Journal of Sustainability Science and Management
Volume 18 Number 2, February 2023: 159-178
eISSN: 2672-7226

SUSTAINABLE DEVELOPMENT OF STRATEGIC ECONOMIC AREA WEST-EAST CORRIDOR WEST SUMATRA BASED ON SERVICE FACILITIES COMPLETENESS INDEX

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Submitted final draft: 28 September 2022 *Accepted: 25 October 2022* http://doi.org/10.46754/jssm.2023.02.012

Abstract: Regional development is a fundamental change in the socio-economic, cultural, and institutional structure to overcome income inequality and alleviate poverty. Regional development aims to formulate and apply theoretical frameworks into policies and programs by integrating social and environmental aspects to realise optimal and sustainable welfare. Learning the role of strategic areas and regional sustainability is necessary to support complete service facilities. The construction of good service facilities ensures efficiency, facilitates the movement of goods and services and increases the added value of the economy. This study looks at the spatial diversity of the factors that influence the Service Facility Index to develop a sustainable west-east corridor strategic economic area. The method used in this research is the scalogram method and Geographically Weighted Regression, with the unit of analysis being the sub-district. The analysis results show that the spatial pattern of the Service Facility Index based on the investigation of Moran I is random along the west-east corridor. The factors that significantly affect the sustainable development of the west-east corridor are the area's population and altitude.

Keywords: sustainable development, regional development, service facilities, Geographically Weighted Regression

Introduction

Regional development attempts to determine the right steps to take for the future with a series of choices (Kuncoro, 2018; Jhingan, 2016). Regional development aims to increase economic growth, increase competitiveness, reduce regional inequality, improve people's welfare, and reduce poverty levels (Kumari & Devadas, 2017)The Author(s. Regional development is a fundamental change in the socioeconomic, cultural and institutional structure to overcome income inequality and alleviate poverty (Todaro & Smith, 2012). Regional development is directed towards realising balanced equity, efficiency, and sustainability (Rustiadi, Saefulhakim, & Panuju, 2018).

Regional development aims to formulate and apply theoretical frameworks into policies and programs by integrating social and environmental aspects to realise optimal and sustainable welfare (Nugroho & Dahuri, 2004). It is necessary to develop a program of integrated and synergised development based on local resources to acknowledge and recognise the acceleration of regional development (Friedmann & Alonso, 2008). One of the efforts to accelerate development by utilising local resources is establishing strategic areas (Ministry of National Development Planning/ Bappenas, 2016; Bappenas, 2014) and local economic development (Saragih, 2015).

Strategic areas are prioritised in developing commodities that can improve people's welfare

(Bozhko, 2018; Komarovskiy & Bondarusk, 2013; Sosnovskh, 2017). Strategic areas are economic areas that have the potential to have a multiplier effect across sectors, regions and actors (Ministry of National Development Planning/Bappenas, 2016). A strategic economic area is a territory with characteristics that distinguish it from other areas (Komarovskiy & Bondarusk, 2013).

Conceptually, the role of strategic areas can encourage the regional economy (Glinskiy, Serga, & Zaykov, 2017; Anwar, 2014). Strategic economic areas are expected to act as growth centres or growth corridors that drive economic growth in the surrounding area (Babkin, Vertakova, & Plotnikov, 2017; Muta'ali, 2015). As an implementation of the concept of growth centres or growth corridors, strategic economic areas are expected to be the prime movers of development that can drive the surrounding area's economy. Strategic economic areas such as growth centres are areas where the population is concentrated with various economic and social activities and has a fairly strong influence on the development of the surrounding area.

Realising the role of strategic areas and regional sustainability, the site needed to be supported by complete service facilities (Sosnovskh, 2017; Rustiadi *et al*., 2018). The construction of good service facilities will ensure efficiency, facilitate the movement of goods and services and increase the added value of the economy (Skorobogatova & Kuzmina-Merlino, 2017; Jurgelane-Kaldava, Ozolina, & Auzina-Emsina, 2019; Hasselgren & Englen, 2016; Sutriadi, Safrianty, & Ramadhan, 2015. Service facilities have a broad role in the context of development, whether environmental, economic, social, cultural, political, or other contexts. Limited service facilities will cause regional inequality (Rustiadi *et al*., 2018).

Various factors influence the existence of service facilities in the west-east corridor. This research is carried out with the assumption and understanding that each observation unit has a different character. Although each observation unit has its nature, it will be directed to become growth corridors. As the corridor grows, the west-east corridor has different characteristics and typologies, so the factors that influence its development will also be various for each region. As part of this study, the GWR approach is used to construct a growth corridor; however, the hypothesis is that the corridor is developed utilising a variety of policies and processes. After all, the assumption is that the east-west corridor has multiple characteristics and typologies.

The East-West Corridor is one of eleven strategic economic areas in West Sumatra. The potential for the development of the West Sumatra region has developed quite rapidly in the last five years, including the provincial Human Development Index (HDI) which is above the national HDI (West Sumatra = 72.65, Indonesia = 72.29 in 2021), the local government's work plan has contained a policy for the recovery of Covid-19. Another success that has been achieved is the reduction of inequality, which is supported by the program for handling disadvantaged areas. This success can be used as a strong capital to accelerate the development of West Sumatra in the future, especially in the west-east corridor. Although West Sumatra has achieved progress and success, West Sumatra still faces various development problems and challenges that must be addressed through a series of policies, programs and activities in sustainability. One of the problems is the weakness of planning and supervision in implementing regional development.

Another problem is the loss of Minangkabau identity among the younger generation of *perantau Minang*. In overcoming these problems, *Perantau Minang* is very much needed in supervising development in West Sumatra. This development potential can be used as capital to accelerate the construction of the west-east corridor. The development of this potential must be accompanied by a series of strategies, policies, programs, and activities (Todaro & Smith, 2017) that are adapted to the conditions and needs of each region. The existence of adequate service facilities indicates a good regional economy to improve the welfare of the community. Improving the economic welfare of the community is one of the principles of sustainable development. Areas with a high Service Facility Index value indicate that the region has a fairly high level of economic welfare. Based on the description above, this study aims to see the spatial diversity of the factors that affect the Service Facility Index to develop a sustainable west-east corridor strategic economic area.

Materials and Methods

Study Area

This research is in the west-east corridor of West Sumatra (Figure 1). The west-east corridor is one of eleven strategic economic areas in West Sumatra, one of the main corridors connecting West Sumatra with other provinces. The west-east corridor covers nine regencies/municipalities (*kabupaten/kota*) and sixty-five sub-districts (*kecamatan*), namely Tanah Datar, Lima Puluh Kota, Padang Pariaman, Agam, Padang municipal, Padang Panjang, Pariaman, Bukittinggi and Payakumbuh.

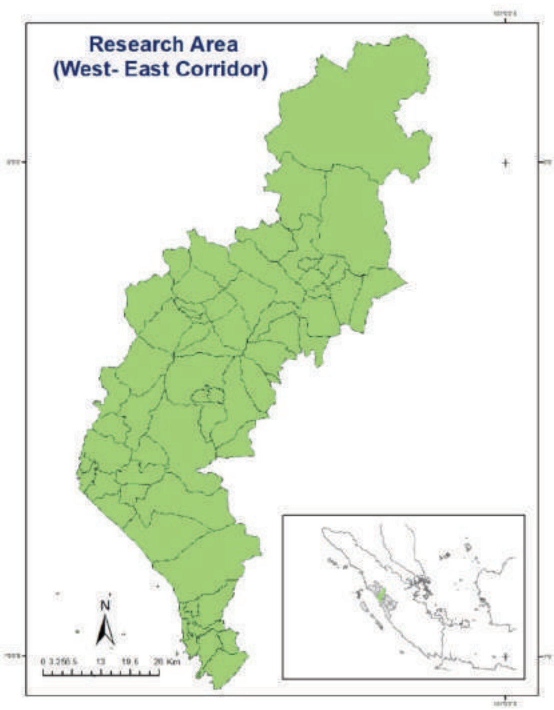

Figure 1: Research area

Research Method

The research method used in this study is a combination of qualitative and quantitative methods. The data used in this study are secondary data and primary data. Secondary data in District data in 2020 was obtained from the Central Statistics Agency (West Sumatra Statistical Agency, 2020). Primary data were obtained from field observations and interviews. The unit of analysis observed is the sub-district in the west-east corridor.

This research is in two stages: the first stage by calculating the Service Facility Index. The second stage looks at the spatial diversity of the factors that affect the sustainability of the developments of the west-east corridor based on the Service Facility Index. The first stage was carried out using the scalogram method (Pribadi, Rustiadi, Panuju, & Pravitasari, 2018), and the second stage was carried out using the Geographically Weighted Regression (GWR) method. The GWR method is a spatial regression model using weighting for each observation location (Wheeler & Paez, 2010) and can see spatial diversity (Mao, Yang, & Deng, 2018).

The Service Facility Index is calculated using a scalogram based on the analysis of indicators per 1000 population (Pribadi *et al.*, 2018). The indicators used in this study are the number of elementary schools, the number of high schools, the number of universities, the number of sports facilities, the number of markets, the number of minimarkets/supermarkets, the number of hotels/inns/motels, the number of private banks/government/Rural Banks, the number of restaurants, number of cooperatives, number of Base Transceiver Stations (BTS), number of hospitals, number of puskesmas, length of roads, length of roads in good condition. These indicators are variables that represent basic community service facilities.

