

# Spatial Assessment of Poverty Distribution in West Java Province

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## Abstract

Poverty is a major issue in many countries around the world. This is a condition that individuals are unable to meet basic needs such as foods, clothings, medicines, and housings. Poverty alleviation becomes a primary goal of the national development programs in accordance with the mainstream agenda of the Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs) as stated in the National Long-Term Development Plan (RPJPN 2005-2025). The national poverty alleviation programs implemented by the government have successfully reduced the percentage of poverty, even though the nominal number of the poor people remains quite high. Development is essentially a continuous process encompassing various dimensions, including social, economic, and environmental dimensions aimed at the welfare of the society. The measurement of the social and economic conditions of a population (poverty) is a part of the assessment of development success. A method to integrate poverty attribute data with maps allows us to visualize the distribution of poor populations in a region. The poverty data may be presented in two data models: macro-level poverty data and micro-level poverty data. In order to achieve spatial equality, the visualization process is presented at the district/city level throughout the West Java Province. In addition, the process is developed under the WebGIS environment, making this poverty information easily accessible to users. Spatial assessment information on the distribution of poor populations and the success of poverty alleviation programs can be accessed through <https://jabar.netlify.app/>.

**Keywords:** attribute, macro-data, micro-data, poverty, spatial

## 1. Introduction

Poverty is a major issue in many countries around the world. This is a condition that individuals are unable to meet basic needs such as foods, clothings, medicines, and housings. Poverty also serves as a measure of social and economic conditions in assessing the government development success in a region (Priseptian and

Primandhana, 2022). Poverty has become a serious issue during the economic downturn caused by the Covid-19 pandemic. This economic decline led to an increase in poverty rates in Indonesia. According to data from the Central Statistics Agency (BPS) in 2020, the percentage of the poor population in Indonesia increased to 9.78% in the first semester and further increased to 10.19% in the second semester. The increase in the percentage of the poor population in Indonesia is partly attributed to the Covid-19 pandemic. According to Topcu (2022), the Covid-19 pandemic indirectly hampers global poverty eradication efforts. In West Java, the percentage of poor population is recorded at 8.4% (BPS, 2021), making it the province with the lowest poverty rate in Indonesia. However, in terms of absolute population figures, West Java ranks second nationally with 4.2 million poor individuals, making it one of the regions with a high level of poverty in Indonesia.

Physical and environmental factors of any place can be identified based on a site and a situation. Site refers to all internal characteristics of a specific area, including size, shape, topography, and all physical conditions. Situation, on the other hand, relates to external characteristics and the location's relationship with surrounding areas in the same geographical space. This includes accessibility, ease of reaching supporting infrastructures, availability of facilities and infrastructures such as transportation networks, electricities, water supplies, and more. The topography in the southern part of West Java Province, that has limited road networks and a hilly terrain, has resulted in a significant economic disparity compared to the central and northern regions. The road network in the southern region is limited (approximately 28.45%) compared to the northern and central regions (approximately 71.55%). This condition significantly affects population mobility. The population distribution in the northern and central regions is 73% with a density of 57 people/ha, while in the south, the population is 27% with a density of 6 people/ha (Riadi and Munajati, 2015).

The integration of tabular data (non-spatial data) collected from the BPS and the Ministry of Village, Development of Disadvantaged Regions and Transmigration (PDRT) with spatial data collected from the National Geospatial Information Agency (BIG) will serve as the basis for spatial assessment of the distribution of poor populations in West Java Province. Poverty data obtained from the BPS is based on the concept that poverty is viewed as an economic inability to meet basic food and non-food needs, measured by expenditures. Here, individuals are categorized as poor if their monthly expenditures per capita fall below the poverty line. The village development program has undergone a transformation by granting recognition and delegating authority to village communities to manage and organize their affairs autonomously. Village autonomy includes aspects of self-governing communities based on origin and local self-government, giving broad authority to villages in terms of local governance, village development implementation, community development, and community empowerment based on community initiatives, origin, and village customs. The Village Development Index (IDM) is a composite index based on three sub-indices: Social Resilience Index, Economic Resilience Index, and

Ecological/Environmental Resilience Index (Ministry of Villages, 2019). The Economic Resilience dimension that forms the IDM includes village production, distribution access, trade access, financial institution access, economic institutions, and trade openness. Economic resilience dimension is closely related to income circulation and income distribution in villages. All aspects of economic resilience reflect improved village development, which can ultimately enhance the economic well-being of village communities.

