal Cluster**



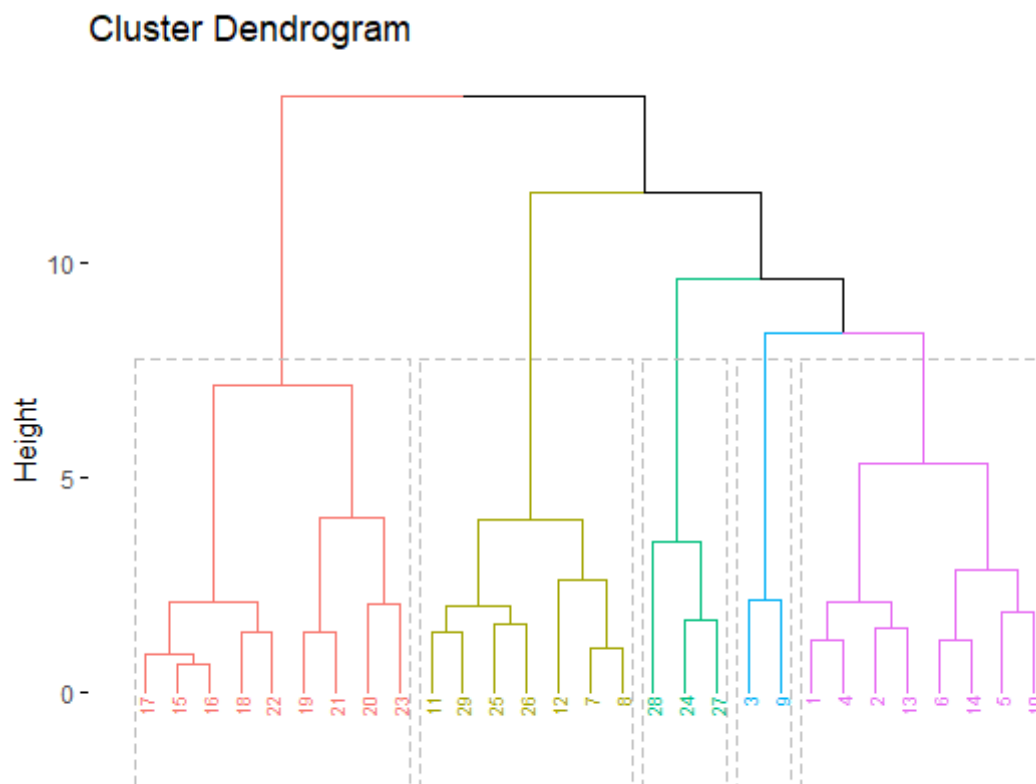
Source: Processed by Author, 2023

The Silhouette Index measures how closely similar objects in a cluster are, which also indicates how precisely objects have been grouped, so the greater the Silhouette Index value, the more similar the objects in a *cluster*. The Silhouette Index value ranges from -1 to 1 so the closer to 1, the number of *clusters* is the most optimal. Based on the graph above, *cluster* validation using the Silhouette Index is known that the optimal number of *clusters* in this study is as many as 5 *clusters* because it has the largest Silhouette Index value.

### Dendrogram Cutting

Dendrogram clusters are projected using R software as shown below. Dendrograms are used to see the *clusters* formed and the members within each *cluster*.

**Figure 3**  
**Dendrogram**



Source: Processed by Author, 2023

From the dendrogram, 5 *clusters* with significantly different groupings were obtained. The results of grouping potential areas in Tangerang Regency by sub-district using the ward method cluster analysis that has been carried out obtained 5 *clusters* with each *cluster* consisting of sub-districts as shown in Table 2 below.