The spatial diversity of the factors that affect the sustainability of the development of the west-east corridor is based on the Service Facility Index using the GWR method. The GWR method can see the spatial diversity along the west-east corridor. The Geographically Weighted Regression (GWR) model develops the classical regression model. The general form of the GWR model can be written as follows:

$$y_i = \pi r^2 = \alpha\,(u_i, v_i) + \sum_{k=1}^{p} \beta_k\,(u_i, v_i) x_{ki} + \delta_i \qquad (1)$$

description:

yi = the observation value of the response variable at the i-th location
xki = value of the k-th explanatory variable at the i-th location (i=1,2…,n)
(*ui,vi*) = coordinates of geographical location of observation location i (ui,vi)
α(*ui,vi*) = constant/intercept GWR
βk(*ui,vi*) = the value of the k-th parameter in the location coordinates (ui,vi)
i = i-th observation error which is assumed to be identical, independent and normally distributed with zero mean and constant variance 2

The model that looks at the factors that influence the development of the strategic area of the west-east corridor of the economic province based on the Service Facility Index are:

$$Y_i = \beta_0\,(u_i, v_i) + \beta_1\,(u_i, v_i) ln x_{1i} + \beta_2\,(u_i, v_i) ln x_{2i} + \beta_3\,(u_i, v_i) ln x_{3i} + \beta_4\,(u_i, v_i) ln x_{4i} + \beta_5\,(u_i, v_i) ln x_{5i} + \beta_6\,(u_i, v_i) ln x_{6i} + \beta_7\,(u_i, v_i) ln x_{7i} + \beta_8\,(u_i, v_i) ln x_{8i} + \delta_i \qquad (2)$$

To see the factors that affect the Service Facility Index using eight independent variables (Table 1). The determination of the independent variables is based on previous research results (Anwar, 2014; Glinskiy *et al*., 2017) and the problems in West Sumatra. The operational definition of each variable is:

Table1: Operational definition of variables

No.	Variables	Units	Operational Definition
1	The Service Facilities Index (Y_i)	value	Value of The Service Facilities Index
2	Residential area (x_1)	Ha	The total area of residential
3	Industry (x_2)	value	Number of large, medium and medium industries
4	The role of *perantau* (x_3)	per cent	Percentage of involvement and participation of Minang immigrants in developing the region
5	The role of LKAAM (x_4)	per cent	Percentage of involvement and participation of LKAAM (traditional institutions) to develop the region
6	The role of the Camat (x_5)	per cent	Percentage of involvement and participation of camat (sub-district head) to develop the region
7	Population (x_6)	person	Total population
8	Regional Security (x_7)	value	Regional security levels based on the number of disasters
9	Altitude Area (x_8)	masl	The altitude of the area as measured from the sea level

The partial parameter significance test was conducted to determine which independent variables affected the dependent variable at each research location. The hypothesis of partial significance is:

H_0: = 0 (Independent Variable X_i at location-i has no significant effect)

H_1: 0 (Independent variable X_i at i-location has a significant effect)

The statistical test used in testing this hypothesis is a test for the k-variable at location -i, which is obtained from the following equation: $t_k(u_i, u_i)$

$$t_k(u_i, u_i) = \frac{\beta_k(u_i.v_i)}{s.e[\hat{\beta}_k(u_i,v_i)]} \qquad (3)$$

The test is performed n x p times for each variable. The null hypothesis is rejected if it is greater than the t table. Where the degrees of freedom are and S is the matrix each row consists of $t_k(u_i, u_i)\left(t\alpha_{/2;df}\right) n - 2v_i + v_2, v_1 = t_r(S)v_2$ $= t_r(S^T S).r_i = X_i(X'W(u_i, v_i)X)^{-1}X'W(u_i, v_i)$.

Results and Discussion

Service Facility Index

The Service Facility Index is calculated using the scalogram method based on the analysis of indicators per 1000 population. The indicators used in the total of service facilities are the number of high schools (A), the number of universities (B), the number of elementary schools (C), the number of sports facilities (D), the number of markets (E), the number of minimarkets/supermarkets (F), number of restaurants (G). Other variables used are the number of hotels/inns/motels (H), the number of private banks/government/Rural Banks (I), the number of cooperatives (J), the number of BTS (K), the number of hospitals (L), the number of health centres (M), the length of the road (N), the size of the road in good condition (O).

Each data is divided by per thousand population. The first step: the information on each indicator will be divided by the total population multiplied by 1000. The second step: calculate the weight of each indicator for each region by calculating the total number of sub-districts divided by the number of sub-districts that have facilities. The third step: calculate the standardised values by subtracting the weight of each indicator from the minimum value. The result is divided by the standard deviation. The Service Facility Index is obtained by adding all indicator values in each region. The index value of service facilities shows that the higher the index value, the more complete the service facilities in an area.

Figure 2 shows the results of the calculation of the Service Facility Index. Based on the spatial pattern calculated by the Moran Index (Moran Index 0.029, p-value 0.332), service facilities are randomly distributed along the west-east corridor. Moran's Index (Moran's I) is the most widely used method to calculate global spatial autocorrelation. This method can detect clustered patterns or form trends in space. The sub-district service facility index results show that three sub-districts have a high diversity value (29.5 – 46.9), namely East Padang District, Central Pariaman District, and Guguak Panjang District. Areas with a low diversity value between 7.3 to 12.6 are Kuranji District, Koto Tangah, Batang Anai, Sintuak Toboh Gadang, Sungai Pua, Banuhampu, Canduang, Ampek Angkek, Luak District, Lareh Sago Halaban District, Harau District, Payakumbuh District, Mungka District.

Spatial Diversity of Factors Affecting the West-East Corridor Service Facility Index

The data processing results show the spatial diversity of the Service Facility Index factors. The eight independent variables used were: the area of settlements, the number of industries, the role of *perantau*, the role of LKAAM, the function of the sub-district head, the number of residents, regional security, and altitude. This research is under observation in the same period, namely 2020.

Geographically Weighted Regression (GWR) modelling produces local regression equations and varies in each regional unit.

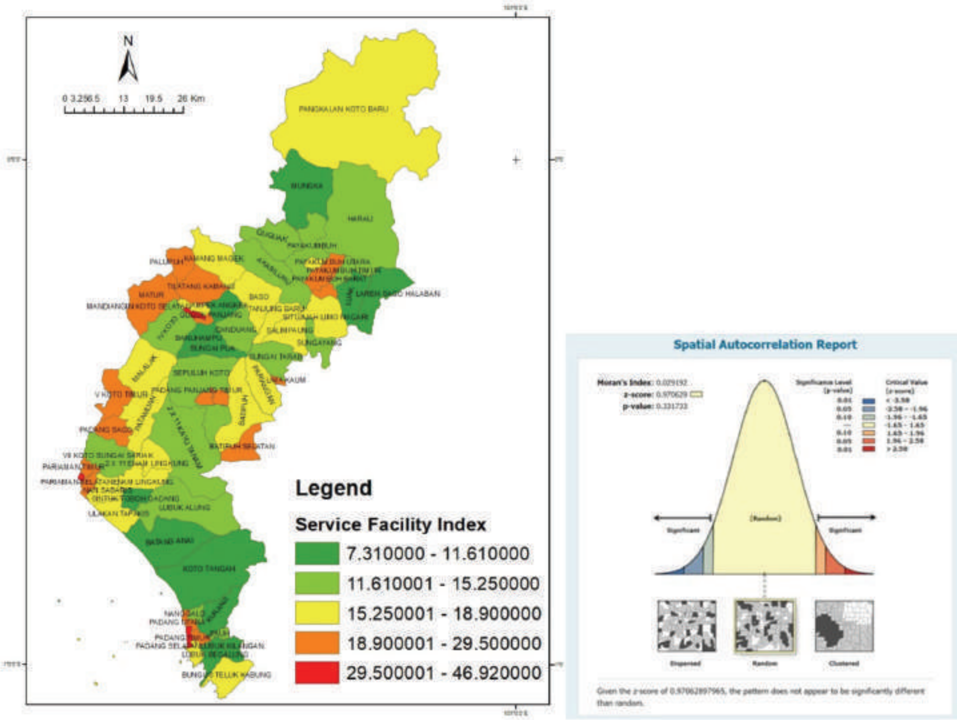

Figure 2: Service Facility Completeness Index and Moran's Index

Figure 3 shows the local coefficient value of the R^2 Service Facility Index (SFI) for the west-east corridor. The spatial pattern of the local coefficient R^2 shows a clustered pattern. The local value of R^2 for each observation area has different results. The sub-districts with a high R^2 value are in the southern part of the west-east corridor (Padang municipal, Padang Pariaman municipal and Pariaman Regency), while the R^2 value is in some sub-districts in the northern part of the east-west corridor. Most sub-districts with a low R2 value are in Agam Regency and Bukit Tinggi municipal.

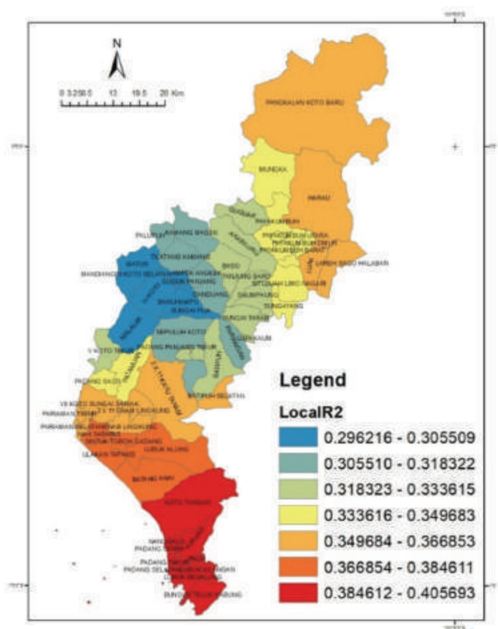

Figure 3: Value of Local Coefficient R^2

Testing the coefficients of the GWR model is carried out to determine the factors that influence it (Li, Zhang, Xu, Xue, & Ren, 2020; Bhattacharya & Nakamura, 2021)in regions where coastal tourism is the primary industry, the implementation of such strategies have been low due to fear of negative economic impact related to loss of coastal view and accessibility. Therefore, this paper examines the influence of coastal amenities to hotel room rates alongside other attributes through hedonic analysis. Specifically, it investigates whether rooms with coastal views, accessibility to beaches, and those located on higher elevations are priced higher than other rooms, in order to quantify the associated values of Japanese coastal areas where tourism is a key economic driver. Subsequently, it suggests the geographical market boundaries to guide the management and risk-mitigation of coastal areas. Findings reveal that: Semi-parametric Geographically Weighted Regression (S-GWR. Service Facility Index for each sub-district in the west-east corridor. The results of the coefficient test using the t-test with a confidence interval of 90% indicate that independent variables have a spatial effect on the sustainability of regional development based on the Service Facility Index (reject H_0 and accept H_1).

The test results of the Ordinary Least Square (OLS) model show that the significant variables are the population variable, with a p-value of 0.0007 and the height of the area, with a p-value of 0.0379 (p-value < 0.05). In contrast, the variable settlement area, number of industries, role *perantau*, the role of LKAAM, the position of the sub-district head, and regional security were not significant (p-value > 0.05). The GWR analysis results show the variable number of significant industries in 30 sub-districts, *perantau* and significant population in all sub-districts, regional security in 1 sub-district, and area height in 38 sub-districts (Table 2).

Based on the results of OLS modelling, the residential area variable has a p-value of 0.3696 (p-value > 0.05). The residential area variable did not significantly affect the Service Facility Index (SFI) for the west-east corridor (Table 2). The residential area variable is not important in increasing the Service Facility Index for the west-east corridor.

Based on the results of GWR modelling, the effect of residential areas on the Service Facility Index (SFI) for each sub-district has a negative coefficient (Figure 4a). The addition of a residential area is not followed by expanding service facilities (Adimagistra & Pigawati, 2016)especially in the city of Semarang increase rapidly, so the government in 2005 make a program called 100,000 RSS (Simple Healthy House because this study was carried out in one observation. The construction of service facilities is not carried out simultaneously as the construction of residential areas in the west-east corridor and West Sumatra in general. The results of the GWR model's coefficient test show that the residential area variable is not a

Table2: Coefficient of OLS and GWR Estimation Results

Variables	OLS Coefficient			GWR Coefficient (α = 0.1)		
	Coef.	t stat	p-value	Max.	Min.	Significant sub-district
C	22.3626	4.6195	0.0000*	23.3301	21.1507	65
Residential Area	-0.0003	-0.9045	0.3696	-0.0002	-0.0004	-
Number of Industries	0.0045	1.6154	0.1119	0.0049	0.0021	30
The role of *perantau*	0.0969	1.9921	0.0512	0.1134	0.0905	65
The role of LKAAM	-0.0235	-0.5304	0.5979	-0.0272	-0.0519	-
The role of the Camat	-0.0586	-0.5933	0.5554	-0.0409	-0.0688	-
Population	-0.0001	-3.6030	0.0007*	-8.7E-05	-0.0002	65
Regional Security	0.0976	1.1572	0.2521	0.14299	0.0738	1
Altitude Area	-0.0053	-2.1261	0.0379*	-0.0019	-0.0058	38

Description: * variables in the model are significant.

factor affecting the SFI of the west-east corridor. The results of the t-test showed that none of these variables was significant in the east-west corridor (Figure 4b).