Geographic Information System (GIS) is a suitable method for mapping a large study area, and allowing analysis within the large study area in a relatively short period of time. The GIS method makes it possible to facilitate the presentation of spatial information on the distribution of poor populations in a province. WebGIS, an online-based Geographic Information System application, combines web application and web mapping application. WebGIS is widely used for publishing spatial information online. Therefore, in this study, WebGIS will be utilized for modeling and displaying the spatial information system for the distribution of poor populations. For this purpose a webGIS application is developed and in order to simplify the internet data transmission process, the development uses a file-based geospatial data system called GeoJSON data format. This GeoJSON data is obtained from a conversion of GIS data resulting from the GIS data process that is stored in shapefile format. Then, from this GeoJSON data, the OpenLayers software is applied to create a web map and to send it to users.

This research is conducted in three stages. Firstly, a literature review is conducted on the concept of poverty and village community development methods, and data is collected from the BPS and the Ministry of PDRT. Secondly, geospatial data for West Java Province that is collected from the BIG and is then integrated with BPS data (attribute data). Finally, a geographic observation is carried out to detect the percentage and distribution of poor populations, interpret the spatial distribution of the poor populations based on indicators of area isolation and infrastructure readiness, and present it in an internet-based information system/WebGIS.

Spatial data is geographically referenced data that represents objects on the Earth's surface in a flat plane. Spatial data involves the interpretation and projection of all natural and human-made phenomena on the Earth's surface. Spatial data comes in two types: vector and raster data. Vector data represents Earth's features as points, lines, curves, or polygons along with their attributes. Raster data, on the other hand, uses a matrix or grid structure of pixels to represent features. This research will utilize both types of spatial data (vector and raster) and employ analysis methods such as overlay, clip, intersect, buffer, query, union, merge, either individually or in combination.

#### Percentage of the Poor Population.

According to BPS (2022), poverty measurement is determined based on the concept of the ability to meet basic needs (basic needs approach). With this approach, poverty is seen as an economic inability to meet basic food and non-food needs,

measured in terms of expenditures. The poor population is defined as individuals with an average monthly expenditure per capita below the poverty line. In this context, the poverty line (GK or Garis Kemiskinan) reflects the minimum expenditure required for an individual to meet their basic living needs for a month, including both food and non-food needs. Macro-level poverty data utilizes the Head Count Index (HCI-Po) data, which is the percentage of the population below the poverty line (GK) provided by BPS. The calculation uses the following formula:

$$P_{\alpha} = \frac{1}{n} \sum_{i=1}^q \left[ \frac{z - y_i}{z} \right]^{\alpha} \tag{1}$$

$$P1 = \frac{1}{n} \sum_{i=1}^q \left( \frac{z - y_i}{z} \right) \tag{2}$$

Where :

$\alpha = 0$

$z$  = poverty line.

$y_i$  = Average monthly expenditure per capita of the population below the poverty line ( $i=1, 2, 3, \dots, q$ ),  $y_i < z$

$q$  = Number of people who are below the poverty line.

$n$  = population

Poverty distribution pattern (BPS, 2021), the percentage of poor people in districts/cities in West Java Province has a diverse distribution ranging from low (2.6% - 5.3%), medium (5.3% - 9.7%), and high (9.7% - 13.1%) and for spatial purposes the distribution pattern is simplified into low (0% - 5%), medium (5% - 10%) and high (10% - 15%) .

The percentage of poverty status in village and sub-district areas is classified (Dyah, Sasmito and Apriliyani, 2021) as follows: non-poor status 0% - 15%, almost poor 15% - 25%, poor 25% - 30% and very poor 30% - 100 %. The village and sub-district poverty level values are calculated using the percentage formula :

$$\text{Percentage : (\%)} = (f:N) \times 100\% \tag{3}$$

Where:

$f$  : number of poor people in the village/district

$N$ : number of village/district residents.

