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Typology and spatial distributions of rural poverty: Evidence from Trenggalek Regency, Indonesia

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ABSTRACT

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Poverty is a condition associated with the inability to meet basic needs such as food, clothing, shelter, education, and health. Although Indonesia is currently experiencing a decline in poverty trend, data show that this extreme state of lack is consent in rural areas, such as Trenggalek Regency. Approximately 99.7% of this region is rural areas, with 10.98% poor populations. Therefore, this study aims to identify rural poverty's typology and distribution pattern in Trenggalek Regency using the spatial approach, which identifies the impact of distance and neighborhood of area towards villages' poverty. The results showed a positive spatial autocorrelation of 0.29232, which indicates the spatial relationship between the poverty in every village in Trenggalek Regency is clustered and divided into four categories. Approximately 25, 28, 5, and 9 villages were in the high-high, low-low, low-high, and low-low categories. Every cluster has similar characteristics, thereby, the villages are influenced by each other. The results further showed that villages with high poverty rates have low accessibility to various facilities and infrastructure. An important factor that makes it possible for a rural area to escape poverty even though the surrounding is experiencing it at a higher rate is activating the micro, small and medium enterprises.

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INTRODUCTION

Regional development can nationally be achieved by integrating harmonious, integrated, efficient, and effective developments in the lowest administrative area (rural area). According to Indonesia's Village Law No. 6 of 2014, rural development is a series of efforts used to improve the quality of life and provide excellent welfare to rural communities (Undang-Undang Republik Indonesia Nomor 6 Tahun 2014 Tentang Desa, 2014). Similarly, Muta'ali (2016) stated that rural development is all efforts made jointly by the government and the community to manage rural resources' potential to achieve sustainability, independence, justice, welfare, and equitable distribution. Development at the village level is needed to strengthen the foundation of the country's economy, reduce disparities between regions, and accelerate poverty alleviation.

Poverty is defined as a condition of inability to meet basic needs such as food, clothing, shelter, education, and health. It is caused by the scarcity of tools to fulfill these needs or difficulty accessing education and work. Poverty is a global problem and one of the objects of sustainable development goals (SDGs). During the Covid-19 pandemic, new policies emerged, limiting the movement of human activities. These policies significantly affected economic growth, with an increase in unemployment, a decrease in the productivity level of individuals and companies, and a rise in the poverty rate (Suryahadi et al., 2020). People who previously depended on urban economic activities slowly returned to the village to survive.

Although poverty is experiencing a declining trend in Indonesia, data show that poor people are still concentrated in rural areas (Hermanto, 2018). Based on BPS data in 2020, the percentages of poor people in rural and urban areas were 12.82% and 7.38%. Ballard, Menchik, and Tan (2016) stated that the pattern of income distribution inequality between urban and rural communities is different. The inequality that occurs in rural communities is lower than that in urban areas. According to Rahajuni et al. (2017), income distribution in urban areas is relatively more even than in rural areas. The poor are generally weak in doing business and have limited access to various economic activities, leaving them behind other communities with higher potential.

Spatial and sectoral approaches are used to alleviate poverty in rural areas (Irawadi et al., 2020). According to Nashwari et al. (2017), using a spatial system to formulate poverty reduction policies leads to well-targeted and balanced policies capable of minimizing the program's failure. This spatial approach can provide an overview of different conditions of poverty and the influencing factors, such as education and income levels, finance, public services, access to health, and location. Furthermore, poverty in a village tends to be interconnected with its surrounding area because something close has more influence than something far away. The complexity of deprivation can lead to a domino effect capable of disrupting government work (Pajriah & Suryana, 2018).

The issue of poverty in Indonesia is still important and has not been resolved in various provinces, including East Java Province which has a relatively high rate above the overall national average. The national urban poor population in 2020 was 7.63%, while in East Java Province the number of urban poor was 8.13%. This figure is still lower when compared to rural poverty in East Java which reached 14.96%, an increase from 2019 which was 14.29%. The development of poor people in East Java from 2017 to 2020 was above the poverty level in Indonesia, which has had a downward trend over the last four years. The decrease in the poor population indicates the declining number of people whose per capita expenditure are lower than the poverty line. One of the areas with a relatively high level of rural poverty and inequality in East Java Province is Trenggalek Regency.

