ECONOMIC SPATIAL PATTERNS AND HUMAN DEVELOPMENT INDEX DISTRICTS AND CITIES IN FIVE SOUTHERN SUMATRA PROVINCES

POLA EKONOMI SPASIAL DAN INDEKS PEMBANGUNAN MANUSIA KABUPATEN DAN KOTA DI LIMA PROVINSI SUMATERA BAGIAN SELATAN

Ahmad Dhea Pratama[a*], Ukhti Ciptawaty[a]

[a]Faculty of Economics and Business, University of Lampung; Bandar Lampung

*Correspondence: Ahmaddheapratama@gmail.com

ABSTRAK

Keterkaitan spasial antar wilayah merupakan bagian penting dari perekonomian wilayah sebagai analisis hubungan dan interaksi antar wilayah. Kajian ekonomi wilayah cenderung hanya berfokus pada kemandirian suatu wilayah sehingga tidak mempertimbangkan efek spasial yang terjadi antara satu wilayah dengan wilayah lainnya. Penelitian ini berfokus untuk melihat autokorelasi spasial yang akan menghasilkan pola spasial dan keterkaitan spasial antar wilayah produk domestik regional bruto dan indeks pembangunan manusia, dengan temuan melihat interaksi spasial dan pola persamaan atau perbedaan pembentukan kedua variabel antar wilayah. Daerah penelitian fokus pada 60 kabupaten dan kota di 5 Provinsi Sumatra bagian selatan dengan tahun penelitian 2015-2019, metode analisis menggunakan Sistem Informasi Geografis dengan software Geoda, hasil perhitungan akan menghasilkan peta Morans's I, LISA Significance dan Clustered. Hasil penelitian menunjukkan bahwa telah terjadi hubungan spasial seperti autokorelasi PDRB dan IPM, pembentukan ekonomi dan modal manusia memiliki hubungan spasial, hasil Moran'I menunjukkan bahwa nilai positif kedua variabel memiliki pola kelompok dan memiliki tingkat pembentukan PDRB dan IPM dengan karakteristik yang sama, scatterplot moran menunjukkan kesamaan dengan daerah yang dihasilkan dibagi menjadi 4 kuadran. Peta klaster LISA memiliki kesamaan dalam temuan hasil PDRB dan IPM, namun kedua variabel tersebut tidak memiliki temuan pola rendah-tinggi.

Kata kunci: PDRB, IPM, Analisis Spasial

ABSTRACT

The Spatial linkages between regions are an important part of a regional economy as an analysis of relations and interactions between regions. Regional economic studies tend to focus only on the independence of a region so it does not consider the spatial effects that occur between one region and another. This study focuses on looking at spatial autocorrelation which will produce spatial patterns and spatial linkages between regions of the gross regional domestic product and the human development index, with the findings of seeing spatial interactions and patterns of similarities or differences in the formation of the two variables between regions. The research area focuses on 60 districts and cities in 5 Provinces of southern Sumatra with the 2015-2019 research year, the analysis method uses Geographic Information Systems with Geoda software, and the results of the calculations will produce Morans's I I, LISA Significance, and Clustered maps. The outcomes show that there has been a spatial relationship as certain autocorrelation of GRDP and HDI, the formation of the economy and human capital has a spatial relationship, results of Moran'I show that the positive value of the two variables has a group pattern and has a level of formation of GRDP and HDI with the same characteristics, moran scatterplot shows the similarity with the resulting region divided into 4 quadrants. The LISA cluster map and the LISA marking are the similarities in the findings of the GRDP and HDI results, but both variables have no findings of Low-high patterns.

Keywords: GRDP, HDI, Spatial Analysis

1. INTRODUCTION

The relationship between regions and the development of regional planning is an effort to apply the concepts of economic development in the spatial dimension so that regional development planning is an uninterrupted accumulation of the concept of economic development. A new concept in regional economics states that knowledge of economic phenomena will become more important and real if the spatial factor is introduced as an additional variable in the framework of economic theory. Many economists in the regional economy associate spatial issues with a policy strategy for sustainable economic development, space and time are an important part of the economy. (Perroux, 1950) Space as a force gives rise to spatial interaction, which defines space as a type of network that is organized in an integrated manner along with the centripetal force and will form the basis of the growth center theory.

Kuncoro (2004), Explaining the relationship between a region and the surrounding environment, this relationship can occur because it is influenced by several important aspects, such as the limitations of an area being an obstacle to meeting the needs of the region itself, the similarity of economic interests in several regions will allow cooperation in the economic field and the growing awareness to form synergies between regions to build regional economic strength.

Hirschman (1984), Discusses how development polarized so that it can benefit both growing regions in the interior and surroundings. Hirschman argues that growth in the emerging regions will generate profits called the trickle down effect. Ultimately, Hirschman has confidence that the trickle down effect will be greater than the polarization effect to increasing pressure to impose economic policies on each other. Regional economic literature study shows that the economy and regional development with regard the spatial dimensions of development activities economic activities distributed in a space that is not homogeneous, because locations have potential and value relative to other locations so activities aimed at economic and social will scattered according to the potential and relative value of the supporting locations. Introduced by (Anselin, 1998) spatial analysis is a technique in statistics that considers territorial elements that contain regional spatial dependence and regional spatial heterogeneity.

Resende et al., (2016), Brazil's territorial financial development at different geographic scales utilizing a cross sectional informational index during the 1990s supplements this investigation by utilizing standard board information models at different spatial scales, in any case, the course of monetary development in Brazil is just concentrated on utilizing non-spatial board information models. The examination connected with local monetary development by assessing models fit for giving further knowledge into the impacts of various spatial overflows because of changes in spatial scale. This gauge demonstrates a critical spatial connection in the information and affirms the past outcome found in the writing that full-scale local development processes present a spatial relationship of lower power when contrasted with the outcomes at the cities level. (Zhou et al., 2020) Regional studies in China in 31 provinces show significant spatial heterogeneity and spatial autocorrelation in economic growth, regional credit, and technological innovation. Both regional credit and technological innovation have an important effect on economic growth, while the interaction between regional credit and technological innovation has a negative effect on provincial economic growth. China should rationally allocate regional credit resources, strengthen technological innovation capabilities, and promote integrated regional credit development. Technological innovation is a very important means of facilitating regional economic integration and sustainable development. The concept of human capital according to (Edward L. Glaeser Bruce I, 2013) explains that the existence of a positive outflow or strategic complementarity creates a social multiplier where the aggregate coefficient of human capital will be greater than the individual coefficient at the aggregate level coefficient. Human resources can be increased by externalities from interconnected areas so that the spatial authorization of human resources has a positive effect on inter-regional development.

Indonesia has the island of Sumatra, which is an area that is considered to have considerable potential to develop and advance beyond the progress that has been achieved by the island of Java, because it is a development area for growth centers that will absorb investment and resources for economic growth.