The variable number of industries based on the results of OLS modelling has a p-value of 0.1119 (p-value > 0.05). The variable number of industries does not significantly affect the Service Facility Index (SFI) for the west-east corridor. The variable number of industries is not important in increasing the SFI of the west-east corridor (Table 2). Based on the results of the coefficient test of the GWR model, it shows that the variable number of industries is not a factor that affects the SFI of the west-east corridor.

The coefficient on the number of industries shows a positive value, meaning that the number of industries can increase SFI (Figure 5a). The influence of several industries can be seen from the number of significant variables in the sub-districts in the east-west corridor. The results of the t-test show that the number of industries is significant in 30 sub-districts of the west-east corridor (Figure 5b). The number of industries in the west-east corridor creates a variety of economic activities (Tian *et al*., 2021), impacting the Service Facility Index. The more diverse industries in the region, the more diverse the economic activities (Jiang, Liao, & Jin, 2021).

The *perantau* variable, based on the results of OLS modelling, has a p-value of 0.0512 (p-value > 0.05). The variable of the nomad role has no significant effect on the SFI of the west-east corridor (Table 2). The role of immigrants has no significant impact on the model in increasing the Service Facility Index (SFI) for the west-east corridor. Based on the results of GWR modelling for the influence of the role of *perantau* on the Service Facility Index (SFI) for each sub-district, the coefficient is positive (Figure 6a), meaning that the role of immigrants can increase SFI.

The role of *perantau* has an important effect on SFI in the west-east corridor; the higher the role of *perantau*, the higher the SFI. It illustrates

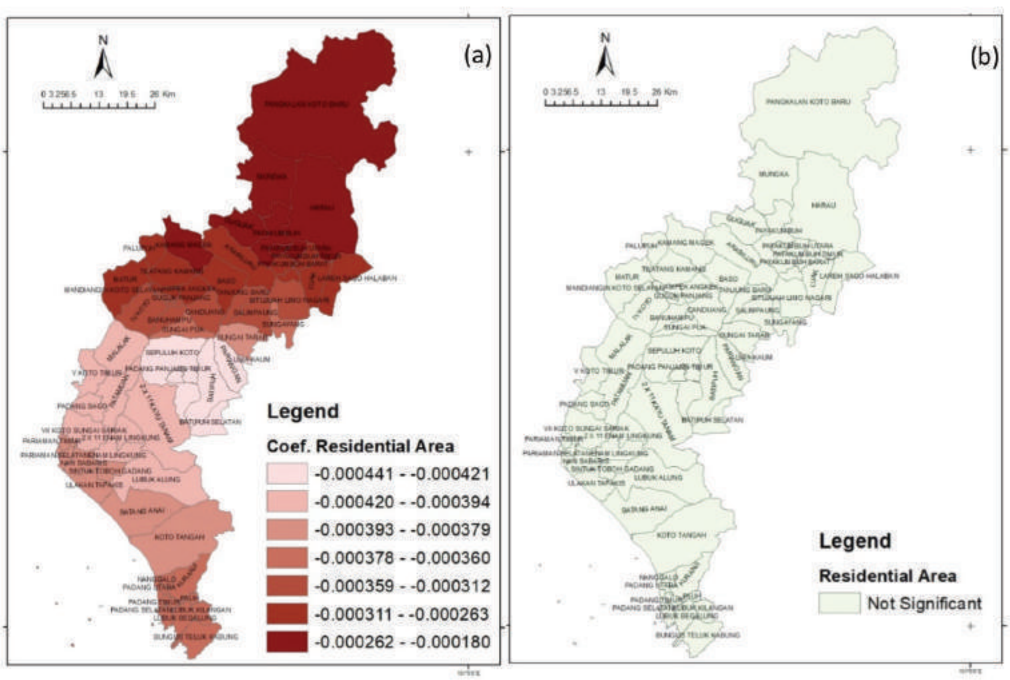

Figure 4: Spatial diversity of factors influencing Service Facility Index based on Residential area variable (a) coefficient, (b) t-test

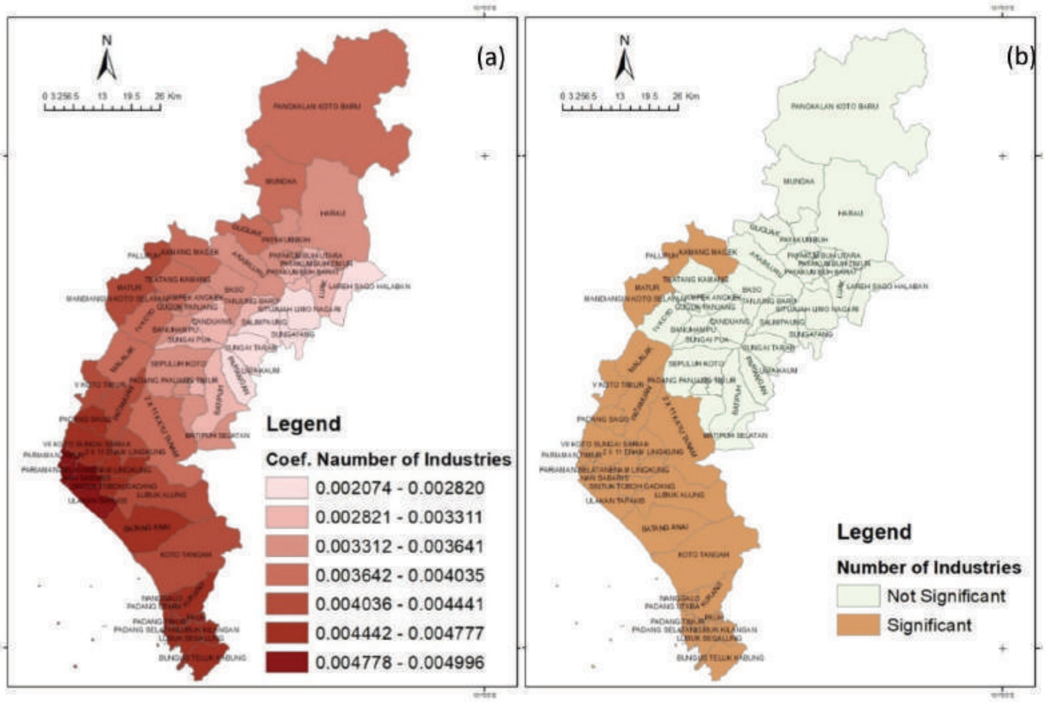

Figure 5: Spatial diversity of factors influencing Service Facility Index based on the number of industries variable (a) coefficient, (b) t-test

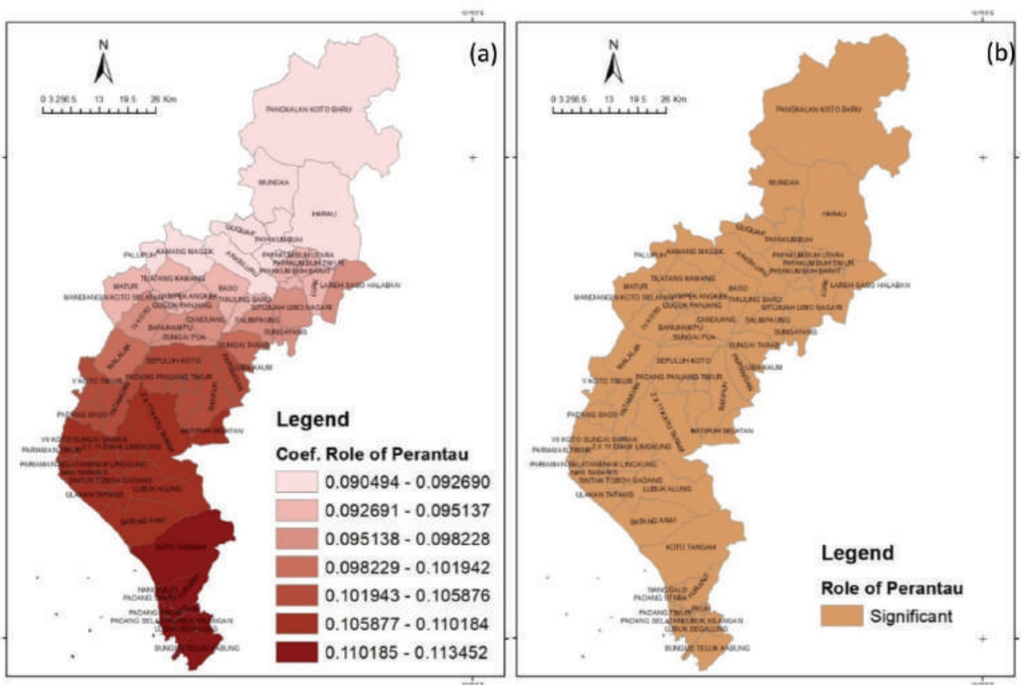

Figure 6: Spatial diversity of factors influencing Service Facility Index based on the role of perantau variable (a) coefficient, (b) t-test

the role of Minang immigrants in supporting the development and economy of their region of origin. Minang people who migrate do not forget their area; *perantau* always helps the community, especially those with family relationships. The assistance provided by migrants includes building/renovating mosques or prayer rooms, building Early Childhood Education (PAUD), renovating schools, and building/renovating other public facilities. The assistance provided by the Minang migrants increased the Service Facility Index in the west-east corridor. Based on the significance test results from 65 sub-districts, the role of the *perantau* variable was significant for all sub-districts.

This significant influence illustrates the role of Minang migrants in supporting sustainable development and improving the regional economy. The culture of wandering the Minang community where Minang people who are teenagers and adults tend to go out of their areas of origin to other places to find a new life, study, trade, seek work experience and want to return to their hometown when successful (Navis, 1986). Migrating and leaving one's hometown is sometimes not a personal decision but is often a group decision, for example, family, neighbours or friendship (Damsar & Indrayani, 2016). The decision to migrate is related to the capital and the network of socio-cultural and political relations they have. Minang people who migrate do not forget their area; migrants help the community, especially those with family relationships (Navis, 1986).

The culture of wandering is a form of local wisdom in the Minang community. The involvement and role of Minang immigrants in the area is a form of innate local wisdom. Local wisdom is the basis for sustainable development (Putri & Damayanti, 2017) and become the basis for regional development (Surur, Sitorus, & Agusta, 2014) and is one of the driving forces of the economy (Mungmachon, 2012) for regional development (Vitasurya, 2016).