This area is located in Development Area (WP) IV of East Java Province, with 99.7% of it is rural area. Development Area (WP) IV consists of Trenggalek, Tulungagung, Nganjuk, Kediri Regency, and Kediri regencies. Compared to other regencies/cities in WP IV in East Java Province, Trenggalek Regency occupies the first position as an area with high poverty rate. The Theil Index of Trenggalek Regency is 0.23, and the community income inequality is 0.38. These figures are still above the average regional inequality of East Java Province, which has 0.18 for Theil index value and 0.37 for the Gini index value. Meanwhile, the percentage of poverty is 10.97, which is slightly higher than the provincial average.

The high poverty rate in rural areas is an important issue that requires special attention because the varying characteristics can cause complex social and economic problems in the community. Therefore, it is interesting to analyse them spatially because the social and economic aspects of the community are related to spatial characteristics. This research further aims to determine the rural poverty's typology and distribution pattern in the Trenggalek Regency with limitations to time and the Covid-19 pandemic.

RESEARCH METHOD

The scope of this research is to analyze the spatial pattern of rural poverty in the Trenggalek Regency. The border area in Trenggalek Regency consists of 152 villages. This research was quantitative research with secondary data obtained. The data used were the percentage of the number of poor people in each village in Trenggalek Regency, obtained from comparing the number of poor people and the total population of each city. These data were sourced from the Trenggalek Regency Social Service, and a literature study was carried out from scientific articles and books. The research used to measure how spatially related the conditions of rural poverty is with the Moran Index Analysis, both locally and globally. The global index explains the spatial autocorrelation in a region, while the local moran index shows spatial autocorrelation in each village. This analysis uses

Global Moran Index

Spatial autocorrelation is an estimate between observed values related to the spatial location of the same variable. One method to determine the spatial relationship is to use the Moran Index. The Moran test determines the dependencies spatial or autocorrelation between observations or locations. In other words, the characteristics of a village will affect (or be influenced) by the features of the nearest town. This technique was created to describe and visualize the spatial distribution, identifying the concentration and the location of outliers. A positive autocorrelation indicates the similarity of values from areas that are close together and tend to be clustered. Negative autocorrelation means that adjacent locations have different values and tend to be different. For the formula of calculating spatial autocorrelation, the Moran Index was used (Anselin, 1995),

$$I = \frac{n \sum_{i=1}^{n} \sum_{j=1}^{n} Wij(X_i - \bar{X})(X_j - \bar{X})}{\sum_{i=1}^{n} (X_i - \bar{X})^2}$$
(1)

in which I is Moran's Poverty Index, n is the number of villages observed, xi is observation value in village i, xj is observation value in village j (neighboring to i), \overline{x} is the mean value of all observed variables, Wij is matrix elements between villages i and j.

At this stage, the hypotheses used were the occurrence of autocorrelation between locations: (i) H0: I=0, there is no spatial autocorrelation of poverty between rural the Moran Index areas; (ii) H1: I \neq 0, there is a spatial autocorrelation of poverty between rural areas in the Trenggalek Regency.

Meanwhile, the expected value of Moran's test is in equation 2.

$$E(I) = I_0 = \frac{-1}{N-1}$$
(2)

The autocorrelation between locations was calculated by:

$$Z_{count} = \frac{I - I_0}{\sqrt{Var(I)}} \sim N(0, 1)$$
(3)

where I is the coefficient of Moran's I, Io is the expected value of Moran's I, and var (I) is the variance of Moran's I. The value or pattern formed in this Moran Index consists of clustering, random patterns, and spreading patterns. Decision-making H0 is rejected if [Zhitung]>Zg/2. The value of I is in the range between

-1 and 1. If I>Io, the autocorrelation value is positive, representing the clustered data pattern. If I<Io, then the autocorrelation value is negative, which indicates the data pattern is spread out.