The number of villages and sub-districts in Indonesia has reached 74,093 villages and 8,412 sub-districts (Ministry of Home Affairs, 2015), and this causes the poverty level in the rural area to become high. This condition is important for developing the rural areas to be more advanced by exploring the potential of each village in order to improve the welfare of its people. The concept of village development

is monitored using the Village Development Index (IDM) in the form of a composite index formed from 3 types of indices, namely the Social Resilience Index, Economic Resilience Index and Ecological/Environmental Resilience Index. The Village Development Index (IDM) functions as a map of development of village building and may be used as a reference in carrying out integration, affirmation (recognition) and synergy of the development, with hope to achieve the prosperous, just and independent of the rural communities. To measure and determine the IDM value of a village, the formula used is:

$$IDM = (IKS+IKE+IKL)/3$$

(4)

Where :

IDM: Developing Village Index Value

IKS: Social Resilience Index Value

IKE: Economic Resilience Index Value

IKL: Environmental Resilience Index Value

This is obvious that the components used for assessing the villages that fall under the category of Self-Reliant Village (Desa Mandiri), Advanced Village (Desa Maju), Developing Village (Desa Berkembang), and Backward Village (Desa Tertinggal) are Social Resilience, Economic Resilience, and Environmental Resilience factors.

According to the Ministry of PDTT in 2023, the IDM consists of five class of village development and self-sufficiency status as follows :

1. Self-Reliant Village or Highly Advanced (Self-Sufficient Village) is a village that has the ability to carry out village development to improve the well-being and quality of life of its residents with sustainable social, economic, and ecological resilience. A Self-Reliant Village is a village with an Index of Village Development (Indeks Desa Membangun) greater than 0.8155.
2. Advanced Village (Pre-Self-Sufficient Village) is a village that has the potential for social, economic, and ecological resources and the ability to manage them for the betterment of the village community, human quality of life, and poverty reduction. An Advanced Village is a village with an Index of Village Development less than or equal to 0.8155 and greater than 0.7072.
3. Developing Village (Intermediate Village) is a village that possesses social, economic, and ecological resources but has not yet optimally managed them. A Developing Village is a village with an Index of Village Development less than or equal to 0.7072 and greater than 0.5989.
4. Backward Village (Pre-Intermediate Village) is a village that has not optimally managed its social, economic, and ecological resource potential in efforts to improve the well-being of the village community, human quality of life, and is experiencing various forms of poverty. A Backward Village is a village with an Index of Village Development less than or equal to 0.5989 and greater than 0.4907.
5. Highly Backward Village (Primary Village) is a village that experiences various forms of poverty and is vulnerable to social conflicts, economic shocks, and various



natural disasters. Thus, it is unable to manage the economic, social, and ecological resource potential it possesses. A Highly Backward Village is a village with an Index of Village Development less than 0.4907.

#### Spatial processing

The management, processing, and analysis of spatial data depend on the data model. This spatial data management, processing, and analysis utilize GIS modeling based on specific needs and analysis. Spatial data processing includes various techniques such as feature overlay, clip, intersect, buffer, query, union, and merge. Spatial data processing can be carried out using geoprocessing techniques that involve combining different values based on specific attributes. Analytical methods in spatial data processing covers processes such as overlay and the integration of spatial data with non-spatial (attribute) data. Descriptive analysis is used to understand the overall spatial distribution of poverty in West Java and the possibility of conducting inferential analysis to determine whether there are spatial effects affecting poverty in West Java in 2022.

## 2. Methods

Spatial analysis has specific characteristics as it can be used in various research fields. Spatial analysis activities use Geographic Information System (GIS) techniques that rely on geographically located data for analysis, storage, and visualization. The best results from GIS analysis can be achieved by analyzing spatial data and attribute data integratively. Attribute data may include social, cultural, and economic data, serving as object identifiers in the database, making it easier to trace objects in the database. The purpose of this research is to identify the distribution patterns of the impoverished population and the success of government programs in addressing them in the West Java province using the integration of spatial and non-spatial data.

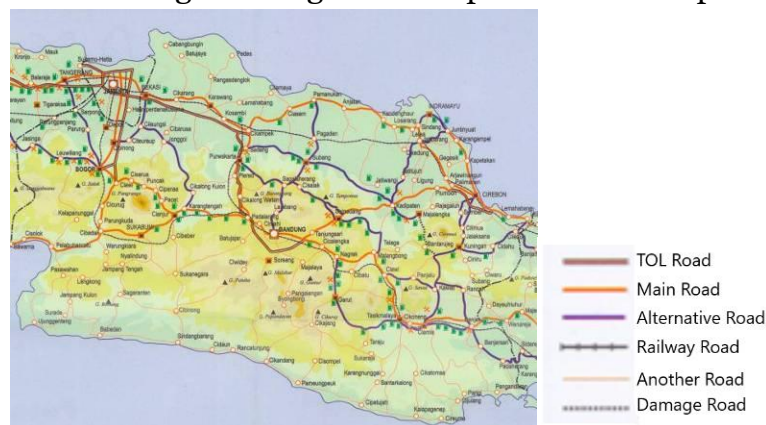


Figure 1 : Research Location

WebGIS is a digital mapping or GIS application that utilizes the internet as a communication medium. It serves as functions of distributing, publishing, integrating, communicating, and providing spatial information in the form of text and digital maps over the internet network. The dissemination of spatial data, which traditionally used print media (maps), CD-ROMs, and other storage media, requires users to physically

come and view the data on-site. This method limits mobility and speed of obtaining information about the data. Therefore, it was deemed necessary to present the results of this research in WebGIS. The research flowchart is as follows (Figure 2).