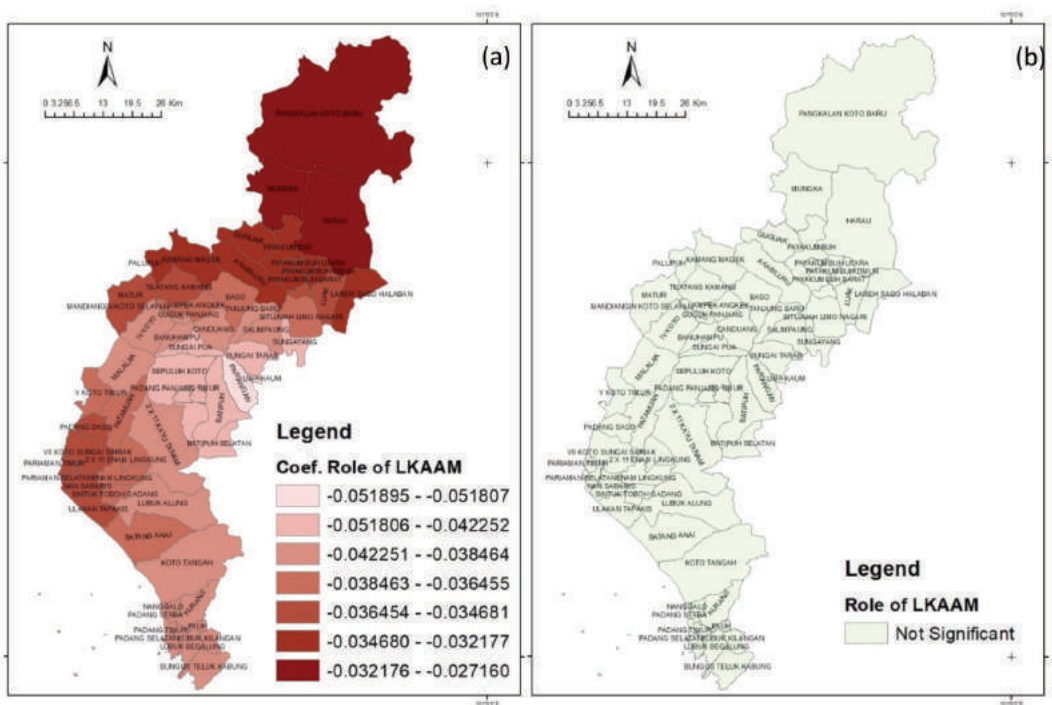

Figure 7: Spatial diversity of factors influencing Service Facility Index based on the role of LKAAM variable (a) coefficient, (b) t-test

The LKAAM role variable based on the results of OLS modelling has a p-value of 0.5979 (p-value > 0.05). The role of LKAAM does not significantly affect the Service Facility Index (SFI) for the west-east corridor (Table 2). The role of LKAAM is not an important factor in increasing SFI for the west-east corridor.

Based on the results of GWR modelling, the effect of the role of LKAAM on the Service Facility Index (SFI) for each sub-district has a negative coefficient (Figure 7a). Based on the significance test results from 65 sub-districts, no LKAAM role variable has a significant effect in each sub-district (Figure 7b). This significant negative effect does not mean that the role of LKAAM reduces the value of SFI in the west-east corridor. It happens because, in many areas in the west-east corridor and the West Sumatra region, the role of LKAAM has not been running properly. LKAAM members of ninik mamak have not been involved in the planning or development process. The roles and functions of LKAAM have not yet been implemented as stated in the AD-ART LKAAM. LKAAM is a functional organisation of ninik mamak of adat stakeholders with strong roots in the nagari as the backbone, which has gathered institutionally in the Kerapatan Adat Nagari (KAN) which has existed for generations. Another cause is that there are still some ninik mamak in West Sumatra who still seem anti-globalisation.

The sub-district role variable based on the results of OLS modelling has a p-value of 0.5554 (p-value > 0.05). The role of the sub-district head variable has no significant effect on the East-West Corridor Service Facility Index (Table 2). The role of the sub-district head has no significant impact on increasing the SFI of the west-east corridor.

Based on the results of GWR modelling for the role of the sub-district head on the Service Facility Index for each sub-district, the coefficient is negative (Figure 8a). Based on the significance test results from 65 sub-districts, no sub-district role variable significantly affects the east-west corridor (Figure 8b). The involvement

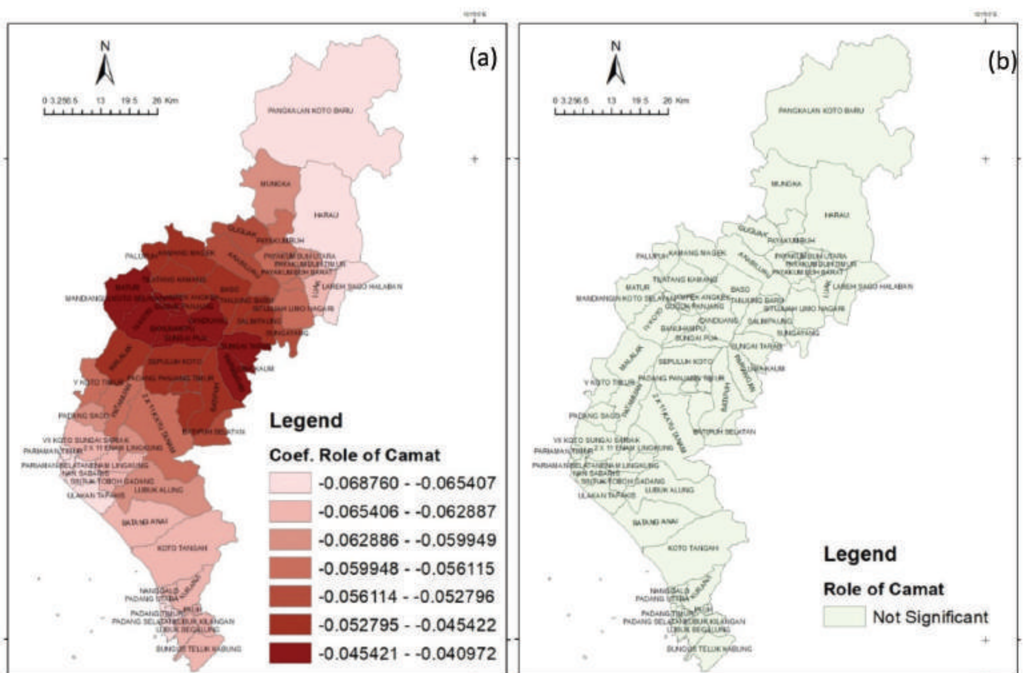

Figure 8: Spatial diversity of factors influencing Service Facility Index based on the role of Camat variable (a) coefficient, (b) t-test

of the sub-district head in the fulfilment of service facilities in an area in a government structure does not play a significant role because the district government is responsible for the fulfilment of service facilities. By policy, the camat is not responsible for making policies related to investment. The camat only plays a role in providing information related to his area to the district government. Regarding land use permits, ninik mamak is more entitled to give licenses to tribal lands (Schoneveld, 2017).

The population variable based on the results of OLS modelling has a p-value of 0.0007 (p-value <0.05). The population variable significantly affects the SFI of the west-east corridor (Table 2). The population has an important effect on increasing the Service Facility Index (SFI) for the west-east corridors.

Based on the results of GWR modelling, the effect of population on the Service Facility Index (SFI) for each sub-district has a negative coefficient (Figure 9a). The population has a significant negative impact on the SFI of the west-east corridor, meaning that the addition of service facilities in the same year does not follow the increase in population. The availability of service facilities has not accommodated and served the entire population (Junianto & Lumbantoruan, 2013; Misnaniarti *et al*., 2018; Luqman & Khan, 2021). The rise does not follow the increase in population in service facilities (Afroj *et al*., 2021)the quality of life of cities may deteriorate due to psychological dissatisfaction of dwellers with urban services. Hence the evaluation of the urban service quality from the citizen's perspective and accordingly addressing the gap is necessary for sustainable urban management. This study shows a common framework incorporating SERVQUAL, Analytical Hierarchy Process (AHP. Based on the significance test results from 65 sub-districts, the population variable significantly affects all sub-districts (Figure 9b).

The regional security variable based on the results of OLS modelling has a p-value of 0.2521 (p-value > 0.05). The regional security variable has no significant effect on the SFI of the west-east corridor (Table 2). Regional security has

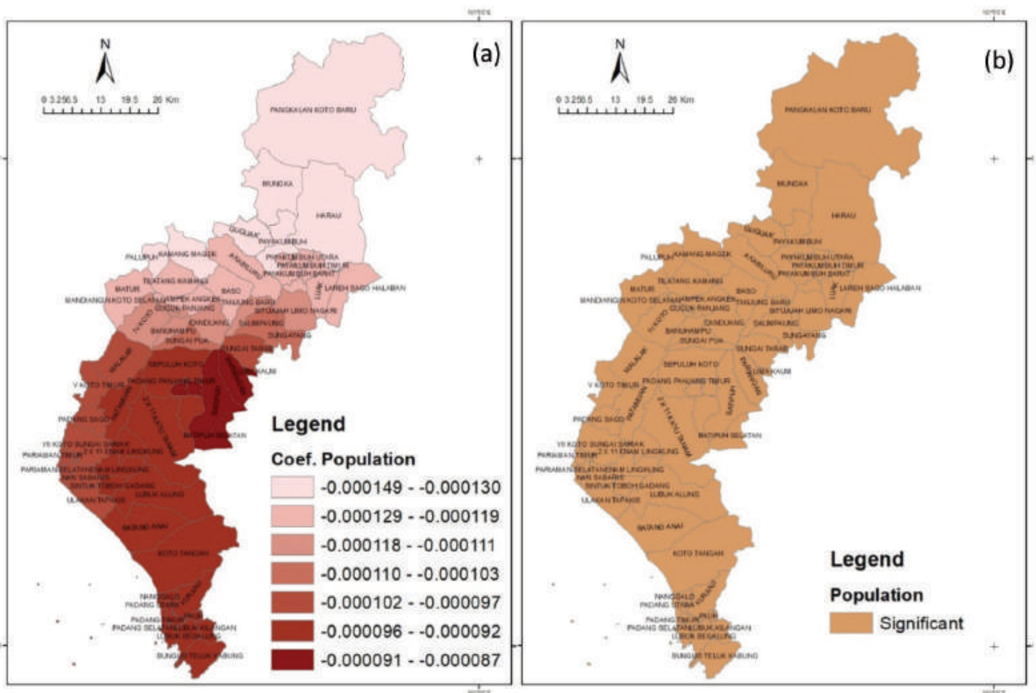

Figure 9: Spatial diversity of factors influencing Service Facility Index based on population variable (a) coefficient, (b) t-test