This study looks at the distribution of the economy through GRDP in 60 districts and cities in 5 southern Sumatra Provinces, the following is the distribution of average GRDP at constant prices in 60 districts and cities.
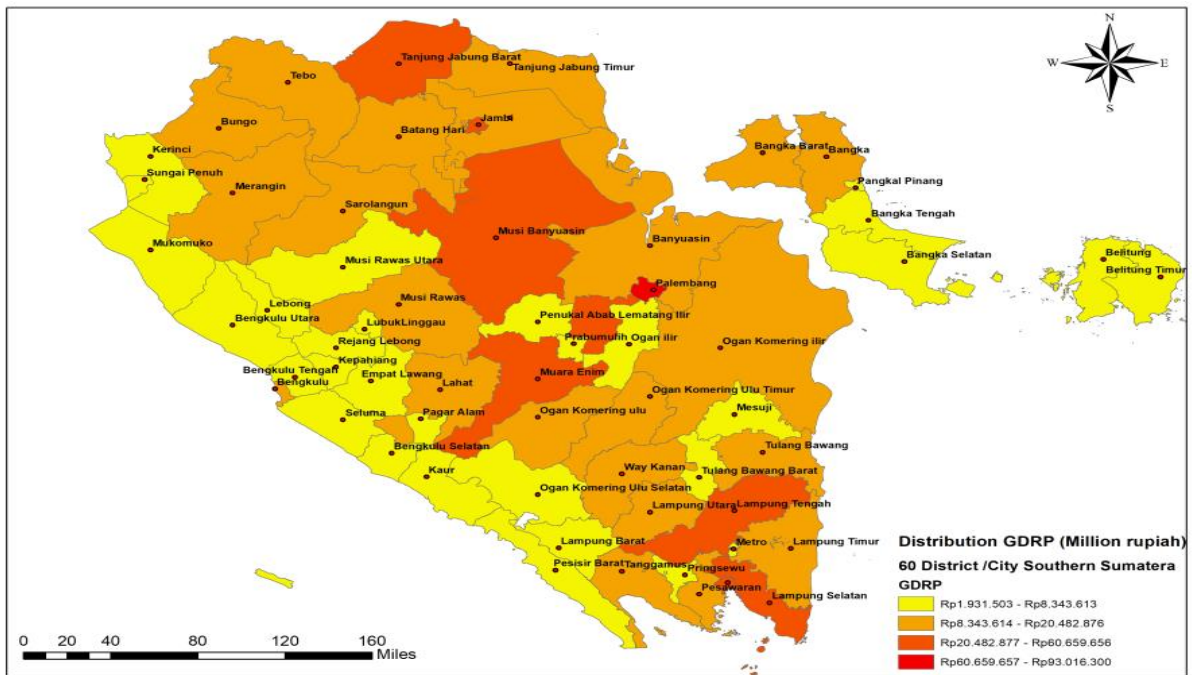

Figure 1. Distribution Pattern of Average GRDP of 60 Districts and Cities
in 5 Provinces of Southern Sumatra in 2015-2019

Figure 1 explains how the pattern of GRDP distribution in 60 districts and cities in southern Sumatra where there is a grouping of the average GRDP in each region, an area that has the highest GRDP value is found in 3 regions with an average value of Rp. 60,659,657-Rp. 93,016,300, with an average value of Rp. 20,482,877-Rp. 60,659,657 covering 7, distribution areas valued at Rp. 8,343,614-Rp. 20,482,877 covering 22 regions and with the lowest value of Rp. 1,931,503-Rp. 8,343,614 covering 28 regions. The high and low GRDP is the result of the economic performance of each region. The regional economic context measure often used is the Gross Regional Domestic Product (GRDP), which is the total gross value added generated by all economic factors in the region. Meanwhile, per capita income is the total income of the region or region divided by the total population for the same year (Tarigan, 2005).

Improvement of an area is certainly focused on human development. Solow's model of economic development reveals that wages are the component that determines the actual capital of the country, the development of human and population resources, and the level of wages that underlie an economy. Human resources play an important role in the improvement of the economy in addition to the actual capital that affects financial turnover. The following is the distribution of the human development index as a calculation of the progress of human capital in 60 districts and cities in southern Sumatra, (Todaro, 2003).

Figure 2 explains the pattern of distribution of the Human Development Index in 60 districts and cities in southern Sumatra where there is a grouping of the average HDI in each region. the areas that have the highest HDI value is found in 8 regions with a value an average of 65%-70%, with an average value of 62% - 65% covering 19 distribution areas, a value of 60%-62% covering 22 regions and with the lowest score with a value of 58% -60% covering 11 regions.
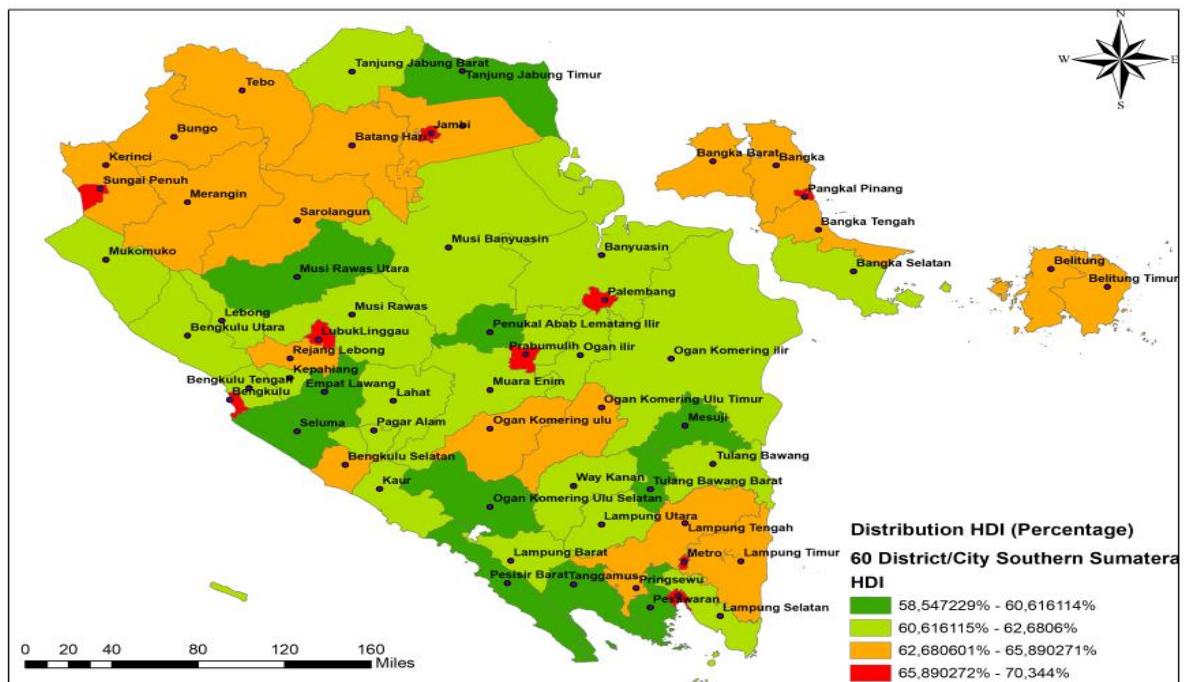
Figure 2. Distribution Pattern of Average HDI of 60 Districts and Cities
in 5 Provinces of Southern Sumatra in 2015-2019