**Table 2**  
**Cluster Table**

Cluster	District
1	Jayanti, Sukamulya, Kresek, Gunung Kaler, Kronjo, Mekar Baru, Mauk, Kemiri, Sukadiri
2	Curug, Kelapa Dua, Cisauk, Pasar Kemis, Sepatan, Sepatan Timur, Kosambi
3	Rajeg, Pakuhaji, Teluk Naga
4	Tigaraksa, Legok
5	Cisoka, Solear, Jambe, Cikupa, Panongan, Pagedangan, Sindang Jaya, Balaraja

Source: Processed by Author, 2023

Based on Table 2, it can be seen that *cluster* 1 consists of 9 members, namely Jayanti, Sukamulya, Kresek, Gunung Kaler, Kronjo, Mekar Baru, Mauk, Candlenut, and Sukadiri. *Cluster* 2 consists of 7 districts, namely Curug, Kelapa Dua, Cisauk, Pasar Kemis, Sepatan, Sepatan Timur, and Kosambi. *Cluster* 3 consists of 3 districts, namely Rajeg, Pakuhaji, and Teluk Naga. *Cluster* 4 consists of 2 districts, namely Tigaraksa and Legok. Finally, *Cluster* 5 consists of 8 districts, namely Cisoka, Solear, Jambe, Cikupa, Panongan, Pagedangan, Sindang Jaya, and Balaraja. The cluster profile figure and table below explain which *cluster* gives the best results, both for each variable and as a whole.

**Table 3**  
**Cluster Profile**

Variable	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Many Inhabitants (souls)	63119	153568	164565	143538	118841
Area (km <sup>2</sup> )	31	24	49	42	34
Horticulture (kw)	2091	5157	5632	57949	8328
Land Use (m <sup>2</sup> )	416	115	57	1012	685
Rice and Palawija (ton)	18148	3748	19705	9404	7116
Fisheries (m <sup>2</sup> )	91989	22479	32528	27748	18143
Animal husbandry (tail)	1659	1464	6268	2898	3243

Source: Processed by Author, 2023

Table 3 is obtained from the results of calculating the average of each variable for the five clusters. Based on the calculation results, it was found that cluster 1 stood out in the potential for rice and crop production, as well as fisheries potential. Cluster 2 is highlighted the number of residents, while Cluster 3 is focused on the potential of many residents, area, rice and crop production, and animal husbandry. Cluster 4 for the potential of many populations, areas, horticulture, and rice field land use. Finally, cluster 5 focuses on the potential population and use of rice fields.

Cluster analysis is a statistical method used to group objects based on characteristics or variables owned. In this study, cluster analysis was conducted to group sub-districts in Tangerang Regency based on regional potential. The results of this cluster analysis can be used as a basis for formulating development policies in Tangerang Regency. Development policies can be adjusted to the potential of each cluster so that development can be carried out more effectively and efficiently.

Tangerang Regency consists of 29 sub-districts divided into five clusters based on their regional potential. Cluster 1 has superior potential in rice and crop production, as well as fisheries. According to data from BPS Tangerang Regency, in 2020, rice production in Tangerang Regency reached 798.49 thousand tons, and around 40% of them came from sub-districts incorporated in Cluster 1. In addition, these sub-districts also have considerable fisheries potential, because they are located near the coast and swamps that allow for fish farming. (BPS, 2021). Cluster 2 in Tangerang Regency includes sub-districts highlighted by the large population. In recent years, the population in these sub-districts has increased significantly. This makes Cluster 2 a potential area for investment in various sectors, especially the service and trade sectors (BPS, 2022).

The sub-districts included in Cluster 3 have considerable potential in rice and crop production, as well as animal husbandry. The potential of this region is supported by its area and relatively large population. According to BPS Tangerang Regency, in 2020, rice production in these sub-districts reached 264.61 thousand tons, and around 30% of them came from Cluster 3. In addition, the potential of animal husbandry in this region is also quite large, because it is supported by the existence of large land for livestock development. (BPS, 2021). Furthermore, Cluster 4 in Tangerang Regency has potential in the number of population, area, horticulture, and rice field land use. This cluster consists of Tigaraksa and Legok sub-districts, which have a relatively large population and a fairly large area. In addition, this region also has the potential for horticultural development, especially in the development of vegetable crops (BPS, 2022). Finally, Cluster 5 in Tangerang Regency includes sub-districts that have the potential for large populations and rice field land use. The potential of this area is supported by the existence of large enough land for agricultural development, especially the use of rice fields. This makes Cluster 5 a potential area for agribusiness development, especially in agriculture and plantation areas (BPS, 2022).