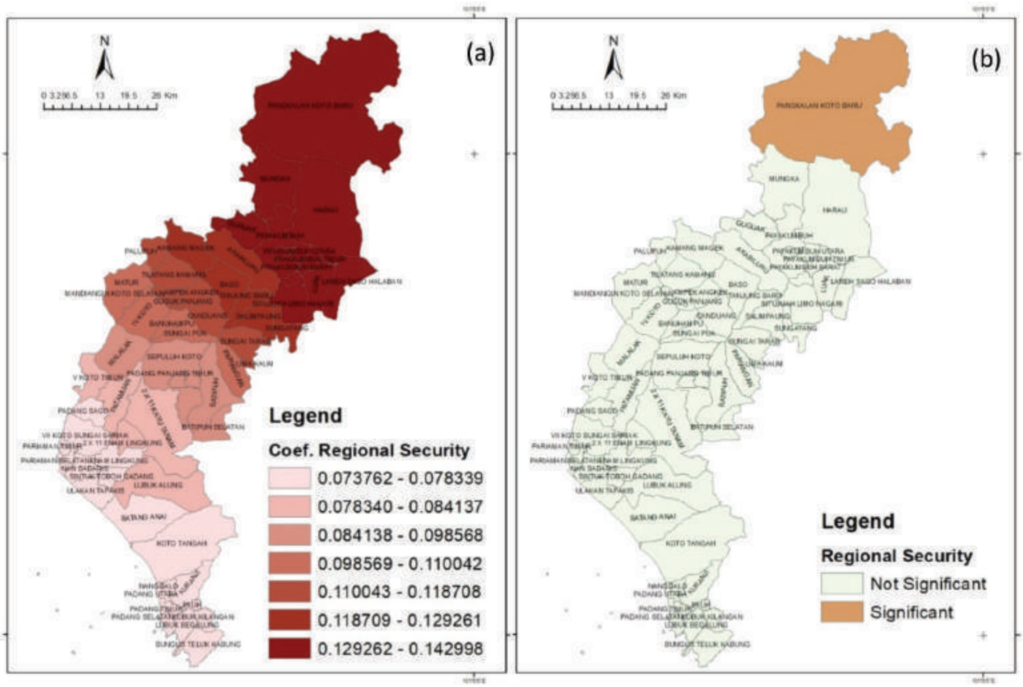

Figure 10: Spatial diversity of factors influencing Service Facility Index based on regional security variable (a) coefficient, (b) t-test

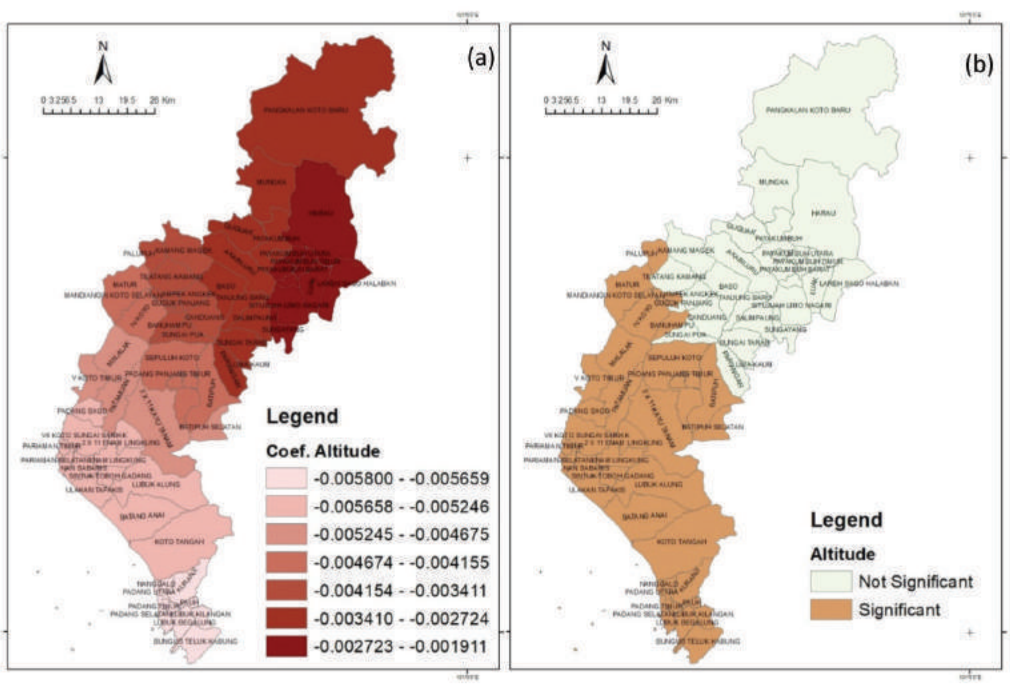

Figure 11: Spatial diversity of factors influencing Service Facility Index based on altitude area variable (a) coefficient, (b) t-test

no significant impact on increasing the Service Facility Index (SFI) for the west-east corridor.

The coefficient is positive based on the results of GWR modelling for the effect of regional security on the Service Facility Index (SFI) for each sub-district (Figure 10a). Regional security has an important effect on the SFI of the west-east corridor. Based on the significance test results from 65 sub-districts, the regional security variable significantly positively impacts the Pangkalan Koto Baru sub-district (Figure 10b). The higher the regional security, the higher the Service Facility Index (Yu, 2020). Regional security has a significant positive effect, meaning that the higher the level of regional security in the west-east corridor, the more service facilities that can build.

The regional elevation variable based on the results of OLS modelling has a p-value of 0.0379 (p-value < 0.05). Variable altitude area significantly affects the SFI of the west-east corridor. The area's height has an important effect on increasing the Service Facility Index (SFI) for the west-east corridor. Based on the results of GWR modelling, the effect of area height on the Service Facility Index (SFI) for each sub-district has a negative coefficient (Figure 11a). The higher an area is, the smaller the SFI value. The higher an area above sea level, the less diverse the land use (Apollo, Andreychouk, Moolio, Wengel, & Myga-Piątek, 2020)and meeting the needs of activity facilities will be more difficult to fulfil (Rukmini, Rosihermiatie, & Nantabah, 2012; Yin, Su, Fan, & Li, 2020). It is due to land use limitations in areas with large slopes and the limited ability of land in areas with slopes.

Conclusion

As a strategic economic area, the East-West Corridor is expected to act as a growth centre that will drive economic growth in the hinterland. In realising the sustainable development of the East-West Corridor, it needs to be supported by complete service facilities. This study wants to see the spatial diversity of the factors that affect the Service Facility Index in developing a sustainable strategic area of the west-east corridor. The variables observed were the area of settlements, the number of industries, the role of *perantau*, the role of traditional institutions (LKAAM), the role of the sub-district head, the number of residents, and regional security and altitude. Variable areas of the residential area, number of industries, *perantau*, the role of LKAAM, the role of sub-district head, and regional security have no significant effect in the model on SFI.

Population and area height variables proved to have a significant negative effect on the Service Facility Index in all sub-districts of the west-east corridor. The population has a significant negative effect, meaning that the availability of service facilities has not served the entire population. The addition of service facilities in the west-east corridor does not follow the increase in population.

The regional altitude variable significantly negatively affects SFI in 38 sub-districts of the west-east corridor. This negative effect means the higher an area above sea level, the less land use diversity. East-west corridors are generally located at an altitude of > 700 meters above sea level with a fairly large slope, so land use is limited.

Based on the results of GWR modelling, the variable number of industries has a significant positive effect in 30 sub-districts, meaning that the number of industries can increase the Service Facility Index. The existence of industry creates a variety of economic activities that impact increasing the number of service facilities in the west-east corridor.

Based on the GWR modelling results, the perantau role variable has significant positive effects in 65 sub-districts in the west-east corridor. The role of *perantau* has an important effect on increasing SFI, meaning that the higher the role of *perantau*, the higher the SFI. Minang migrants have a major role in supporting the development and the economy in the west-east corridor.

Based on the GWR modelling results, the regional security variable has a significant positive effect in Pangkalan Koto Baru District. The higher the security of an area, the higher the Service Facility Index. The higher the level of regional security in the east-west corridor, the more service facilities are built.

Planning and supervision in regional development and completeness of service facilities are needed to realise sustainable development. Local governments can use *Perantau Minang* to develop their regions to create sustainable development, especially in the west-east corridor. The assistance provided by *Perantau Minang* includes building/renovating mosques or prayer rooms, building Early Childhood Education (PAUD), renovating schools, and building/renovating other public facilities.

Acknowledgements

The author is grateful to all who have helped carry out this research. Thank you to the stakeholders for the discussion.

References

Adimagistra, T., & Pigawati, B. (2016). Evaluasi penyediaan sarana dan prasarana di Perumahan Puri Dinar Mas Semarang. *Jurnal Pengembangan Kota*, *4*(1), 58. https://doi.org/10.14710/jpk.4.1.58-66

Afroj, S., Hanif, F., Hossain, M. Bin, Fuad, N., Islam, I., Sharmin, N., & Siddiq, F. (2021). Assessing the municipal service quality of residential neighborhoods based on SERVQUAL, AHP and Citizen's Score Card: A case study of Dhaka North City Corporation area, Bangladesh. *Journal of Urban Management*, *10*(August 2020), 179-191. https://doi.org/10.1016/j.jum.2021.03.001

Anwar, M. A. (2014). New modes of industrial manufacturing: India's experience with special economic zones. *Bulletin of Geography*, *24*(24), 7-25. https://doi.org/10.2478/bog-2014-0011

Apollo, M., Andreychouk, V., Moolio, P., Wengel, Y., & Myga-Piątek, U. (2020). Does the altitude of habitat influence residents' attitudes to guests? A new dimension in the residents' attitudes to tourism. *Journal of Outdoor Recreation and Tourism*, *31*(September). https://doi.org/10.1016/j.jort.2020.100312

Babkin, A., Vertakova, Y., & Plotnikov, V. (2017). Study and assessment of clusters activity effect on regional economy. *SHS Web of Conferences*, *35*, 01063. https://doi.org/10.1051/shsconf/20173501063

Bappenas. (2014). Kajian Evaluasi Program Pembangunan dan Pengembangan Kawasan Khusus dan Daerah Tertinggal. In *Kawasan. Bappenas.Go.Id*. http://kawasan.bappenas.go.id/images/data/Produk/Kajian/Laporan_Kajian_2014.pdf

Bhattacharya, Y., & Nakamura, H. (2021). Spatial hedonic analysis to support tourism-sensitive tsunami mitigation planning. *International Journal of Disaster Risk Reduction*, *60*, 102283. https://doi.org/10.1016/j.ijdrr.2021.102283

Bozhko, L. (2018). Development scenarios for the interregional economic interaction in the context of economy clustering in the Republic of Kazakhstan. *Energy Procedia*, *147*, 397-401. https://doi.org/10.1016/j.egypro.2018.07.109

Damsar, D., & Indrayani, I. (2016). Konstruksi sosial budaya Minangkabau atas pasar. *Jurnal Antropologi: Isu-isu Sosial Budaya*, *18*(1), 29. https://doi.org/10.25077/jantro.v18i1.52

Friedmann, J., & Alonso, W. (2008). *Regional development and planning: A reader*. Cambridge: The MIT Press.