The relationship between regions and spatial patterns with the concept of economic development is a very interesting topic to discuss. In terms of regional economics, regions have their respective intrinsic space and time to carry out the regional development process. Regional economies can play a role in analyzing the trends in the direction of movement of economic development activities in the future. Spatial autocorrelation analysis will provide results of spatial distribution patterns and characteristics of the economy and human capital in a region. Based on this background, the research question arises "What is the distribution pattern and spatial relationship between gross regional domestic product and the human development index in 60 districts and cities in southern Sumatra?" The purpose of this study is to analyze the distribution patterns and spatial linkages of gross regional domestic product and human development index in 60 districts and cities in southern Sumatra.

2. DATA AND METHODS

2.1 The Scope of The Research Area

The scope of the location in the study covers 5 provinces with 60 districts and cities in southern Sumatra with their geographic location: South Sumatra Province is located at coordinates 1–4° south latitude and 102–106° east longitude, with 12 districts and 5 cities, Jambi Province is located at coordinates 2.45 ° south latitude and 101.10 ° -104.55 ° east longitude, with 9 districts and 2 cities, Bengkulu Province is located at coordinates 5° 40' – 2° 0 'south latitude and 40' – 104 ° 0 ' east longitude, with 9 districts and 1 cities, Lampung Province is located at coordinates 3 ° 45'-6 ° 45' south latitude and 105 ° 45'-103 ° 48 'east longitude, with 13 districts and 2 cities, Bangka Belitung Province is located at coordinates 1°50' – 3°10 'south latitude and 105°-108° east longitude, with 6 districts and 1 cities. The following are the areas of 60 districts in southern Sumatra presented on the map.

Figure 3. Research Location Map Area 60 Districts and the Cities in Southern Sumatra

2.2 Types and Sources of Research Data

This type of research is classified as a quantitative descriptive study because this research is presented with the numbers obtained from the population and the sample is analyzed using spatial statistical methods by mapping using a geographic information system which is then interpreted. In the preparation of this study, the type of data used by researchers is secondary data with time-series data from the 2015-2019 period and 60 regions of cross-section data. The data collection process was obtained from each of the web publications of the Statistical Center Agencies (BPS) in 5 provinces of southern Sumatra.

2.3 The Explanation of variables in research

Functional Definitions and Depictions of Exploration Factors are shown in Table 1.

Table 1. The Functional Definition and Depiction of Exploration Factors

No	Variable	Symbol	Unit	Explanation
1.	Gross Regional Domestic Product	GRDP	Million Rupiah	The GRDP used is the value of GRDP in millions of Rupiah as a result of the equation for the 2010 base year in 60 districts and cities in 5 provinces in southern Sumatra.
2.	Human Development Index	HDI	Percent	Human Development Index (HDI) is the value of the achievement of basic human development capabilities built through a three-dimensional approach, namely long and healthy life, knowledge, and decent life, in 60 districts and cities in 5 provinces of southern Sumatra.

2.4 Spatial Autocoleration Analysis Method

This study uses spatial relationship analysis between regions, and analyzes neighborly relationships with the spatial autocorrelation method. Calculation of spatial patterns and mapping using geoda software which presents the distribution of the Moran scatter plot, LISA map grouping, and LISA map significance. The following presents the process of the spatial autocorrelation method.
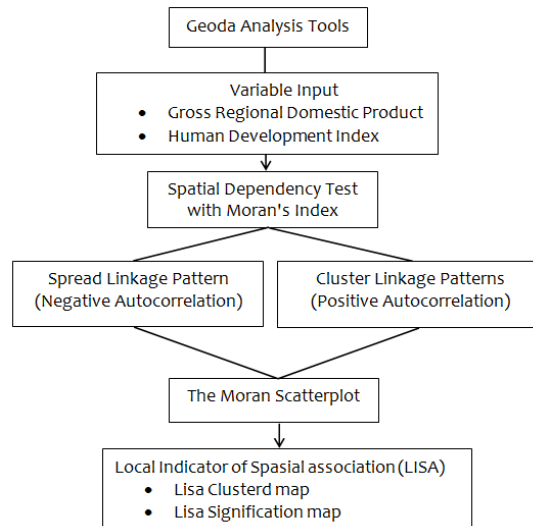

Figure 4. Process of Spatial Autocorrelation Method in Research

2.5 Analysis to Measure Spatial Interrelationships
1. Spatial Autocoleration with Morans's I Index

The spatial relationship in this study utilizes the worldwide moran file and nearby anselin moran as the local insights of the dispersion results. The worldwide Moran List spatial autocorrelation is estimated by the accompanying equation:

$$I = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}\,(x_i - \bar{x})(x_j - \bar{x})}{S_0 \sum_{i=1}^{n}(x_i - \bar{x})}$$

Where x is the average observation and W_{ij} the linkage between regions i and j. In testing the Moran's I Index output, the hypothesis can be used as follows, H_0 was rejected at the time of $-Z(I) < -1.645$. If the value of $Z(I) >$ of $Z\alpha/2$ or $-Z(I) < -Z\alpha/2$ then it can be concluded that there is a significant regional linkage at the level of α significance. The range of values of the Moran's Index in the case of a standardized spatial weighting matrix is $-1 \le I \le 1$. Value $-1 \le I < 0$ indicates the presence of negative spatial autocorrelation, while the value $0 < I \le 1$ indicates the presence of positive spatial autocorrelation, the zero-value Moran's Index value indicates ungrouped. Spatial autocorrelation is the correlation between variables and themselves based on space or can be said the similarity of objects in a space, whether distance, time or region. The amount of spatial autocorrelation can be used to identify spatial relationships (Anselin, 1998). For spatial autocorrelation measurement can be calculated using Moran's Index with the following formula:

$$I = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}\,(xi - \bar{x})(x_j - \bar{x})}{\sum_{i=1}^{n}(xi - \bar{x})^2}$$

Where:
I   = Morans's I Index
n   = Total number of locations in the observed area of 60 districts/cities
Xi   = Value at location in each area of observation in 60 districts/cities
Xj   = Overall value of observations in 60 districts/cities
x   = Average value in 60 districts/cities (xi) from n locations
wij   = Spatial weighting element that has been standardized between i and j.