Each cluster has unique potential and can be developed to support economic growth and improve the quality of life of its residents. Governments and the private sector can work together to identify the most promising sectors and invest in infrastructure, technology, and human resources to support the development of those sectors. For example, the government can invest in irrigation systems and agricultural research to support the Cluster 1 agricultural sector, while the private sector can invest in health and education to support the Cluster 2 service sector. The government can invest in livestock research and infrastructure to support the Cluster 3 livestock sector, while the private sector can invest in agribusiness to support the Cluster 4 horticulture sector. Lastly, the government and private sector can work together to develop the Cluster 5 residential and commercial sectors by investing in infrastructure, such as roads and public transport, and promoting the region's potential to attract investors and residents. The discussion for each cluster is clearer as follows:

#### **Cluster 1: Jayanti, Sukamulya, Kresek, Gunung Kaler, Kronjo, Mekar Baru, Mauk, Kemiri, Sukadiri**

Cluster 1 has great potential in rice and crop production as well as fisheries. Regional policy recommendations to develop areas based on this potential are to increase rice and crop production through the development of agricultural technology and the provision of quality seeds. In addition, local governments can promote fisheries potential in the region by developing infrastructure and supporting facilities, such as ports and fish markets. The steps that must be taken by the local government of Tangerang Regency to maximize the potential of Cluster 1 are to improve the accessibility and quality of infrastructure, such as roads, irrigation, and markets. Local governments can also provide training and education to local farmers and fishermen to improve their skills and knowledge in managing agricultural and fishery businesses. In addition, local governments can facilitate cooperation between farmers and fishermen with the private sector to improve market access and obtain better prices.

The local government of Tangerang Regency can also take advantage of central government programs, such as the National Community Empowerment Program (PNPM) and the Micro, Small and Medium Enterprises (UPMKM) Productivity Improvement Program, to support the development of the agricultural and fisheries sector in Cluster 1. These programs can provide capital assistance, training, and mentoring to local farmers and fishermen to improve their productivity and business quality. In the long term, the local government of Tangerang Regency can develop the agribusiness and tourism sector in Cluster 1 to increase the added value and competitiveness of the region. Local governments can facilitate private

sector investment in the processing of agricultural and fishery products, as well as promote the natural and cultural tourism potential of the region. Thus, Cluster 1 can become the center of growing economic activity in the Tangerang Regency area.

### **Cluster 2: Curug, Kelapa Dua, Cisauk, Pasar Kemis, Sepatan, Sepatan Timur, Kosambi**

Cluster 2 has potential in large populations. Regional policy recommendations to develop areas based on this potential are to improve the accessibility and quality of infrastructure, such as roads, public transportation, and health facilities. In addition, local governments can promote the potential of the region by developing the service sector, such as tourism and trade. The steps that must be taken by the local government of Tangerang Regency to maximize the potential of Cluster 2 are to improve the accessibility and quality of infrastructure, such as roads, public transportation, and health facilities. Local governments can also facilitate private sector investment in service sector development, such as tourism and trade, to increase the added value and competitiveness of the region. In addition, local governments can provide training and education to local communities to improve their skills and knowledge in managing service businesses.

In the long run, the local government of Tangerang Regency can develop the education and health sector in Cluster 2 to improve the quality of life of its residents. Local governments can build more schools and hospitals, as well as provide education and health assistance to local communities. In addition, local governments can facilitate cooperation between the education sector and the private sector to improve the quality of education and employment opportunities in the region.