Overlay, or superimposition, is one of the procedures in GIS analysis (Geographic Information Systems), this is the capability to place the graphics of one map on top of another map and visualize the results on a computer screen. Overlay involves overlaying one map on top of another (at least 2 maps) along with their attributes and produces a combined map that contains attribute information from both maps, resulting in a new map.

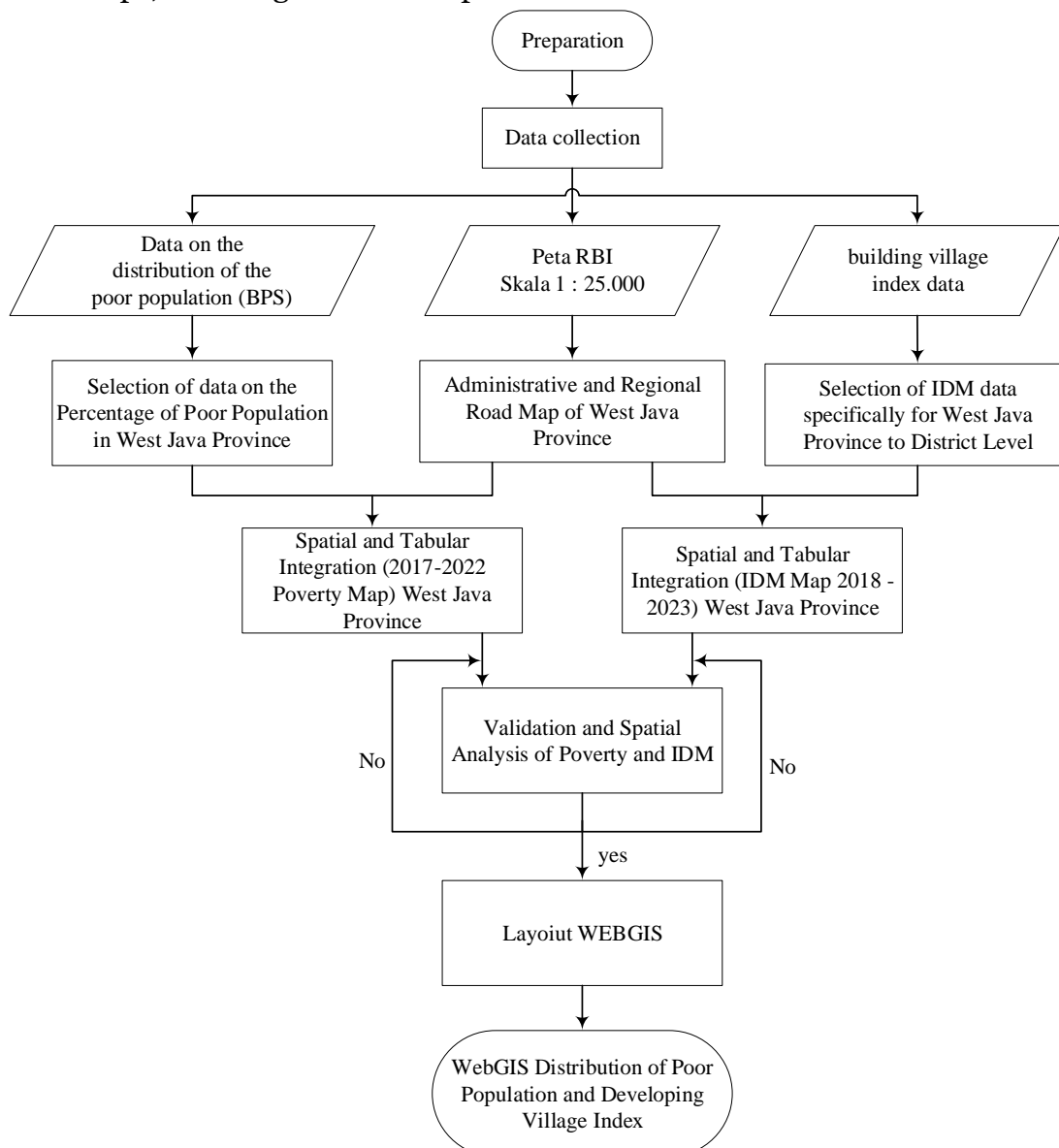


Figure 2 : Research methods

### 3. Results and Discussion

The poor population is the population below the GK, the percentage of poor people to the total population is called the poverty level. The poverty level is not always directly proportional to the number of poor people or the contribution of poverty to