The value Moran's I is equal to the correlation coefficient of -1 to 1. A high value means that the correlation is high, while the value 0 means the absence of autocorrelation. However, to say there is or is no autocorrelation is necessary compared to statistical value I with the value of expectations. The expected value of I is:

$$E\ (\text{I}) = \frac{-I}{(n-1)}$$

The Moran's Index is widely used to measure global spatial autocorrelation and for local spatial autocorrelation testing can be used the LISA Index which identifies how the relationship between an observation location to another observation location (Jay et al., 2001). Test statistics used are derived from the standard normal spread, namely:

$$Z\ (\text{I}) = \frac{I-E(I)}{\sqrt{Var\ (I)}} \sim N(0,1)$$

where:
I   = Morans's I Index
Z(I)   = The factual worth of the Moran Record autocorrelation test results
E(I)   = The normal factual worth of the Moran File

On the off chance that Z(I) > Z1-α H0 is dismissed (there is a positive spatial autocorrelation) The mathematical scale scope of the Morans's I Index used to consider the presence of spatial autocorrelation to be found in the table (Jay et al., 2001).

Table 2. Morans's I Index Scale

No	Description	Morans's I I
1	Cluster/group patterns with adjacent dots show the same characteristics (positive spatial autocorrelation)	I > E(I)
2	Random pattern or no specific pattern indicated by dots based on characteristics	I = E(I)
3	Negative spatial autocorrelation, with adjacent dots showing different characteristics	I < E(I)

Source: Jay et al., 2001

The autocorrelation test in this study used Spatial Autocorrelation (Moran Index) analysis tool from Geoda software. The tool calculates spatial autocorrelation based on the attribute values and location of each sub-district. From these attribute values and locations, the tool will present the output of the Moran Index value and the pattern formed whether it is clustered, random, or dispersed.

2. Anselin Local Moran Analysis

Local Indicator of Spatial Association (LISA) is a statistic used to find out the specific relation of the region. (Anselin, 1995), suggested LISA should meet two requirements: LISA for each observation indicates a significant spatial grouping around observations, the sum of LISA in each local size for all observations proportional to global size. The purpose of LISA is to identify local groupings that are outlierspatial. The formulation of the Local Moran Index is as follows:

$$I_i = \frac{(X_i - \bar{X})\sum_{j=1}^{N} w_{ij}\left(X_j - \bar{X}\right)}{\sum_{i=1}^{N}(X_i - \bar{X})^2/n}$$

Where:
Ii   = Moran Index Area in 60 districts/cities
Wij   = Spatial weighing element which refers to the location of the 60 districts/cities to neighboring
              areas between observations
X   = average of observations in 60 districts/cities
Xi   = Variable value between regional observations 60 districts/cities
Xj   = Value of all regional observation variables 60 districts/cities

If the value (Ii) is positive and significant, then the grouping of regions that occur around the region I is a grouping of regions that have the same characteristics as region (Ii). Conversely, if the value i is negative and significant, then the grouping of regions that occur around region (Ii) is a grouping of regions that have different characteristics from region (Ii), (Anselin, 1995).

3. The Moran Scatterplot

Moran scatterplot is a tool used to look at the relationship between standardized observation values and the average values of standardized neighbors. Mapping using Moran scatterplot will present four quadrants that describe the four types of relationships of a region with other surrounding areas as neighbors (Anselin, 1995).

Quadrant I *High-High*	Quadrant IV *High-Low*
Quadrant II *Low-High*	Quadrant III *Low-Low*

Zhukov (2010) makes sense of the division of the quadrants in the Moran Scatterplot as a degree of noticed region values as follows:
1. In quadrant I, HH (High-High) shows that areas that have high observational value are surrounded by areas that have high observational values.
2. In quadrant II, LH (Low-High) shows that areas with low observational values are surrounded by areas that have high observational values.
3. In quadrant III, LL (Low-Low) shows that areas that have low observation values are surrounded by areas that have low observation values.
4. In quadrant IV, HL (High-Low) shows that areas with high observational values are surrounded by areas that have low observational values.

Qualities of I and Io values and the division of quadrants in a noticed region should be visible and broke down through Morans's I Disperse Plot Record. The Dissipate Plot Morans's I File portrays an outline to see the connection between the worth of an area (normalized) and the typical worth of the areas related with that area (Jay et al., 2001). On Morans's I Index test the hypothesis was carried out as follows:

> H0: I = 0 (no autocorrelation between areas)
> Ha: I ≠ 0 (there is autocorrelation between areas)

4. Local Indicator of Spasial Association (LISA)

The aftereffects of the Nearby Mark of Spatial Affiliation (LISA) are spatial insights that will be utilized as an instrument to decide the particular connection between the noticed regions with one another (Anselin, 1995), The LISA should meet two prerequisites: the LISA for every perception displays a critical spatial grouping around the perceptions, the quantity of LISAs in every neighborhood measure for all perceptions that is similar to the worldwide size. The point of LISA is to distinguish neighborhood groupings that are outlierspatial. The detailing of Nearby Moran List is as per the following:

$$I_i = \frac{(Y_i - \bar{Y})\sum_{j=1}^{N} w_{ij}\left(Y_j - \bar{Y}\right)}{\sum_{i=1}^{N}(Y_j - \bar{Y})^2/N}$$

The LISA speculation states, In the event that the worth of I is positive and critical, the gathering of regions that happen around districts I is a gathering of locales that have similar attributes as area I, there is a closeness in the qualities of the variable example. Then again, in the event that the worth of I is negative and huge, the gathering of regions that happen around districts I is a gathering of areas that have various qualities from locale I, the consequences of collection between factors are unique.

3. RESULT AND DISCUSSION

3.1 Spatial Results of Gross Regional Domestic Product

The attention to spatial effects in econometrics is no longer obscure, but part and parcel of theory and empirical practice. To some extent, this is undoubtedly due to the ready availability of increasing volumes of geo-referenced data and user-friendly technology to manipulate these in geographic information systems. However, equally important is the growing attention to a spatial perspective stimulated by an important shift in theoretical focus. This provides new theoretical perspectives to analyze phenomena, such as peer effects, neighborhood effects, spatial spillovers, and network effects (Anselin, 2010). Economic linkages basically describe the economic relationship between an area and its surrounding environment (Kuncoro, 2002). This linkage can occur because it is influenced by several aspects, including:

a. The limitations of an area make it a barrier to meeting the needs of the region itself. These limitations can be in the form of natural, human, technological, and financial limitations.

b. The common economic interests of several regions will allow for cooperation in the economic sector. This cooperation is expected to have a positive impact on the output of economic development in these areas.

c. Growing awareness to form synergies between regions in order to build regional economic strength. This will increase regional economic activity and is expected to be able to stimulate economic development in the region and its surroundings.

1. The Result of Spatial Autocoleration with Moran Index

The following is the calculation result of the Spatial Autocorrelation of Gross Regional Domestic Product in 60 districts and cities in 5 southern Sumatra, in this section shows the results of Moran'I for the entire study period from 2015-2019 can be seen in the table.