### **Cluster 3: Rajeg, Pakuhaji, Teluk Naga**

Cluster 3 has potential in the number population, area, rice and crop production, and animal husbandry. Regional policy recommendations to develop areas based on this potential are to increase rice and crop production through the development of agricultural technology and the provision of quality seeds. In addition, local governments can promote the potential of livestock in the region by developing infrastructure and supporting facilities, such as animal markets and livestock processing centers.

The steps that must be taken by the local government of Tangerang Regency to maximize the potential of Cluster 3 are to improve the accessibility and quality of infrastructure, such as roads, irrigation, and markets. Local governments can also provide technical assistance and education to local farmers and ranchers to improve their skills and knowledge in managing agricultural and livestock businesses. In addition, local governments can facilitate cooperation between farmers and ranchers with the private sector to improve market access and obtain better prices.

In the long term, the local government of Tangerang Regency can develop agribusiness and livestock sectors in Cluster 3 to increase the added value and competitiveness of the region. Local governments can facilitate private sector investment in the processing of agricultural and livestock products, as well as promote the natural and cultural tourism potential of the region. Thus, Cluster 3 can become the center of growing economic activity in the Tangerang Regency area.

### **Cluster 4: Tigaraksa, Legok**

Cluster 4 consists of two sub-districts, namely Tigaraksa and Legok, with the main potential in horticulture and rice field land use. According to data from BPS Tangerang Regency in 2020, horticultural production in Tangerang Regency reached 711,933 tons, with



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the largest contribution from vegetables and fruits. In terms of land area, around 11,153 hectares of agricultural land in Tigaraksa and Legok are designated for horticulture.

To develop horticultural potential in Cluster 4, regional policy recommendations that can be done are improving the quality of human resources through training in modern farming techniques, procurement of adequate agricultural equipment, and development of local and regional markets to improve product accessibility. In addition, local governments can facilitate capital and business planning in the form of credit and training for farmers who want to develop horticultural businesses. The steps that can be taken by the local government of Tangerang Regency to maximize horticultural potential in Cluster 4 are improving the quality of agricultural infrastructure, such as irrigation and water distribution networks, adequate road access, and public lighting. In addition, local governments can also expand the range of modern agricultural technology to increase production efficiency, increase productivity, and reduce production costs.

In the long term, local governments can make efforts to develop agrotourism by utilizing natural beauty and local culture as tourist attractions. This can boost the local economy by attracting tourists and opening up new business opportunities in the tourism sector. In maximizing horticultural potential in Cluster 4, local governments need to take strategic steps to address possible problems, such as technical, licensing, regulatory, and financing issues. Therefore, good coordination and partnership between local governments, farmers, and the private sector are needed to create a conducive environment for sustainable horticultural business development.

#### **Cluster 5: Cisoka, Solear, Jambe, Cikupa, Panongan, Pagedangan, Sindang Jaya, Balaraja**

Cluster 5 consists of 8 sub-districts. With the attention of the area in this cluster focused on the number of residents and the use of rice fields. Tangerang Regency has a fairly large area and has a high population density. One of the sub-districts in Cluster 5 with the largest population is Balaraja with a population of 342,812 people in 2020 (BPS, 2020). Regional policy recommendations to develop areas in Cluster 5 are to improve the quality of road and public transportation infrastructure. It aims to facilitate people's access to centers of economic activity, such as markets, shopping centers, and workplaces. In addition, local governments can improve irrigation systems to increase agricultural production and improve the quality of education and health so that people are more qualified and productive.