Local Moran Index

In identifying and classifying village areas that have a fundamental similarity to the poverty level or spatial pattern locally, the Local Indicator of Spatial Autocorrelation (LISA) analysis was carried out. The higher the local value, the more the adjacent locations have a similar value or form a clustered distribution. The LISA formula is

$$I_i = Z_i \sum_{i=1}^n W_i j Z_j \tag{4}$$

where I_i is LISA coefficient, $Z_i Z_j$ is standardized data, *Wij* is the weighting between village i and village j, j is the village located around i

The test hypotheses for the LISA parameters are as follows: (i) H0: I=0 means no autocorrelation between villages; (ii) H1: I \neq 0 meaning there is an autocorrelation between villages.

If not all observed villages had a spatial effect, the LISA test was required for each studied village. The dependency test also uses a spatial weighting matrix. The weighting code is binary coded, where Wij is 1 for adjacent I and I and Wij is 0 for the other.

The grouping of rural poverty was done by dividing it into four clusters based on the average value of the surrounding area and the observation value of each region. The characteristics of each group were (i) A high-high (HH) cluster is a grouping of villages with a high poverty rate surrounded by villages with a high poverty rate. Cluster I is called Hot-Spot because it consists of villages with high characteristics with positive spatial autocorrelation; (ii) High-low (HL) outliers are villages with high poverty surround villages with low poverty. It is a spatial outlier because it consists of regions with different characteristics. If the area tends to cluster in spatial outliers, it is said to have a negative spatial relationship; (iii) Low-low (LL) clusters are villages with low poverty rates and are surrounded by low poverty levels. Cluster III is the Cold-Spot because it has common characteristics with positive spatial autocorrelation; (iv) Low-high (LH) outliers are villages with low poverty surrounded by high poverty. Cluster IV is said to have a negative spatial relationship.

RESULT AND DISCUSSION

Rural Poverty in Trenggalek Regency

Poverty is still a global problem with yearly increases, with a rise in the community's growing needs. Numerous poverty alleviation programs have been issued by the government, such as Raskin (Rice for low-income families), Direct Cash Assistance (BLT), Family Hope and others. However, these programs are associated with inconsistencies and have not solved or reduced poverty rates, especially in rural areas such as in Trenggalek Regency, East Java Province.

Table 1. Categorization of Village Poverty Levels Based on Normal Distribution

Poverty level	Number of Villages	Proportion
		%
High	52	34
Medium	47	31
Low	53	35

High level if poverty rate more than average poverty rate plus 0.5 standard deviation. Low level if poverty rate less than average poverty rate minus 0.5 standard deviation. Medium level is poverty rate in between high and low level

Approximately 99.7% of this area is rural, with 14 sub-districts and 152 villages. Based on 2021 data from the Department of Social Affairs, Women's Empowerment and Child Protection of Trenggalek Regency, 42% of people living in this area were poor.

The highest and lowest rate of poor people were found in Sengon (85%) and Dompyong (5%) villages, as many as 2,011 and 36,640 people, respectively. The proportion of rural poverty levels in this regency is in accordance with the standard distribution theory categorized into three classes, namely high, medium, and low, as shown in Table 1.

Villages with high poverty rates are located in hilly and mountainous areas. The higher the average village elevation, the greater the constraints on accessibility and infrastructure development, increasing the incidence of rural poverty. The distribution of poor areas is influenced by topographic factors, such as slope and elevation (Luo et al., 2021). This complex topography further impacts agricultural production by influencing local climate, hydrology, biology and others. Additionally, the problematic terrain also has a significant impact on infrastructure and socio-economic development (Li et al., 2020). This condition occurs in Indonesia and several other countries such as Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan. According to Hunzai et al. (2011), poverty is higher in the mountain areas than in other geographic regions due to various causes. The spatial distribution of rural poverty levels in the Trenggalek Regency in 2021 is shown in Figure 1.