Glinskiy, V., Serga, L., & Zaykov, K. (2017). Identification method of the Russian Federation Arctic Zone Regions Statistical Aggregate as the object of strategy development and a source of sustainable growth. *Procedia Manufacturing*, *8*(2017), 308-314. https://doi.org/10.1016/j.promfg.2017.02.039

Hasselgren, B., & Englén, T. (2016). Challenges for transportation planning and organization in the Stockholm Region. *Transportation Research Procedia*, *14*(2016), 538-546. https://doi.org/10.1016/j.trpro.2016.05.109

Jhingan, M. L. (2016). *Ekonomi pembanguan dan perencanaan* (Translate). Jakarta: RajaGrafindo Persada.

Jiang, Y., Liao, F., & Jin, L. (2021). Effects of locational accessibility on firm diffusion characteristics: The case of Sino-Europe Economic Corridor. *Transport Policy*, *105*(February), 80-93. https://doi.org/10.1016/j.tranpol.2021.02.013

Junianto & Lumbantoruan, W. (2013). Analisis ketersediaan fasilitas pelayanan sosia, ekonomi di Kecamatan Batang Kuing Kabupaten Deli Serdang. *Jurnal Geografi*, *5*(1), 150-156.

Jurgelane-Kaldava, I., Ozolina, V., & Auzina-Emsina, A. (2019). Modeling the influence of transportation and storage industry on the economic development of Latvia. *Procedia Computer Science*, 450-456. https://doi.org/10.1016/j.procs.2019.01.161

Kementerian PPN/Bappenas. (2016). Kajian Telaah Kritis Penetapan Kawasan Strategis dalam RPJMN dan RTRWN. In *Buku*. https://www.bappenas.go.id/files/kajian-trp/Kajian_Telaah_Kritis_Penetapan_Kawasan_Strategis_dalam_RPJMN_dan_RTRWN.pdf

Komarovskiy, V., & Bondarusk, V. (2013). The role of the concept of " Growth Poles " for regional development. *Journal of Public Administration, Finance and Law*, (4), 31-42.

Kumari, R., & Devadas, V. (2017). Modelling the dynamics of economic development driven by agricultural growth in Patna Region, India. *Journal of Economic Structures*, *6*(1), 01-27. https://doi.org/10.1186/s40008-017-0075-x

Kuncoro, M. (2018). *Perencanaan pembangunan daerah: Teori dan applikasi*. Jakarta: Garamedia Pustaka Utama.

Li, M., Zhang, C., Xu, B., Xue, Y., & Ren, Y. (2020). A comparison of GAM and GWR in modelling spatial distribution of Japanese mantis shrimp (Oratosquilla oratoria) in coastal waters. *Estuarine, Coastal and Shelf Science*, *244*(January), 106928. https://doi.org/10.1016/j.ecss.2020.106928

Luqman, M., & Khan, S. U. (2021). Geospatial application to assess the accessibility to the health facilities in Egypt. *Egyptian Journal of Remote Sensing and Space Science*, *24*(3), 699-705. https://doi.org/10.1016/j.ejrs.2021.02.005

Mao, L., Yang, J., & Deng, G. (2018). Mapping rural–urban disparities in late-stage cancer with high-resolution rurality index and GWR. *Spatial and Spatio-Temporal Epidemiology*, *26*, 15-23. https://doi.org/10.1016/j.sste.2018.04.001

Misnaniarti, M., Hidayat, B., Pujiyanto, P., Nadjib, M., Thabrany, H., Junadi, P., … Yulaswati, V. (2018). Ketersediaan Fasilitas dan Tenaga Kesehatan dalam Mendukung Cakupan Semesta Jaminan Kesehatan Nasional. *Jurnal Penelitian dan Pengembangan Pelayanan Kesehatan*, *1*(1), 6-16. https://doi.org/10.22435/jpppk.v1i1.425

Mungmachon, M. R. (2012). Knowledge and local wisdom: Community treasure. *International Journal of Humanities and Social Science*, *2*(13), 174-181.

Muta'ali, L. (2015). *Teknik Analisis Regional untuk Perencanaan Wilayah, Tata Ruang dan Lingkungan* (1st ed.). Yogyakarta: Badan Penerbit Fakultas Geografi (BPFG) UGM.

Navis, A. A. (1986). *'Alam Takambang jadi Guru" Minangkabau customs and culture'*. Jakarta: Temprint.

Nugroho, I., & Dahuri, R. (2004). *Pembangunan Wilayah perspektif ekonomi, sosial dan lingkungan* (Cet.1). Jakarta: LP3ES.

Pribadi, D. O., Rustiadi, E., Panuju, D. R., & Pravitasari, A. E. (2018). *Permodelan Perencanaan Pengembangan Wilayah*. Bogor: Crestpent Press.

Putri, S. L., & Damayanti, M. (2017). Peran Sumber Daya Sosial Budaya dalam Pengembangan Pariwisata di kawasan Gunung Merapi Desa Umbulharjo dan Desa Kepuharjo. *Jurnal Ruang*, *3*(1), 1-10. https://ejournal2.undip.ac.id/index.php/ruang/article/view/3079

Rukmini, Rosihermiatie, B., & Nantabah, Z. (2012). Ketersediaan dan Kelayakan Ruangan Pelayanan Puskesmas berdasarkan Topografi, Demografi dan Geografi Indonesia. *Buletin Penelitian Sistem Kesehatan*, *15*(4), 408-417.

Rustiadi, E., Saefulhakim, S., & Panuju, D. R. (2018). *Perencanaan dan Pengembangan Wilayah* (4th ed.; A. E. Pravitasari, ed.). Jakarta: Yayasan Pustaka Obor.

Saragih, J. R. (2015). *Agricultural-based local economic planning and development, theory and application*. Yogyakarta: Pustaka Pelajar.

Schoneveld, G. C. (2017). Host country governance and the {African} land rush: 7 reasons why large-scale farmland investments fail to contribute to sustainable development. *Geoforum*, *83*, 119-132. https://doi.org/10.1016/j.geoforum.2016.12.007

Skorobogatova, O., & Kuzmina-Merlino, I. (2017). Transport infrastructure development performance. *Procedia Engineering*, 319-320. https://doi.org/10.1016/j.proeng.2017.01.056

Sosnovskikh, S. (2017). Industrial clusters in Russia: The development of special economic zones and industrial parks. *Russian Journal of Economics*, *3*(2), 174-199. https://doi.org/10.1016/j.ruje.2017.06.004

Surur, F., Sitorus, S. R. P., & Agusta, I. (2014). Pertimbangan aspek sosial budaya dan kearifan lokal dalam pengembangan Kawasan Danau Tempe Provinsi Sulawesi Selatan. *Jurnal Tataloka*, *16*(3), 168. https://doi.org/10.14710/tataloka.16.3.168-180

Sutriadi, R., Safrianty, A. A., & Ramadhan, A. (2015). Discussing cities and regencies in the context of Regional Rating System. Promoting communication, reaching sustainable growth. *Procedia Environmental Sciences*, *28*(2015), 166-175. https://doi.org/10.1016/j.proenv.2015.07.023

Tian, P., Li, J., Cao, L., Pu, R., Gong, H., Liu, Y., … Chen, H. (2021). Impacts of reclamation derived land use changes on ecosystem services in a typical gulf of eastern China: A case study of Hangzhou bay. *Ecological Indicators*, *132*, 108259. https://doi.org/10.1016/j.ecolind.2021.108259

Todaro, M. P., & Smith, S. C. (2012). *Economic development* (11th ed.). Boston, Mass: Addison-Wesley.

Vitasurya, V. R. (2016). Local wisdom for sustainable development of rural tourism, case on Kalibiru and Lopati Village, Province of Daerah Istimewa Yogyakarta. *Procedia - Social and Behavioral Sciences*, *216*(2016), 97-108. https://doi.org/10.1016/j.sbspro.2015.12.014

West Sumatra Statistical Agency, W. S. S. (2020). *Kecamatan Dalam Angka 2020*. Padang.

Wheeler, D. C., & Paez, A. (2010). Geographicaly Weighted Regression. In M. M. Fisher & A. Getis (Eds.), *Handbook of Applied Spatial Analisis Software Tools, Methods and Applications* (pp. 461-486). https://doi.org/10.1007/978-3-642-03647-7_17

Yin, J., Su, B., Fan, C., & Li, Q. (2020). Location of the public service facilities in an urban comprehensive park using a multi-hierarchy and multi-constrained configuration model. *Journal of Urban Management*, *9*(2), 205-215. https://doi.org/10.1016/j.jum.2020.04.001

Yu, W. (2020). Reachability guarantee based model for pre-positioning of emergency facilities under uncertain disaster damages. *International Journal of Disaster Risk Reduction*, *42*, 101335. https://doi.org/10.1016/j.ijdrr.2019.101335

Appendix

The results of the calculation of the index of service facilities

Sub-District	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Index
Ten Koto	1,507	0.437	1,533	0.334	1,402	0.166	0.748	0.135	0.625	0.829	2,604	0.000	1,631	1,419	0.835	14,206
Batipuh	1,264	0.000	2,091	0.490	3.087	0.244	0.549	0.000	1.147	1.105	1,912	0.000	1,589	2.182	1.242	16,901
South Batipuh	3,623	0.000	2,830	2.807	1.475	0.000	0.175	0.000	0.000	1,590	4.263	0.000	2.438	2.871	2.290	24,361
Pariangan	1.455	0.985	2,757	0.752	0.790	0.749	1.311	0.457	0.705	1,597	1,630	0.000	1.133	1,659	1,694	17,673
Five Clans	1.026	1.562	1,670	1.391	0.835	1.387	1,930	0.403	1,863	3.030	2,586	2.486	1,220	1.333	1,276	23,999
love	1.100	0.000	1,674	0.853	2,688	0.000	0.000	0.000	1,199	0.996	1,110	0.000	1.335	1,624	1,380	13,959
Tarab . River	0.635	0.000	1992	0.246	1.552	0.245	0.429	0.000	0.692	0.948	2.135	0.000	2,583	1,829	1,677	14,965
Salimpaung	1.344	0.000	1970	0.000	2,919	0.000	0.000	0.000	0.976	1.454	3.013	0.000	1.019	2.272	2,395	17.363
New Cape	1,470	0.000	2,351	1,139	2,395	0.000	1.135	0.000	1.068	0.287	0.989	0.000	1.909	3.164	2,967	18,875
Stem Anai	1,410	0.000	1.141	1,561	0.984	0.778	0.194	0.127	0.585	1.070	1.354	0.000	0.255	1.114	1.032	11,606
Lubuk Alung	1,461	2.118	1,604	0.162	0.680	0.484	0.282	0.131	0.909	0.903	2.104	0.674	0.924	1.369	1.447	15.253
Sintuak Toboh Gadang	1,506	0.000	1977	1,945	1,635	0.388	0.097	0.000	0.000	0.236	1,350	0.000	1.186	0.295	0.000	10,614
Do Tapakis	0.956	0.970	2.176	2,592	1,557	0.738	0.553	0.000	1.041	0.952	0.964	0.000	1.111	1,734	1.516	16,860
Nan Sabari	0.670	0.680	2.163	1,557	0.545	1.293	0.065	0.000	0.486	1.015	0.901	0.000	0.668	3.057	3.328	16,427
2 X 11 Six Circles	0.986	0.000	1.383	0.000	0.803	0.381	0.666	0.310	1.075	1,756	2,985	0.000	4.217	1.503	0.623	16,689
Six Circles	0.942	0.000	2,302	0.365	0.767	0.000	0.091	0.000	1.027	1,908	1,267	0.000	1.090	3.553	3.426	16,738
2 X 11 Planting Wood	1.406	0.713	1,299	0.272	0.572	0.814	0.271	0.110	0.511	0.897	1.181	0.000	2.898	1,570	0.890	13.406
Vii Koto Sungai Sariak	0.803	0.543	2.477	1.037	0.436	0.000	0.258	0.000	0.583	0.754	0.360	0.000	1,289	2,922	2,328	13,791
Patamuan	0.567	0.000	1966	0.439	1,847	0.876	0.000	0.000	0.412	0.596	3,430	0.000	1.387	2.121	2004	15,645
Sago Field	1.114	0.000	3,741	0.000	1,814	0.000	0.000	0.000	1.618	0.292	2,995	0.000	3.082	3,413	3.361	21,429
V Koto Timur	1,265	0.000	4.636	1,470	3.090	0.000	0.122	0.000	1.378	0.861	3.827	0.000	3.551	4.448	4.855	29,504
mature	1.187	0.000	4.062	3.678	3.866	0.917	0.916	0.560	0.862	1.097	4.389	0.000	1,470	1,951	2,100	27.055
Iv Koto	1,645	0.000	2.464	1,274	2009	0.000	0.952	0.000	0.597	0.567	2.211	0.000	0.905	0.762	1.054	14,440
Malalak	0.000	0.000	4.064	3.396	3,570	0.000	0.000	0.000	0.000	0.000	0.737	0.000	3.027	0.777	1,264	16,834