To maximize the potential of the area in Cluster 5, the steps that must be taken by the local government of Tangerang Regency include increasing food production through the application of modern agricultural technology, such as the use of organic fertilizers, good irrigation systems, and effective pest and disease control. In addition, local governments can provide training and guidance to farmers to improve their skills and knowledge in managing paddy fields. In the long run, the local government of Tangerang Regency can develop the agribusiness sector in Cluster 5 to increase the added value and competitiveness of the region. Local governments can facilitate private sector investment in the processing of agricultural products, as well as promote the natural and cultural tourism potential of the region. Thus, Cluster 5 can become the center of growing economic activity in the Tangerang Regency area.

However, keep in mind that the policy recommendations provided must be adjusted to the characteristics and potential of the area owned by each sub-district, and must involve the active participation of the community and other related parties. Thus, the policies implemented can be more targeted and have a positive impact on socio-economic development in Tangerang Regency. Overall, the Tangerang Regency Government needs to implement appropriate

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measures for the recommended policies to be successfully implemented. Some steps that can be done are:

1. Further, identify the strengths and weaknesses of each cluster. After that, it is necessary to conduct studies on social, economic, and environmental aspects to understand the situation in the field.
2. Formulate regional policies based on the potential possessed by each cluster. This regional policy must be able to facilitate the development of regional potential by optimizing existing resources. In addition, it is also necessary to integrate existing regional policies with new policies that will be made to strengthen the implementation of recommended policies.
3. Provides support to the community and other relevant parties to be involved in regional development. This can be done by strengthening community participation in the process of planning and implementing regional development programs. In this case, the role of local governments as facilitators and mobilizers is very important to encourage community participation in regional development.
4. Strengthen the facilities and infrastructure needed to support regional development. This can be done by improving the accessibility of the region, such as the construction of roads, bridge, and transportation infrastructure. In addition, it is also necessary to improve public facilities such as markets, terminals, and other public service centers.
5. Monitoring and evaluation of the implementation of recommended regional development policies and programs. This is very important to ensure that the implementation of these policies and programs runs well and effectively by the desired objectives.

The development potential of each cluster requires careful planning and implementation. Governments and the private sector can work together to identify the challenges and opportunities facing each cluster and develop appropriate strategies to address those challenges. For example, the government can develop training and education programs to improve the skills and knowledge of locals, while the private sector can invest in technology and innovation to improve the efficiency and productivity of existing sectors. With good cooperation between the government and the private sector, Tangerang Regency can develop the potential of each cluster and become the center of growing economic activity in the Banten Province area.

## Conclusion

Based on the information that has been presented, there are five sub-district clusters in Tangerang Regency with different potentials. Each cluster has excellent potential that needs to be considered by the Tangerang Regency Government to develop its area. Cluster 1 has potential in rice and crop production, as well as fisheries potential. Cluster 2 has potential in large populations. Cluster 3 has potential in many populations, areas, rice and crop production, and animal husbandry. The government needs to develop the agricultural and livestock sector in the region by optimizing the use of available land and natural resources. Cluster 4 has potential in many populations, areas, horticulture, and rice field land use. Cluster 5 has potential in the number of residents and the use of rice fields. In developing the Tangerang Regency area, the Government needs to consider various factors such as environmental sustainability, natural resource management, and community welfare. Therefore, the steps taken need to accommodate the interests of all parties to achieve sustainable and sustainable development.

Based on the results that have been described, it can be concluded that Tangerang Regency has considerable potential in the agricultural and livestock sectors, especially in rice, crops, and horticulture production. In addition, this area also has potential in the fisheries sector and the use of rice fields. To develop the area, the Tangerang Regency Government needs to take appropriate measures, such as strengthening infrastructure, improving accessibility, and providing financial and technical support to farmers and ranchers. The government should also pay attention to existing policies to boost economic growth in the region, including strengthening partnerships between the public and private sectors. On the other hand, the community also needs to receive education and training in the development of modern agricultural and livestock technology to increase productivity and competitiveness. By taking appropriate steps and synergy between the government and the community, the potential of the area in Tangerang Regency can be maximized to encourage economic growth and community welfare.

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