Figure 1. Distribution of rural poverty in Trenggalek Regency



Figure 2. General spatial patterns of poverty in Trenggalek District

Typology of Rural Poverty

Spatial autocorrelation is an analysis process used to determine the pattern of relationships or correlations between observed locations. It is also pattern used to describe the distribution characteristics of an area and the interrelationships between locations. Anselin and Rey (2010) stated that a relationship between areas closer to each other has greater influence than those far away. Most times, the observations at one location are dependent on words in neighbouring sites. The Moran index analysis, which ranges from -1<I<1, was used to show the significant relationship of the region and its surrounding areas. The poverty pattern resulting from using this tool is shown in Figure 2.

Data were collected from a percentage of poor people in 152 villages in Trenggalek Regency using the spatial poverty analysis, and the result show that there was a positive spatial autocorrelation. This means that the poverty pattern in each rural area in Trenggalek Regency is clustered, as indicated in Figure 3. Furthermore, the results show that the value of Moran's Index (I) was 0.29232 and more significant than the Expected Index (I0) value of -0.006623. This indicates that each village in Trenggalek Regency has a tremendous spatial influence capable of affecting the level of poverty, as shown in Table 2. Therefore, areas with low poverty levels can be affected by neighbouring regions with low poverty levels and vice versa.

Table 2. Moran Index analysis results

Indikator	Index			
Moran's Index	0.292032			
Expected Index	-0.006623			
Variance	0.001609			
z-score	7.444527			
p-value	0.000000			



Figure 3. Map of regional clusters indicating local spatial autocorrelation

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Low-high (LH)	High-high (HH)			
Bendungan District: Dompyong	Dongko District: Cakul, Pandean, Salamwates, Watuagung			
Dongko district: Pringapus	Munjungan District: Craken, Karangturi, Masaran,			
Kampak District: Ngadimulyo	Ngulungkulon, Ngulungwetan, Sobo			
Suruh District: Suruh	Panggul District: Manggis, Ngrambingan, Ngrencak, Sawahan,			
Tugu District: Pucanganak	Tangkil			
	Pule District: Jombok, Karanganyar, Sukokidul			
	Suruh District: Gamping, Nglebo, Puru, Wonokerto			
	Tugu District: Duren, Nglinggis, Prambon			
Low-low (LL)	High-low (HL)			
Durenan District: Durenan, Karanganom, Pakis	Bendungan District: Botoputih			
Kampak District: Sugihan	Durenan District: Sumbergayam			
Karangan District: Buluagung, Salamrejo, Sumber	Gandungsari District: Jajar, Wonoanti			
Pogalan District: Ngadirenggo, Ngetal, Ngulankulon,	Kampak District: Karangrejo			
Ngulanwetan, Pogalan, Wonocoyo	Karangan District: Jatiprahu, Kerjo, Sukowetan			
Trenggalek District: Karangsoko, Rejowinangun, Sambirejo,	Munjungan District: Bendoroto			
Sukosari, Sumbergedong				
Watulimo District: Dukuh, Gemaharjo, Margomulyo,				
Ngembel, Pakel, Prigi, Sawahan, Slawe, Tasikmadu,				
Watulimo				

Spatial Patterns of Rural Poverty

The next step was to cluster villages included in the poverty criteria based on Moran's Scatterplot quadrant. Of the 152 villages in Trenggalek Regency, only 67 had local spatial autocorrelation, while the remaining 85 were insignificant. Therefore, the spatial grouping analysis based on the poverty level in Trenggalek Regency consisted of 4 groups. The first group was villages with high poverty and surrounded by villages with high poverty rates (high-high). The second group was villages with low poverty surrounded by low poverty (low-low). The third group was villages with low poverty surrounded by high poverty (Low-High) and the fourth was villages with High poverty surrounded by low poverty (high-low). The analysis results of the poverty pattern in the Trenggalek Regency are shown in Figure 3 and Table 3. The figure shows that 25, 28, 5, and 9 villages in this regency were included in the High-high, low-low, low-high, and low-low categories, respectively. Each cluster formed had relatively the same characteristics to influence each other.

The existence of this poverty cluster shows that each village has a strong spatial influence in influencing its insufficiency level. Villages with high poverty will affect their neighbours, and vice versa. One of the causes of the high level of village poverty is a decrease in accessibility, inadequate educational and health facilities, and poor access to information technology, the central government, and the market. This is in line with Liu et al. (2020) research that rural poverty is significantly correlated with county-level, water resource, and town-level accessibilities. The accessibility conditions of minimum service facilities in rural areas in Trenggalek Regency based on poverty clusters are as follows.