Sub-District	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Index
Banuhampu	1.126	1.372	0.835	1.222	0.734	0.522	0.739	0.212	0.327	0.182	1969	0.000	0.328	0.174	0.381	10,124
Pua River	1.144	0.000	1.089	1.182	1.242	0.000	0.736	0.000	0.554	0.308	1,282	0.000	0.812	0.506	0.751	9,607
Ampek Angkek	0.925	0.000	0.955	1.003	0.603	0.286	1.071	0.174	0.672	1.008	1,741	0.000	0.204	0.295	0.597	9.535
opium	1,689	0.000	1,636	0.000	0.000	0.000	1,223	0.133	0.000	0.372	1987	0.000	0.939	1,630	2,359	11,967
meatball	1,131	0.574	1,751	0.438	2,302	0.655	2.237	0.178	0.821	0.812	3.040	0.000	1.382	1,290	1,659	18,271
Kamang	2,799	0.000	2,311	1,627	1,140	0.541	0.878	0.440	0.762	1.344	3.293	0.000	1,799	1,881	2,688	21.502
Kamang Magek	1920	0.000	2,894	1,860	3.128	1,854	0.556	0.151	0.697	0.709	1,291	0.000	1.118	1.272	1.396	18,847
Palupuh	0.714	0.000	3.812	0.553	2,324	0.000	0.413	0.000	0.000	1.377	4.318	0.000	1.842	3.938	3,422	22,713
Payakumbuh	0.808	0.000	1,713	1.252	0.877	0.832	0.104	0.085	0.782	1.109	2,535	0.000	0.465	0.808	0.797	12.165
Akabiluru	0.693	0.000	2.276	1.073	1,692	0.803	0.201	0.000	0.503	0.880	2.095	0.000	1,777	1.173	0.920	14,086
Badger	1.031	0.000	1,747	1.065	0.000	0.531	0.199	0.000	0.250	1.049	1.155	0.000	0.695	0.835	0.411	8,967
Lareh Sago Halaban	0.501	0.000	2,062	1,941	0.816	0.580	0.000	0.000	0.910	0.688	1.010	0.000	1.183	1.038	0.728	11,457
Situjuah Limo Nagari	0.863	0.000	2,644	1.338	3.515	0.667	0.083	0.000	0.941	1,279	1,741	0.000	0.968	1,236	0.937	16,213
Harau	0.872	0.354	1,407	1.351	0.852	0.404	0.101	0.384	0.886	1.474	3.047	0.000	0.711	0.489	0.268	12,597
Guguak	1.544	0.000	2,715	1.396	1,677	0.398	0.000	0.000	0.561	1.047	2.076	0.000	1.226	0.854	0.382	13,875
maybe	0.348	0.000	1,533	0.810	1,702	0.000	0.000	0.000	0.759	0.797	2,576	0.000	0.710	1.126	0.631	10,993
New Koto Base	0.926	0.000	2,354	0.956	3.015	0.238	0.119	0.097	0.448	0.594	3.319	0.000	2,499	2,334	1.999	18,898
Wrap the Bay of Mourning	0.374	0.000	1.322	2,901	0.610	1,735	0.650	0.471	0.272	1,749	2,769	0.000	0.791	1.331	1.253	16,226
Refinery Ground	0.500	0.339	0.384	1.422	0.543	1.675	0.773	0.000	1.333	1.183	0.673	0.000	0.147	0.297	0.407	9,677
Lubuk Begalung	0.533	0.155	0.000	0.708	0.496	1,881	1.087	0.096	0.332	0.680	1.023	0.000	0.102	0.208	0.332	7,632
South Field	1.581	0.963	1.055	1.960	0.000	1,954	0.885	0.497	0.919	2,332	1,701	0.511	1.100	0.334	0.426	16,220
East Desert	1.909	0.727	1.083	2.496	0.389	3,410	0.898	0.637	1,733	2,553	1,524	2,699	0.000	0.467	0.685	21,208
West Desert	4.128	5.447	1.197	2,399	0.672	2.870	4.621	4,800	5.846	6.064	1,665	5.336	0.270	0.755	0.854	46,924
North Field	2007	2.173	0.571	1.555	0.436	2,997	1,679	1.093	1,846	3,520	1.079	1,729	0.874	0.652	1.078	23,291
Nanggalo	0.767	2.181	0.430	1,783	1,000	3.319	0.652	0.096	0.669	0.946	1,651	0.000	0.581	0.494	0.653	15,223

Sub-District	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Index
Kuranji	0.689	0.382	0.233	0.728	0.612	1,500	0.314	0.039	0.501	0.721	1.516	0.405	0.213	0.662	0.569	9.085
Pauh	0.757	0.769	0.013	1,467	0.206	2.145	1.145	0.040	1,283	1.152	1,867	0.816	0.021	0.791	0.900	13,371
Koto Tangah	0.773	0.784	0.060	0.561	0.157	0.709	0.168	0.030	0.351	0.915	0.032	0.468	0.379	1.144	0.781	7.313
West Long Field	1,622	2,634	1,467	2010	1.057	1.503	3.506	0.918	1,885	1,896	1.090	1.048	1,641	0.463	0.394	23.135
East Long Field	5.077	1,586	1.428	1.513	0.000	0.905	1,885	0.614	0.567	1,837	1,838	1.262	2.051	0.590	0.520	21,673
Lambau	3,473	3.085	0.684	2018	2.474	2.850	1,299	5,731	5.360	2,746	1,459	2.104	0.976	0.000	0.029	34,287
Bathing in Koto Selayan	1,813	1,841	0.649	1,405	0.295	2,382	1,400	1.311	0.263	0.467	1.585	0.586	1,879	0.327	0.397	16,600
Aur Birugo Tigo Baleh	1,410	2,147	0.663	1,638	0.574	3.539	0.204	1,108	1,536	1,812	2,369	2.278	0.723	0.339	0.411	20,750
West Payakumbuh	1,608	0.363	0.361	1,938	1.455	1,794	4,551	0.393	1,427	2,071	2,402	1.154	1,291	0.278	0.170	21.255
South Payakumbuh	5.005	1,694	0.688	2,585	0.000	1,289	1.610	0.262	2.424	2,519	1.122	0.000	4,801	1.070	0.634	25,703
East Payakumbuh	2,673	0.678	0.813	1.035	0.544	0.258	0.387	0.735	1,213	2,998	0.000	2.159	0.666	0.342	0.349	14,852
North Payakumbuh	1.474	0.599	1.660	2,513	1.441	0.683	2,333	0.463	1,499	2,993	2.180	1.906	0.544	0.397	0.468	21,155
Lamposi Tigo Nagori	2.811	1.902	0.914	2,904	0.000	0.000	0.362	0.294	0.681	1,654	0.000	0.000	2,534	1.342	1.293	16,690
South Pariaman	1.434	0.000	1.305	5.186	0.779	2,586	1,753	0.451	0.695	2,312	2.893	1.545	2,594	2.259	2.246	28.038
Central Pariaman	2,402	1,219	1.383	3.257	1,956	3.015	3.071	3,492	2.835	3.286	2018	2,911	0.561	1.509	1,781	34,696
East Pariaman	1.513	2,047	1991	2,734	1,642	1.168	1.070	0.475	0.000	0.499	1.356	1,629	2,756	2,564	2,666	24.111

International Journal of Sustainable Development and Planning
Vol. 17, No. 1, February, 2022, pp. 185-193
Journal homepage: http://iieta.org/journals/ijsdp

Mapping the Diversity of Regional Characteristics Towards Sustainable Economic Strategic Area Development: A Case Study of West-East Corridor of West Sumatra Province

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https://doi.org/10.18280/ijsdp.170118

Received: 14 December 2021
Accepted: 28 January 2022

Keywords:
regional development, development strategy, sustainability development, urban-rural development, spatial analysis

ABSTRACT

There are different characteristics distinguishing a region from the others, thereby, leading to the diversities in the regional potentials and problems as well as the strategic regional development policies to be implemented. The East-West Corridor is one of the eleven provincial strategic economic areas in West Sumatra. It covers nine regencies or cities and 65 sub-districts with different characteristics and typologies and this leads to diversity in the strategies to develop this area. This study aims to determine the diversity associated with the characteristics and typologies of the strategic area of the East-West Corridor. This involved using Principal Component Analysis (PCA) analysis technique, spatial clustering analysis, and overlay analysis. Moreover, the regional characteristics and typologies were grouped based on 17 observational variables used in producing four main components including trade and tourism services, agriculture, livestock/fishery, and tourism. The results of spatial clustering analysis produced 3 clusters which are the urban, desa-kota, and rural areas while the overlay analysis produced ten regional characteristics and typologies used as the basis to make strategies and policies for each region's development and to increase investment opportunities in the strategic area of West-East Corridor and the Province of West Sumatra in general.