Table 3. The Result of Morans's I GRDP in 60 Districts and Cities in Southern Sumatra Province from 2015 to 2019

Year	Morans's I	E(I)	Z-Value
2015	0,13140	-0,0169	1,9815
2016	0,12100	-0,0169	1,6708
2017	0,10771	-0,0169	1,5104
2018	0,0943	-0,0169	1,3581
2019	0,0830	-0,0169	1,2336

Source: Processed, Open Geoda, 2021

The value of Morans's I in the entire period from 2015-2019 research has a positive autocorrelation value and has a spatial relationship in the form of grouping in GRDP.

Table 4. The Result of Morans's I GRDP in 60 Districts and Cities in the Province Of Southern Sumatra in 2015-2019

Morans's I	E(I)	Z-Value	P-Value
0,807134	-0,0169	8,8763	0,001000

Source: Processed, Open Geoda, 2021

The spatial relationship of GRDP between 60 districts and cities in 5 provinces in southern Sumatera in 2015-2019 is known that Moran's I value is 0.807134. This indicates that there is a spatial relationship in the form of positive autocorrelation, which means that the GRDP between districts and cities in 60 districts and cities in 5 provinces in southern Sumatera has a clustered pattern of regions with the same characteristics. To see whether there is a statistically significant spatial relationship, a Z test is performed. If the Z value is greater than $Z\alpha/2$ or less than $-Z\alpha/2$, it can be concluded that there is a significant spatial relationship at the α level of significance. In this study, the critical value of α was 5% or $Z0.95 = 1.654$. Overall, the value of Z (I)> Z0.95 is 8.8763> 1.654, which means that there is a significant spatial relationship between GRDP.

2. The Result of Morans's I Scatterplot and Local Indicator of Spatial Association (LISA)

The aftereffects of the Morans's I scatterplot of GRDP show a circulation design that is partitioned into four sections, in particular regions with spatial example investigation of high, low-high, low, and high-low to identify the presence of nearby groupings, GRDP of 60 locale and urban areas in 5 territories in southern Sumatra, the consequences of the dispersion quadrant are introduced in the accompanying figure.
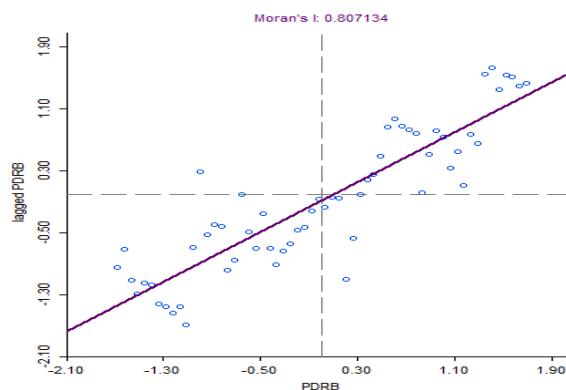

Figure 5. Results of Morans's I Scatterplot GRDP in 60 Districts and Cities in 5 Southern Provinces 2015-2019

201

The aftereffects of Morans's I Scatterplot show the division of quadrants in Morans's I, Quadrant I: HH (High), there are 2 districts, Quadrant II: LH (Low-High) there are 28 locales, Quadrant III: LL (low) there are 5 areas and in Quadrant IV: HL (High-Low) there are 25 areas. That year, the GRDP of an area will in general be assembled and as per its adjoining districts. Coming up next is the LISA Bunch Guide in Figure 5.
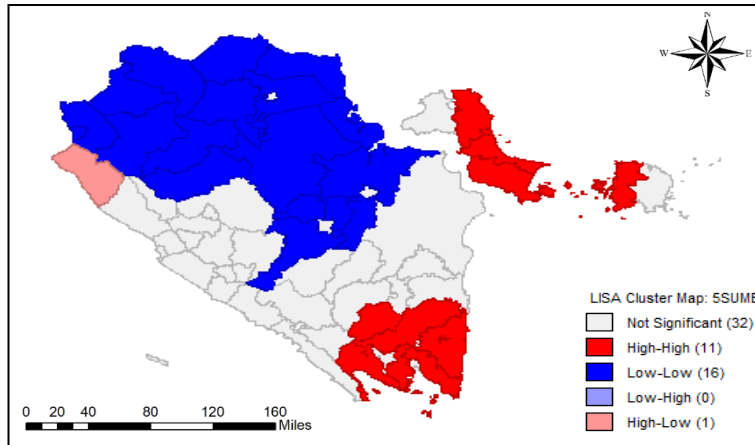

Figure 6. LISA Cluster Map GRDP in 60 Districts and Cities in 60 Districts and Cities
in 5 Provinces of Southern Sumatra 2015-2019

The LISA Cluster map depicts the grouping of GRDP with an indication of the *High-high* areas covering 11 regions, namely Bangka, Pangkal pinang, Central Bangka, South Bangka, Belitung, Pesawaran, South Lampung, East Lampung, Tanggamus, Central Lampung, North Lampung. This area is an indication that spatial groupings have high GRDP values surrounded by areas with high values.

The Regions with low signs cover 16 regions, to be specific Kerinci, Merangin, Sarolangun, Batang Hari, Muaro Jambi, Tanjung Jabung Timur, Tanjung Jabung Barat, Tebo, Bungo, Sungai Penuh, Muara Enim, Musi Bayuasin, Banyuasin, Ogan Ilir, Penukal Abab Lematang, and Musi Rawas Utara. This region shows that the spatial gathering has low GRDP values encompassed by regions with low qualities. Region with high-low sign covers 1 region in particular mukomuko, this region shows that the spatial gathering has high GRDP values encompassed by regions with low qualities. Coming up next are the consequences of the degree of importance nearby with the LISA Importance map in Figure 6.
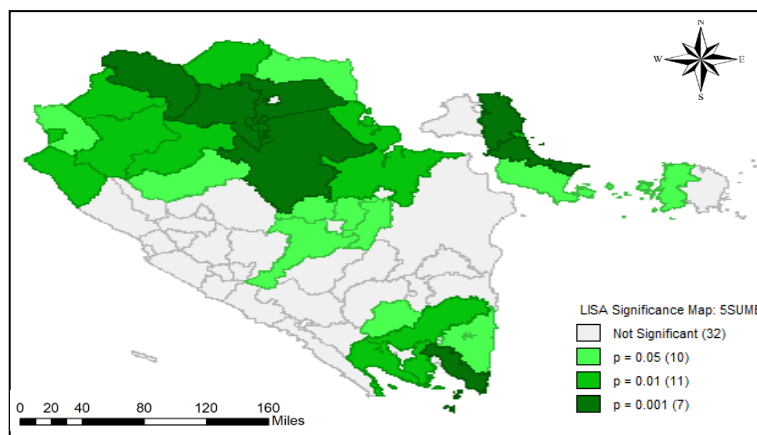

Figure 7. LISA Signification Map GRDP in 60 Districts and Cities in 60 Districts and Cities
in 5 Provinces of Southern Sumatra 2015-2019

The LISA meaning guide at 0.05 importance covers 10 districts, in particular Kerinci, North Rawas Musi, Tanjung Jabung timur, Penukal Abab Lematang, Muara Enim, ogan ilir, South Bangka, Bangka Belitung, North Lampung, and East Lampung. The 0.01 importance covers 11 regions, in particular Sungai Penuh, Mukomuko, Merangin, Sarulangun, Bungo, Tanjung Jabung Barat, Banyuasin, Central Lampung, Pesawaran, Tanggamus, and Pangkalpinang. The degree of meaning of 0.001 covers 7 regions, in particular Bangka, South Bangka, South Lampung, Musi Banyuasin, Muaro Jambi, Tebo and Batang Hari. The difference in the amount of GDP of each districts/cities will cause grouping or distribution, the neighborhood relationship plays a role in how the region influences its neighbors.