Access to education

The high correlation between poverty levels and educational facilities has the ability to improve human resources (Fajriwati, 2016). This is because the higher the level of education, the lower the poverty level (Parwa & Yasa, 2019; Susanto & Pangesti, 2019). Facilities' availability and distance determine access to educational facilities. Figure 4 shows that villages in the HH (high-high) category had the most extended average length of 6.5 km because most are located in the mountains and are quite far from the urban centre. Meanwhile, those in the LH (low-high), HL, and LL categories had average distances of 5.7 km, 5.7 km, and 4 km to Senior High School location.



Figure 4. Distance of villages to Senior High School in Trenggalek Regency

Access to health

The overall functional, physiological, psychological, and sociocultural dimensions of people is determined by their health. Health is an investment to support economic development, and it is essential in poverty reduction efforts. Liu et al. (2020) stated that the village government's ability to spend in the health sector significantly reduces poverty. Villages in the HH category had the furthest distance to the hospital and public health centres by approximately 34 km and 5.5 km (Figure 5). Villages in the LH category had access to the hospital, which is 20.6 km, and the public health centre is 4.8 km. Meanwhile, those in the HL category had an average of 15 km and 4.8 km to access the hospital and public health centre. Finally, the villages in the LL category had the closest access compared to others, which was 10 km and 3 km to the hospital and public health center.



Figure 5. Distance of villages to the medical facility in Trenggalek Regency.

Access to communication

Poverty is not only an economic disability but also an inability to use technology to access information. Therefore, the easier it is for a community to access communication, the greater its ability to reduce the poverty rate (Widiyastuti, 2015). Villages in the LL category had higher communication facilities, namely 2 Base Transceiver Station (BTS) and 4 telephone operator facilities, than other types (Figure 6). Then, for the LH category, there were 2 BTS facilities and 3 telephone operator facilities. The HL category also had 1 BTS and 3 telephone operator facilities. The HH category had the lowest availability of communication facilities, i.e. 1 BTS with only one telephone operator.

Access to the center of government

Villages in the HH category had the farthest distance from the government center. The average

length from the villages to the sub-district and regent's offices is 8 km, respectively. In the LH category, the distances from the village to the sub-district and regent offices are 4.4 km and 22 km (Figure 7). Meanwhile, in the HL category, the distances from the village to the sub-district city and the regent's offices are 4.4 km and 18 km. In the LL category, the distances from the village to the sub-district and regent offices are 4.8 km and 16 km, respectively. The farther from the government center, the more complex and slower it will be in managing population administration activities.



Figure 6. Rural communication access in Trenggalek Regency



Figure 7. Distance of villages to the central government in Trenggalek Regency

Economic activities

Economic activities are the production, distribution, and consumption of activities carried out by economic actors to meet the needs of life. The activities include agriculture, services, industry, and trade. In this study, rural economic activities are seen from the number of stalls in each village, which describes the fulfillment of daily needs.

Figure 8 shows that villages in the LH category had the highest number of stalls per village (87). This is followed by villages in the LL category, with an average number of 55 stalls per village (Figure 8). The average length of villages in the HH and HL categories from the villages to the sub-district and regent's offices is 8 km, with 45 and 42 stalls per village, respectively. The graph explains that rural poverty can decrease, supposing the village has many trading points. These stalls and grocery stores show that economic activity is developing well because much money is circulating. According to Hidayah et al. (2020), increasing the rural economy by improving and synergizing micro, small and medium enterprises is necessary. The increasing number of MSMEs in an area indicates the development of economic potential in the region.



Figure 8. Average number of stalls per village in Trenggalek Regency

Research Implication

Spatial autocorrelation is a method used to understand the relationship of neighboring areas that influence each other. The use of this method can be adopted to describe the neighboring relationship between regions and their poverty levels. The research described poverty in the Trenggalek Regency divided into four clusters of poverty with varying forming factors. These results are expected to be taken into consideration by the government in making decisions and determining the right steps to reduce knowledge. The pattern of poverty distribution in space is helpful in planning and informing policy formulation for its eradication (Majid et al., 2016). Policy formulation needs to be prioritized for villages with high-high and high-low characteristics because they have the highest rates. Poverty alleviation policies should focus on poor village clusters with social infrastructure development (Ari et al., 2021).