the total population of Indonesia. The following is a map of regency/district/city poverty data in West Java which is classified based on low poverty (0-5%), medium poverty (5-10%) and high poverty (10-15%).

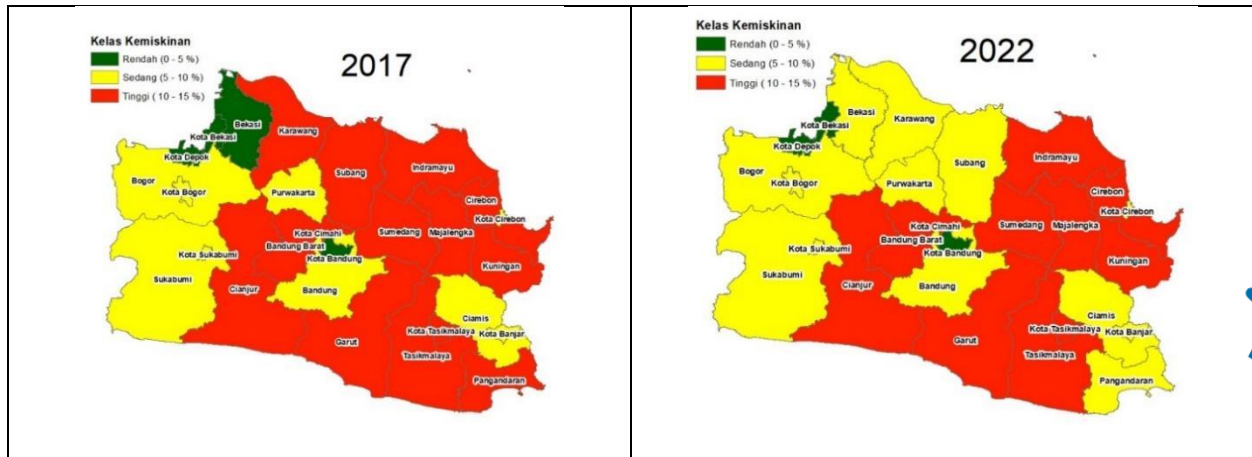


Figure 3 : Spatial Information on the Percentage Distribution of the Poor Population in 2017 and 2022

In 2017, the percentage of poor people in West Java (8.95%), Depok City, Bekasi City, Bandung City and Bekasi Regency had a low percentage of poor people. Meanwhile, the percentage distribution of poor people is spreading in Bogor City, Sukabumi City, Cimahi City, Bogor Regency, Banjar City, Sukabumi Regency, Bandung Regency, West Bandung Regency, Ciamis Regency (Figure 3.). Based on this spatial information, in West Java Province there are 14 districts/cities that have a high percentage of poor people. According to BPS (2019), the poverty rate in West Java Province reached 7.45% (Figure 4), or below the national poverty rate (9.66%). However, in terms of numbers it is still very large, especially considering the large disparities between regions.

The Corona Virus Disease 2019 (COVID-19) pandemic was declared by the World Health Organization (WHO) as a Global Pandemic since March 11 2020, and was designated as a public health emergency based on Presidential Decree Number 11 of 2020 which was followed by the Determination of a Public Health Emergency ( COVID-19) as a non-natural disaster. This was followed by the issuance of Presidential Decree Number 12 of 2020 concerning the Determination of the Spread of Non-Natural Disaster (COVID-19) as a National Disaster, which has an impact on various aspects of life including broad health, economic and social aspects in Indonesia. As a result of COVID19, economic growth weakened and caused poverty in West Java to increase again in 2020 to 7.88% or the equivalent of 3.92 million people. In 2021, it was recorded that 4.19 million or 8.40% of the population of West Java Province experienced financial poverty during the COVID-19 pandemic. At the end of 2022 PPKM (Implementation of Restrictions on Community Activities) has been lifted by the government and normal life will return, without masks. In this position, the



data on the number of poor people in West Java Province is 4.07 million people (8.06%), in March 2023 the poor population in West Java Province is 7.62%, which means the number of poor people is still higher compared to the condition of poverty in 2019.