The results of the spatial linkages in the gross regional domestic product in 60 districts and cities in a positive spatial relationship with Morans's I, I throughout the 2015-2019 research year. The results of this indication indicate that the economy in 60 districts and cities in southern Sumatra has a spatial dimension between regions, autocoleration identifies that the gross regional domestic product in each research area which is located close to each other has the same characteristics between regions, the economy tends to have similarities in terms of creating GRDP value between regions.

The results of the spatial relationship study indicate that the economies of 60 districts and cities in southern Sumatra have economies with the same characteristics between regions, this is indicated by the grouping of GRDP values and regions which have a spatial impact on other regions. (Capello, 2009) The creation of the potential for regional economic growth can be influenced by economic growth and the behaviors of neighboring regions. Economic dynamics in an area can affect neighboring areas through the spillover effect given. The spillover effect is an impact that arises because of the dependency relationship between regions. These impacts can be in the form of expected impacts/positive impacts or unexpected impacts or negative impacts.

Regions have different characteristics in the aspect of the economy according to their capabilities and resources. The results of the study (ANWAR, 2017), analyze the problem of economic patterns in districts and cities on the island of Java, economic growth shows that the overall value of Morans's I I for the year is positive, which means that there is positive autocorrelation, during that year and the growth value of one region tends to be clustered and according to its neighboring regions. In general, the pattern that is formed is a cluster pattern but does not specifically give the position that one region is the center of economic growth for another. The economies of districts and cities on the island of Java have the same tendency in the problem of economic development between regions. (D. A. Novitasari, 2015) The results show that the distribution pattern of the proportion of GRDP in East Java tends to be clustered (cluster), that is, clustered in certain districts. While the results of testing with Morans's I I show that there is no spatial autocorrelation in the data on the proportion of GRDP in East Java Province. Meanwhile, locally, districts that have spatial autocorrelation are only districts that have spatial autocorrelation, only Bangkalan, Pamekasan, Sampang, and Sidoarjo.

3.2 Spatial Results of Human Development Index

The relationship between economic growth and human development is a strong two-way relationship. On the one hand, economic growth provides the resources that enable sustainable development in human development. Meanwhile, development in the quality of human capital is an important contributor to economic growth. (Krugman, 1999), Despite the indication that the effect of total human capital is not positively related to economic growth due to negative spillover effects, the direct effect amplifies the need for local investment in human capital. A new economic geography model that shows the trend for the population to be concentrated in a few cities. The negative spillover effect of population density across all estimates is also a sign that the population is concentrated in a few places.

1. The Result of Spatial Autocoleration with Moran Index.

    The following is the calculation result of the Spatial Autocorrelation of Human Development Index in 60 districts and cities in 5 southern Sumatra, in this section shows the results of Moran'I for the entire study period from 2015-2019 can be seen in the table.

Table 5. The Result of Morans's I HDI in 60 Districts and Cities
in Southern Sumatra Province from 2015 to 2019

Year	Morans's I	E(I)	Z-Value
2015	0,077782	-0,0169	0,9917
2016	0,074878	-0,0169	0,9638
2017	0,068550	-0,0169	0,8924
2018	0,071290	-0,0169	0,9208
2019	0,076486	-0,0169	0,9758

Source: Processed, Open Geoda, 2021

The value of Morans's I in all periods from 2015-2019 research has a positive autocoleration value and has a spatial relationship in the form of grouping in the HDI.

Table 6. The Result of Morans's I HDI in 60 Districts and Cities
in The Province Of Southern Sumatra In 2015-2019

Morans's I	E(I)	Z-Value	P-Value
0,81103	-0,0169	9,0176	0,001000

Source: Processed, Open Geoda, 2021

The spatial relationship of HDI 60 districts and cities areas in 5 territories in southern Sumatra in 2015-2019 is known to have a Morans's I worth of 0.81103. This shows that there is a spatial relationship as certain autocorrelation, implying that the HDI among locale and urban communities in 60 districts and cities areas in 5 territories in southern Sumatra has a bunched example of regions with similar qualities. To see whether there is a genuinely huge spatial relationship, a Z test is performed. Assuming the Z esteem is more noteworthy than $Z\alpha/2$ or not exactly - $Z\alpha/2$, it tends to be inferred that there is a critical spatial relationship at the importance level. In this study the basic worth is 5% or $Z0.95 = 1.654$. Generally the worth of Z(I) > Z0.95 is 9.0176 > 1.654, and that implies there is a huge spatial connection between HDI.

2. The Result of Morans's I Scatterplot and Local Indicator of Spatial Association (LISA)

    The results of the Morans's I scatterplot of HDI show a distribution pattern that is divided into four parts, namely areas with spatial pattern analysis of high-high, low-high, low-low, and high-low to detect the presence of local groupings, HDI of 60 districts and cities in 5 provinces in South Sumatra, the results of the distribution quadrant are presented in the Figure 8.
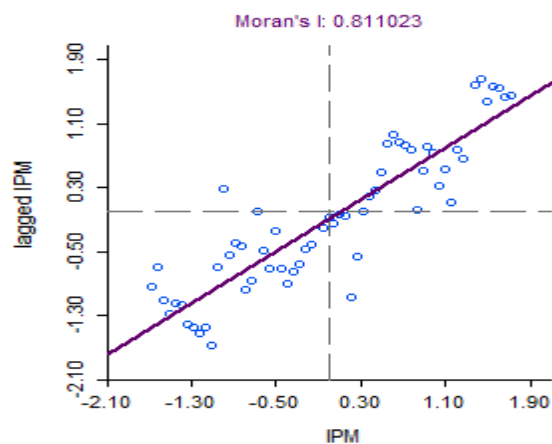
Figure 8. Results of Morans's I Scatterplot HDI in 60 Districts and Cities in 5 Southern Provinces 2015-2019