The existence of grouping and concentration of spatial patterns in the Trenggalek Regency is expected to be the basis for formulating poverty reduction policies. The areas with high poverty should prioritize the reduction policy. High poverty must be seen based on the condition of its neighbors, which enables the target locus to be closer in each village (Harmes et al., 2017). Uniform policy-making without identifying spatial poverty patterns leads to unsuitable policies, which can negatively impact causes poverty and increased inequality. On the other hand, spatial mapping of poverty is both an opportunity and a challenge to encourage policies, plans and programs to reduce poverty that is right on target.

Areas with high-high clusters need to be prioritized to receive special attention. This cluster requires various programs to support minimum service facilities in education, health, and the economy. Meanwhile, villages included in the high-low and low-high areas need a policy. This is in accordance with Indonesia's Village Law No. 6 of 2014, article 91, which explains that villages can cooperate with third parties. Cooperation between villages in one sub-district can increase public services and development effectiveness and efficiency. Cooperation can be carried out by developing the economic potential and resources of the Region, strengthening the capacity of economic institutions and Village Owned Enterprises (BUMDes), and improvement of basic infrastructure and village economy. Hakim (2016) stated that the rural area development policy includes five aspects. The first is participatory spatial planning which tends to accommodate all thoughts, ideas, and interests from various parties regarding the desired space design. The second is inter-village growth centers, which are associated with developing the community's economy. The third is strengthening community capacity to promote regional development. The fourth is institutional aspects and economic partnerships, which are important in development areas because with good institutional management the villages will be independent, without relying on the government and the private sector. The fifth is the aspects of infrastructure development, which need to open access between villages and accelerate the regional economy.

The results of this study are undoubtedly positive and can be used as primary data for a strategic regional project for the next five years. They are also helpful for the government to channel various poverty

alleviation programs to the right target and become a policy evaluation tool that has been carried out by analyzing the program's success implemented in the pockets of poverty. Furthermore, this research also has implications in revealing the economic status of the village. Previously it was difficult for the government to determine the community's economic position in various village areas. In that case, this study describes each village's economic status based on the classification to improve their economic position of rich, middle, or poor villages. Apart from being an information material because the data is clustered, this research can also contribute to those willing to deepen studies their on poverty. Therefore, the recommendation is to increase the quantity and quality of minimum service facilities, such as health centers and secondary schools in poor areas. It also aims to encourage the economic improvement of rural communities through empowerment activities to ensure the people are productive. Village funds in community empowerment need to be increased to encourage development, especially in remote areas, by exploring local resources (Aji, 2020). According to Luo et al. (2021), rural public expenditure has a significant spatial spillover effect on poverty reduction, greater than the direct effect. This is in accordance with the research by Liu et al. (2020), stating that rural public expenditures in the education, health care, social security, and infrastructure sector can reduce poverty significantly. Those are some of the statements that confirm and support the implications of this research. This is expected to help policy makers determine priorities in poverty alleviation.

CONCLUSION AND SUGGESTION

Based on the analysis results, it can be concluded that the distribution of rural poverty in the Trenggalek Regency is categorized into three levels, i.e. high (34%), medium (31%), and low (35%) with 52, 47, and 53 villages, respectively. Meanwhile, the poverty typology is clustered into four regional categories, namely high-high, low-low, low-high, and high-low with 25, 28, 5, and 9 villages. Each cluster formed has relatively the same characteristics to influence. Villages belonging to the high-high and low-high groups tend to be far from the government center and have low accessibility, compared to those in the highlow. However, low-high villages have better infrastucture condition because the region has many developing economic activities; therefore, poverty is relatively lower. The government is expected to consider these results while making decisions. Subsequently, this study suggests the need to increase access to education, health, communication, government services, and economic infrastructure.

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