According to Elisabet Siahaan (2022), the ideal calculation system for measuring the poverty level of the population in an area is measured based on the percentage increase and decrease in the poverty rate, not the number of poor people. When looking at poverty, the correct and objective reference is to pay attention to the percentage compared to the total population in the area. Measuring the poverty level based on the number of poor people is not suitable as a reference (Siahaan, 2022), because each region has a different population. Poverty remains a topic for evaluating the performance of government agencies, this issue is also used as a benchmark for the government's ability to improve the welfare of its citizens.

The phenomenon of poverty is generally associated with a lack of income to meet the basic needs of a decent life, a condition of complete lack of fulfillment of basic needs as a side effect of a policy that cannot be avoided. The helplessness of the population at the lower levels of society is multidimensional, the root of the problem is related to non-economic issues (social, cultural and political). The multidimensional face of poverty requires a balanced approach between economic and non-economic. In other words, fulfilling basic needs does need to be prioritized, but it is also necessary to overcome poverty from non-economic factors (Arifin, 2020). Indonesian society has a unique character, to overcome poverty the community requires a balanced structural and cultural approach.

The cause of structural poverty is that this poverty occurs in poor individuals not because they are too lazy to work or have no income, but rather because the existing social structure of society limits their rights to access the economic resources available to them. Groups that fall into structural poverty include sharecroppers, uneducated workers, MSMEs (Arifin, 2020). The emergence of structural poverty can be caused by low access for a person or community to resources and development, such as education, health and employment opportunities. Cultural poverty refers to problems with a person's or society's mental attitude caused by cultural factors.

Poverty reduction is the main target of the national development programs in accordance with the mainstreaming of the Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs) agendas as stated in the National Long Term Development Plan (RPJPN 2005-2025). The poverty reduction program launched by the government has succeeded in reducing the percentage of poverty, even though in nominal terms the number of poor people is still quite high. Poverty alleviation efforts that have been and are currently being implemented still face various challenges in the cultural values of Indonesian society. In essence, development is a continuous process between various dimensions, both social, economic and environmental, which aims for the welfare of society.

West Java Province consists of 18 districts with 9 cities, has 627 sub-districts consisting of 5,322 villages with 645 sub-districts. Villages are the leading entity in development, contributing 75% to the achievement of Sustainable Development Goals (SDGs), and 89% of government areas are villages with 72% of the population living in villages (Pemprov, 2022). The government has great attention to creating a just and prosperous society, one of the important aspects to achieve this is by carrying out village development. The success of development in villages is assessed based on indicators developed in the Developing Village Index (IDM), which uses the concept that to move towards a developed and independent village, a sustainable development framework is needed where social, economic and ecological aspects are forces that complement each other and maintain potential and the Village's ability to improve village life.

Policies and activities for development and empowerment of village communities aim to produce equality and justice, by strengthening local and cultural values, as well as being environmentally friendly in managing natural resource potential well and sustainably. The Village Development Index monitors/sees the development of village independence based on the implementation of the Village Law with the support of village funds and village assistants. The Developing Village Index provides direction in carrying out policy interventions by correlating appropriate development interventions from the government based on community involvement and/or participation which correlates with the characteristics of the village area. The results achieved in IDM activities for the West Java Province region are presented spatially (Figure 4.) using the percentage of poor people in 2019 and IDM information, juxtaposed as follows:

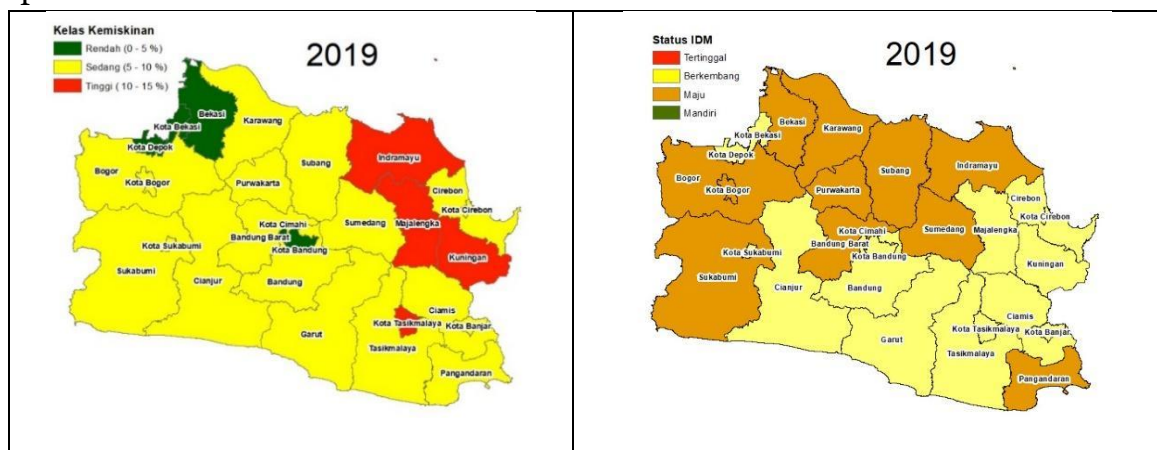


Figure 4. Spatial information on the percentage of poor and IDM people in 2019

The number of under-developed villages or backward villages in West Java in 2018 reached 929, and very under-developed villages or highly backward villages numbered 48. It was recorded that there were 37 independent villages and 695 developed villages (Developing IDM), and spatially it provides information that there are 8 districts/cities that have advanced IDM status and the rest or 19 districts/cities have a developing IDM status. In 2019 districts/cities with advanced IDM increased to 11 regions (Figure 4.). In the 2022 period, the status of the West Java IDM is

experiencing a very good progress, 18 districts/cities have advanced IDM strata and 9 districts/cities have independent IDM strata (Figure 5.). In 2023, independent villages will reach 1,828 villages and there are also two regions in West Java where all villages are independent, namely Pangandaran Regency and Banjar City (Pemprov, 2023).

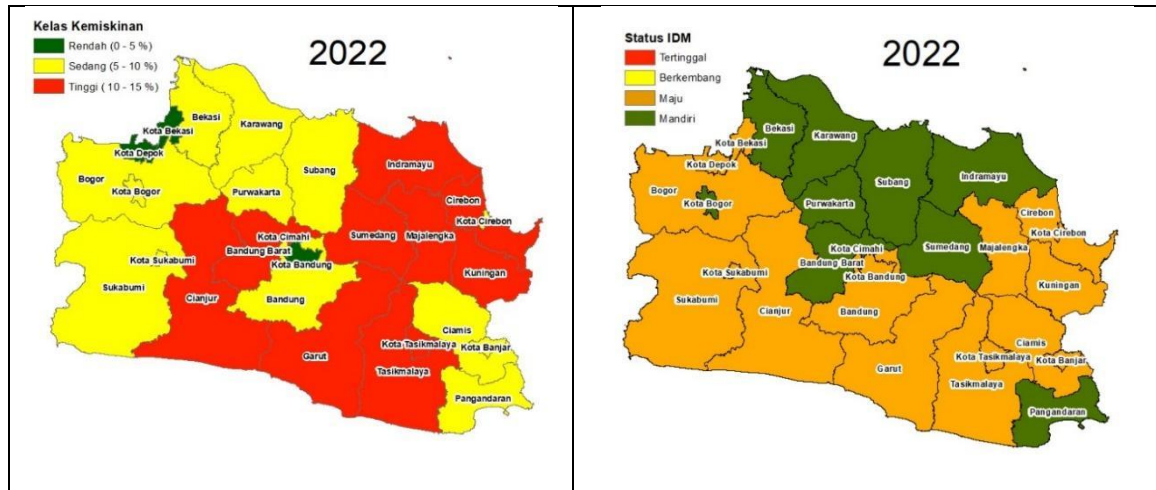


Figure 5. Spatial information on the percentage of poor and IDM people in 2022

Looking at the spatial information from (Figure 4) and (Figure 5), there are differences in the spatial assessment of poverty in an area. These differences arise as a result of the integration of spatial data with different non-spatial data, that is the poverty percentage/class data using BPS data where poverty data is obtained from survey results (Susenas data/sample results), focusing on aggregate poverty levels, usually at the national level. Aggregate poverty figures or what are often called macro poverty figures are used to measure the progress of a nation's development. Macro poverty data is estimated data on the number of poor people in each region. With the basic needs approach concept, poverty data is intended for planning and evaluating poverty programs with geographic targets. The aim of presenting macro poverty data is to obtain consistent and comparable calculation results from time to time (Ministry of Finance, 2023). The second data is the Village Development Index (IDM) data, which reveals micro poverty data using a multidimensional concept, or a non-monetary approach in calculating the data. The poverty rate is based on an index or Proxy Means Test (PMT) of household characteristics. The resulting data shows the number of target households, namely very poor, poor, almost/vulnerable to poverty by name and address. Micro poverty data is used for social assistance and protection programs such as Direct Cash Assistance (BLT), Family Hope Program (PKH), rice subsidies for the poor (Raskin), National Health Insurance (JKN), etc. In measuring poverty levels in Indonesia, there are two types of poverty data used, namely macro poverty and micro poverty. These two types of data have different calculation methodologies and uses so they cannot be compared.