The results of Morans's I Scatterplot indicate the division of quadrants in Morans's I , Quadrant I: HH (High-High), there are 1 regions, Quadrant II: LH (Low-High) there are 29 regions, Quadrant III: LL (Low-low) there are 5 regions and in Quadrant IV: HL (High-Low) there are 25 regions. That year, the HDI of a region tends to be grouped and in accordance with its neighboring regions. The following is the LISA Cluster Map in Figure 9.
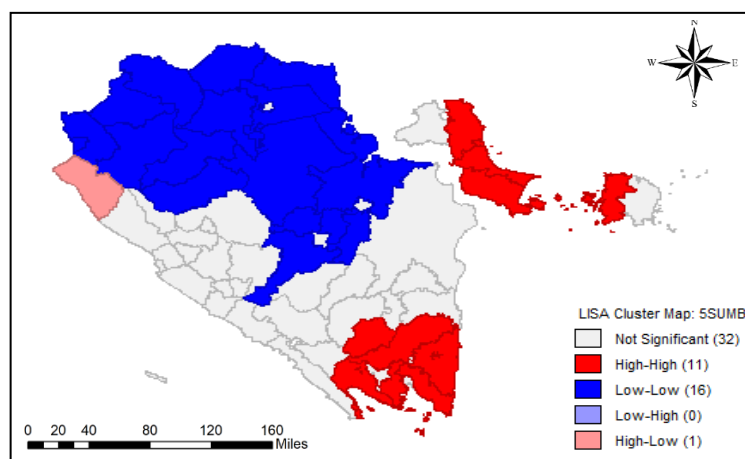

Figure 9. LISA Cluster Map HDI in 60 Districts and Cities in 60 Districts and Cities
in 5 Provinces of Southern Sumatra 2015-2019

The LISA Bunch map portrays the gathering of HDI with a sign of the Great high regions covering 11 districts, to be specific Bangka, Pangkal Pinang, Central Bangka, South Bangka, Belitung, Pesawaran, South Lampung, East Lampung, Tanggamus, Central Lampung, and North Lampung. This region means that spatial groupings have high HDI values encompassed by regions with high qualities.

The Regions with low signs cover 16 regions, to be specific Kerinci, Merangin, Sarolangun, Batang Hari, Muaro Jambi, Tanjung Jabung Timur, Tanjung Jabung Barat, Tebo, Bungo, Sungai Penuh, Muara Enim, Musi Bayuasin, Banyuasin, Ogan Ilir, Penukal Abab Lematang, and Musi Rawas Utara. This region demonstrates that the spatial gathering has low HDI values encompassed by regions with low qualities. Region with high-low sign covers 1 region in particular Mukomuko, this region shows that the spatial gathering has high HDI values encompassed by regions with low qualities. Coming up next are the consequences of the degree of importance nearby with the Lisa Importance map in Figure 10.
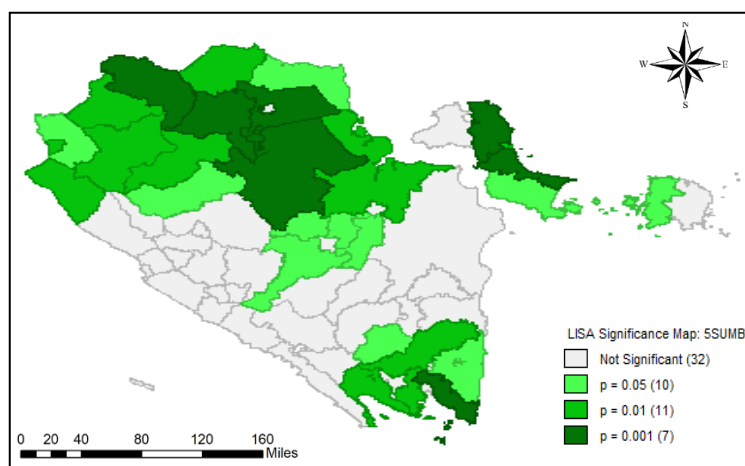
Figure 10. LISA Signification Map HDI in 60 Districts and Cities in 60 Districts and Cities
in 5 Provinces of Southern Sumatra 2015-2019

The LISA signification map at 0.05 significance covers 10 regions, namely Kerinci, North Rawas Musi, Tanjung Jabung Timur, Penukal Abab Lematang, Muara Enim, Ogan Ilir, South Bangka, Bangka Belitung, North Lampung, and East Lampung. The 0.01 significance covers 11 areas, namely Sungai Penuh, Mukomuko, Merangin, Sarulangun, Bungo, Tanjung Jabung Barat, Banyuasin, Central Lampung, Pesawaran, Tanggamus, and Pangkal Pinang. The level of significance of 0.001 covers 7 areas, namely Bangka, South Bangka, South Lampung, Musi Banyuasin, Muaro Jambi, Tebo, and Batang Hari. The difference in the amount of HDI of each districts and cities will cause grouping or distribution, the neighborhood relationship plays a role in how the region influences its neighbors.

The results of the spatial linkages in the Human Development Index in 60 districts and cities resulted in a positive spatial relationship with Moran I throughout the 2015-2019 research year. The results of this indication indicate that human capital in 60 districts and cities in southern Sumatra has a spatial dimension between regions, Autocoleration identifies that the human development index of each research area which is adjacent (neighboring) has the same characteristics between regions, the human development index tends to have the same in creating human capital that has three-dimensional indicators, namely long and healthy life, knowledge, and decent living between regions. The results of the spatial linkage indicate that the human development index in 60 districts and cities in southern Sumatra has human development capital which has the same characteristics in shaping human capital, this is indicated by the grouping of HDI values and areas that have a spatial impact on other regions.

Human resources in monetary terms is frequently utilized for schooling, wellbeing and different other human limits which when expanded can increment efficiency. Instruction assumes a significant part as far as an economy's capacities to take on current innovation and in building its ability for supportable turn of events and development, while wellbeing is an essential for expanded efficiency. Subsequently wellbeing and schooling can likewise be viewed as fundamental parts in development and improvement as contributions for the total creation work (Todaro, 2000).

The difference in the characteristics of human capital in each region becomes an important picture in regional development, if a region is related to one another it tends to have a human capital that is not much different from its neighboring areas. The results of research (Nisa, 2017), that districts and cities in West Papua Province do not have a spatial dependence on HDI figures in 2012. In any case, it is important to additional review what angles influence HDI figures connected with nearness to regions. It ought to be noticed that geologically West Papua territory is overwhelmed by sloping regions which are challenging to reach by excursion so it is workable for monetary and instructive exercises to rely upon the simplicities of transportation accessible. (D. Novitasari & Khikmah, 2019) In 2017 The HDI figure for Central Java

territory came to 70.52% and expanded by 0.77% from the earlier year, this is on the grounds that the HDI figure in a space is impacted by the HDI figure in the encompassing region. The area/local element is remembered to affect the HDI figure. This worth is demonstrated by the positive Moran'I esteem in the examination region.