According to Johan Arifin (2020), poverty alleviation in Indonesia is considered quite successful. This statement is based on data on the decline in the percentage of Indonesia's poor population, from a poverty rate of 10.12% in 2017 to 9.41% in 2019. The condition of poverty in West Java Province is described as follows:

8.95% (2017) , 8.71% (2018), 7.45% (2019), 6.91% (2020), 7.88% (2021) and 8.06% (2022). In 2022 the number of poor people will be 4.07 million people (8.06%), in March 2023 the poor population will be 7.62%, that the number of poor people will still be higher than the percentage of 7.45% in 2019 (BPS, 2023). Economic growth in West Java has not yet reached the lower middle class community as a whole, because the origin of growth is still dominated by the real estate sector, which means that economic growth is not yet pro-poor to lower society. The health, education and purchasing power/decent living standards sectors have a negative effect on poverty levels. Government assistance in the form of General Allocation Funds (DAU) and direct assistance to poor communities, has a significant influence on reducing poverty levels (Ardian and Destanto, 2020).

Infrastructure is a form of public capital (physical capital) formed from investments made by the government including roads, bridges, sewer systems and so on. These physical assets are very necessary to support economic activities in the fields of production and consumption. The availability of road infrastructure is important in supporting the development of a region, which is characterized by the smooth distribution of movement of people, goods and services so that the region's economy develops and advances. Road infrastructure is a means of traffic to serve the movement of people and goods from a place of origin to a destination, and roads are an important means of supporting regional economic development because of the smooth distribution of the movement of people and goods. The progress of a region raises demands for the availability of electrical energy, apart from electricity for households, it is necessary to provide electricity for industrial purposes on a household industrial scale as well as for medium and large scale industries.

The problem is, economic growth and regional development are still not free from the problem of disparities between regions. Poverty cases in a district or city require a statistical approach that pays attention to spatial aspects to see the dependencies between these regions. According to Taqiyuddin and Irfan (2022), using Spatial Autoregressive Quantile Regression analysis, the level of open unemployment, GRDP and population density have a significant effect on the level of poverty in West Java Province. The response variable used is the poverty percentage level with the predictor variables, namely: average years of schooling (years), life expectancy (%), open unemployment rate (%), GRDP (millions) and population density (persons/km<sup>2</sup>).

#### 4. Conclusion

Various poverty reduction programs have been implemented by the government, which have significantly succeeded in reducing the number of poor people and the national poverty level. This success cannot be separated from sectoral programs which are implemented in an integrative and coordinated manner between the West Java regional government and ministries/agencies. As a result of cases of non-natural disasters, according to BPS (2019) the percentage of poverty in West Java



Province reached 7.45%, which is below the national poverty level (9.66%), the occurrence of the Covid19 Pandemic increased the percentage of poor people again to 6, respectively. 91% (2020), 7.88% (2021) and 8.06% (2022). In March 2023 the poor population was 7.62%, that the percentage of poor people was still higher than the percentage of 7.45% in 2019. Spatially, it provides information that in 2019 West Java had 8 districts/cities with advanced IDM and 19 districts /city has a growing IDM. In 2022 the status of IDM of Prov. West Java is experiencing a very good progress, 18 districts/cities have advanced IDM and 9 districts/cities have independent IDM. It can be concluded that infrastructure development has a significant influence on regional economic growth in West Java, due to the smooth distribution of goods and movement of people. The analysis of the IDM spatial changes for each district/city and sub-district in West Java Province from 2018 to 2023 can be accessed via the link <https://jabar.netlify.app/>.

### Acknowledgements

We would like to express our thanks to LPPM Unpak who supported this research activity, we would also like to express our thanks to the Central Statistics Agency (BPS), Geospatial Information Agency (BIG), PDTT Ministry and OSM (Open Street Map); which provides data online so that this research activity can be carried out.

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