4. CONCLUSION

The spatial relationship between gross regional domestic product and the human development index in 60 districts and cities in southern Sumatra has positive autocorrelation results throughout 2015-2019. This indication of a positive spatial relationship shows that the GRDP and HDI values have a cluster pattern with adjacent dots showing the same characteristics, this also indicates that the economy is marked by GRDP, and human capital marked by HDI between 60 districts and cities has similar values Indicates a pattern that is mutually correlated with neighboring areas.

Moran Scatterplot results from GRDP and HDI show the similarity is divided into 4 quadrants of regions, The results of Morans's I I GRDP Scatterplot indicate the division of quadrants in Morans's I I, Quadrant I: HH (High-High), there are 2 regions, Quadrant II: LH (Low-High) there are 28 regions, Quadrant III: LL (Low-low) there are 5 regions and in Quadrant IV: HL (High-Low) there are 25 regions, The results of Morans's I I HDI Scatterplot indicate the division of quadrants in Morans's I I, Quadrant I: HH (High-High), there are 1 region, Quadrant II: LH (Low-High) there are 29 regions, Quadrant III: LL (Low-low) there are 5 regions and in Quadrant IV: HL (High-Low) there are 25 regions. LISA cluster map and LISA signification of the similarity of findings in the results of GRDP and HDI describe grouping with an indication of High-high area covering 11 regions, Areas with low-low indications covering 16 areas, Areas with high-low indications covering 1 area, but both variables no results were found for the Low-high pattern, the absence of areas with low scores that were surrounded by areas with high scores.

The economies of 5 southern Sumatra Provinces in 60 districts and cities produce a pattern of relationships and interactions and the same characteristics, this indicates that the neighborhood relations between regions are very important, this finding also provides an indication of policies that must work together between regions in creating and spurring Improvement of the economy for the better and the long term. The results of this spatial interaction must be utilized in shaping the GRDP value so that making policies by considering the interactions between provinces is relevant to have mutually beneficial relationships in the economy. Human capital is still an important part of economic development in 5 provinces with 60 districts and cities in southern Sumatra. The same results are shown by the HDI variable. Cooperation in the formation of human capital between regions and the transfer of human capital between regions in the relationship to the formation of HDI is an important part this is related to long-term economic development that must be supported by qualified human capital. Consistency of a policy in continuously increasing the level of human capital and monitoring really of HDI will be a key in the economy of southern Sumatra.

5. ACKNOWLEDGMENTS

6. REFERENCES

Anselin, L. (1995). Local indicators of spatial organization -LISA. *Geographical Analysis*, 27(2), 93–115.
Anselin, L. (1998). Spatial Econometrics: Methods And Models by L. Anselin. *Journal Spatial Econometric*, 7(2), 1–16.
Anselin, L. (2010). Thirty years of spatial econometrics. *Papers in Regional Science*, 89(1), 3–25. https://doi.org/10.1111/j.1435-5957.2010.00279.x
ANWAR, A. (2017). Ketimpangan Spasial Pembangunan Ekonomi Dan Modal Manusia Di Pulau Jawa: Pendekatan Explatory Spatial Data Analysis. *Ajie Asian Journal of Innovation and Entrepreneurship*, 2(2), 90–109.

https://doi.org/10.20885/ajie.vol2.iss2.art2

Capello, R. (2009). Spatial Spillovers and Regional Growth: A Cognitive Approach. European. Planning Studies, Vol. 17, No. 5, p: 639-658.

Edward L. Glaeser Bruce I. (2013). THE SOCIAL MULTIPLIER. *Journal of Chemical Information and Modeling*, *01*(01), 1689–1699.

Hirschman, A. (1984). A Dissenter´s Conffesion: "The Strategy of Economic Development" Revisited. *Pioneers in Development*, *1*(1), 85–111. http://www.rrojasdatabank.info/pioneers4.pdf

Jay, L., Wiley, Jossey-Bass, Pfeiffer, Lasser, & Capstone. (2001). *Statiscal Analysis with ArcView Gis* (I. John Wiley & Sons (ed.)). John Wiley & Sons, Inc. All rights reserved.Published simultaneously in Canada.

Krugman, P. (1999). The role of geography in development. *International Regional Science Review*, *22*(2), 142–161. https://doi.org/10.1177/016001799761012307

Kuncoro. (2002). Banking Management, Theory and Applications. Jakarta: PT. Gramedia Group Index

Kuncoro, M. (2004). Pertumbuhan Ekonomi dan Ketimpangan Antar Wilayah dalam buku Otonomi Dan Pembangunan Daerah. Penerbit Erlangga. Jakarta.

Nisa, E. K. (2017). Identifikasi Spatial Pattern Dan Spatial Autocorrelation Pada Indeks Pembangunan Manusia Provinsi Papua Barat Tahun 2012. *Jurnal At-Taqaddum,* *9*(November 2017), 37–39.

Novitasari, D. A. (2015). Spatial Pattern Analysis Dan Spatial Autocorrelation Produk Domestik Regional Bruto (Pdrb) Sektor Industri Untuk Menggambarkan Perekonomian Penduduk Di Jawa Timur. *Jurnal Ekbis*, *13*(1), 9. https://doi.org/10.30736/ekbis.v13i1.113

Novitasari, D., & Khikmah, L. (2019). Penerapan Model Regresi Spasial Pada Indeks Pembangunan Manusia (IPM) Di Jawa Tengah Tahun 2017. *STATISTIKA Journal of Theoretical Statistics and Its Applications*, *19*(2), 123–134. https://doi.org/10.29313/jstat.v19i2.5068

Perroux, Francois. (1950). 'Economic Space: Theory and Applications'. *Quarterly Journal of Economics*, Vol. 64(1): 89-104.

Resende, G. M., de Carvalho, A. X. Y., Sakowski, P. A. M., & Cravo, T. A. (2016). Evaluating multiple spatial dimensions of economic growth in Brazil using spatial panel data models. *Annals of Regional Science*, *56*(1), 1–31. https://doi.org/10.1007/s00168-015-0706-9

Tarigan, Robinson. (2005). Ekonomi Regional. Teori dan Aplikasi. Bumi Aksara. Jakarta

Todaro P. Michael. (2000). Third World Economic Development Volume I, Jakarta. Publisher: Erlangga.

Todaro, M.P. dan Smith Stephen. C. (2003). Pembangunan Ekonomi di Dunia Ketiga. Edisi kedelapan. Jilid 2. Jakarta: Erlangg

Zhou, H., Qu, S., Yang, X., & Yuan, Q. (2020). Regional Credit, Technological Innovation, and Economic Growth in China: A Spatial Panel Analysis. *Discrete Dynamics in Nature and Society*, *2020*. https://doi.org/10.1155/2020/1738279

Zhukov, Y. M. (2010). Applied Spatial Statistics in R , Section 4 Spatial Point Processes Spatial Data and Basic Visualization in R. In *Statistics*.