1. INTRODUCTION

Strategic areas are regions prioritized in order to accelerate regional development through the utilization of local resources [1] and the improvement of community welfare [2]. They are considered very important for regional development [3] due to their significant multiplier effect on the region [4]. They also have specific characteristics distinguishing them from other regions [5]. Distinguishing characteristics based on economic potential, topography, geography, and regional typology. The terminologies used for strategic areas vary with different countries and these include the Artic Zone [6], specific economic zone [7], airport economic zone [8], potential border zone [9], river economic zone [10-12], special zone [13], special economic zone [14-16], special border economic zone [17], and heritage corridor [18].

The conceptual role of strategic areas is to encourage the regional economy [3, 14, 19]. This means they are expected to act as the growth centers or corridors which can be used to drive economic growth [20]. They are normally designed to be the prime mover of development in a particular area. Moreover, there is usually a concentration of population conducting several economic and social activities with a strong influence on the development of the surrounding area.

These strategic areas also have characteristics distinguishing them from other regions [5] and this means they have different potentials and problems, thereby, leading to the need for specific strategies for development in each region [21, 22]. Some of the areas studied in previous studies include industrial [16, 23], trade [15], service [7], forest [24], as well as mining and energy areas [10]. It was discovered that the differences in the characteristics of these areas led to a variation in the factors influencing their development [25].

West Sumatra Province has eleven strategic economic areas [26] and one of them is the west-east corridor [27] which has specific characteristics observed to be different from those of others. This, therefore, makes the area has specific problems [28] which require a particular approach to handle. The corridor covers several administrative areas such as the Padang City, Padang Panjang City, Pariaman City, Bukitinggi City, Payakumbuh City, Padang Pariaman Regency, Tanah Datar Regency, Agam Regency, and Limapuluh Kota Regency. It is located on the west-east axis and has the highest frequency of economic movement of goods and services as well as a higher growth rate than other provinces in the western part of Sumatra. Moreover, the west and east axes also have tourism potential in addition to the existence of a trade and service corridor. It is important to note that each of the nine regencies and cities in this area has different potentials and characteristics, and this means the development of the East-West Corridor strategic area requires considering the diversity in these potentials [29].

The strategic economic area in West Sumatra is characterized by trade and services, ocean fisheries, industry, and tourism in line with the potentials and problems of each region. This means the response and development strategy to be employed needs to be based on each region. Determination of regional characteristics and typology will help local governments to make regional development policies and strategies. Therefore, this present study was conducted to determine and analyze the characteristics and typologies of the strategic economic areas in a specific corridor in order to ensure the sustainable development of the region.

This study uses factor analysis in the form of Principal Component Analysis (PCA) to reduce many variables into new variables that are independent of each other and do not have multicollinearity problems. PCA analysis in research related to regional development is often associated with Geographic Information Systems (GIS) to study spatial dynamics. Regional typology classification is done using spatial clustering analysis.

2. METHOD

2.1 Study area

This research was conducted in the West-East Corridor which consists of nine (9) regencies/cities and sixty-five (65) sub-districts with a sub-district analysis unit as indicated in Figure 1. The nine regencies/cities include Agam Regency, Limapuluh Kota Regency, Tanah Datar Regency, Padang Pariaman Regency, Padang City, Pariaman City, Padang Panjang City, Bukittinggi City and Payakumbuh City.

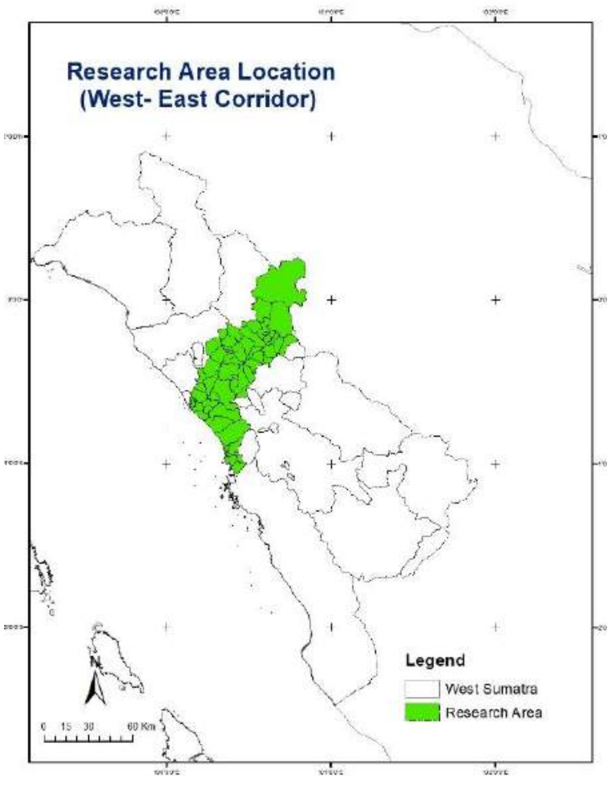

Figure 1. Research area location

The strategic economic areas of the West-East Corridor were delineated based on the definition of arterial roads as stated in Government Regulation number 34 of 2006 concerning Roads. Also, PD 5-01-2004-B concerning Construction and Building Guidelines: Criteria for space utilization and control of space utilization along with primary arterial network between cities. It was discovered from the document that the arterial roads continuously connect national, regional, and local activity centers to environmental activity centers.

2.2 Data collection and processing

The secondary data from the Central Bureau of Statistics in Kecamatan Dalam Angka 2020 [30] were used in this study. They are multidimensional because they combine both spatial and non-spatial data as indicated in Table 1. This data provides objective results to make it easier to formulate strategies and policies to increase investment and develop the East-West Corridor. The variables used are variables that represent the region's economic potential and a characteristic of regional typology [7, 9, 15].

The analysis of the diversity associated with the characteristics of the West-East Corridor was conducted in two stages. The first focused on determining the region's characteristics based on its potential using the method of Principal Component Analysis (PCA) while the second involved grouping the typologies through the Spatial Clustering method based on the weighting results on each of the observation locations. This spatial clustering is a simple concept observed to have been implemented in different areas such as landscape management [31], irrigation management [32], national food policy [33], the efficiency of the infrastructure of the region [34], and to determine the geographical pattern and characterize individual and environmental sociology [35].

Table 1. Observation variables and operational definitions

Variable	Operational definition
Production of agriculture (ton)	Total production of agricultural products
Fishery production (ton)	Total production of fishery products
Livestock and Poultry Population (head)	Total population of farm animals
Tourist sites (unit)	Number of tourist attraction locations
Restaurant (unit)	Number of restaurants
Hotel (unit)	Number of hotels
Inn/motel/guesthouse (unit)	Number of Inns/motels/guesthouses
Hospital (unit)	Number of hospitals
Shops/trades (unit)	Number of Shops/Trades
Bank(unit)	Number of state, private, and rural banks
Cooperative (unit)	Number of Active Cooperatives
Agricultural harvest area (ha)	Total harvested area of agricultural products
Tourist visit (person)	The number of both national and foreign tourist visits
Rice Field Area (ha)	The total area of rice fields
Population density (people/ha)	Total population versus regional area
Forest area (ha)	The total area of forest land
Clean water user households (KK)	Number of households using Local Water Supply Utility (PDAM) for clean/drinking water

Principal Component Analysis (PCA) was used to determine the characteristics of the observations grouped based on the region's potential. This is due to its ability to transform a data structure with a variable free (x) which is mutually correlated into a new data structure with one or more new variables containing a combination of independent variable (x) liveliness [36]. PCA can also simplify the origin of a polynomial variable into a new small variable with relatively unchanged diversity [37]. This method has been applied in the process of planning and developing a region to assess the spatial dynamics [38], socio-economic [39], and ecology [40] of the region as well as to serve as an evaluation tool [41].

PCA is a multivariate analysis that transforms the correlated origin variables formed into uncorrelated new variables. It reduces the number of these variables to ensure they have smaller dimensions which can explain most of the diversity of the original variables. This dimension simplification can be achieved through the percentage of the data diversity criteria described by the first few significant components. For example, when the first few significant components have more than 70% of the original data diversity or have a root (λ) greater than 1, then, it is sufficient to analyze up to the significant component. Moreover, the first significant component represented by PC_1 contains a large amount of total data variation, and this means it can be linearly combined with variable X_i; i=1, 2, ..., p.

$$\begin{aligned} PC_1 &= a_{11}X_1 + a_{12}X_2 + \cdots + a_{1p}X_p \\ PC_2 &= a_{21}X_1 + a_{22}X_2 + \cdots + a_{2p}X_p \\ PC_p &= a_{p1}X_1 + a_{12}X_2 + \cdots + a_{1p}X_p \end{aligned} \quad (1)$$

where, PC_1 is the first factor, PC_2 is the second factor, and the same applies to the others. This sequence reflects the magnitude of the variance of each variable noted as var (PC_1) ≥ var (PC_2) ≥ ... ≥ var (PC_p). In PCA, the variants of most variables are expected to be as small as possible to ensure the PC variables obtained have a small number but large variants.

The external results from the main component variables of PCA analysis were grouped into three clusters according to the typology of the region using spatial clustering analysis. This method involves grouping several objects in a class or cluster such that the objects in one cluster have a remarkable resemblance with each other but have none with those in other clusters [42, 43]. The clustering was reported to have previously been conducted using distance sizes such as Euclidean Distance, Mahalanobis, or Diagonal Distance [44]. The application of this technique is in two categories with the first being the determination of the existence of clusters in a study area while the second involves identifying the location of the cluster [45].

Clustering techniques are divided into hierarchical and partitional aspects [43]. The hierarchical aspect usually focused on dividing the entire data set into clusters such as single linkage, complete linkage, average linkage, and average group linkage. Meanwhile, the partitional aspect does not have a hierarchical structure but involves each cluster having a central point (centroid) to minimize the distance (dissimilarity) of the entire data to the center of the respective cluster. Some examples of the partitional clustering techniques include K-Means, Fuzzy k-Means, and Mixture Modeling.

The Fuzzy k-Means method is a data grouping technique which involves determining the existence of each data in a cluster based on the degree of membership. Moreover, the Fuzzy k-means algorithm uses fuzzy models which allow all the data in a group to be formed with Boolean membership degrees between 0 and 1 [44]. The distance in this method can be calculated using Cosine Dissimilarity, Jaccard Dissimilarity, and Euclidean Distance. This present study used the Cosine Dissimilarity as indicated in Eq. (2). Cosine dissimilarity is a distance that characterizes fuzzy k-means and is based on the cosine of the angle between two observations. The wider the angle, the greater the cosine dissimilarity, which approaches 1, where 1 is a 90° angle which means that no variables are shared between observations.

$$Distance\ (p,q) = 1 - \cos(p,q) = 1 - \frac{pq^T}{\left|\left[[A]\right]\left[[B]\right]\right|} \quad (2)$$

Spatial clustering analysis is often used in designing the composition and structure of cities [46], grouping flood areas [47], and determining land use zones [48]. It was, therefore, applied in this study because of the similarity in the adjacent objects [42].

3. RESULTS

3.1 Factors determining the characteristics and typologies of the region

The strategic area of the west-east corridor was developed based on the diversity of the region's potentials [25, 29]. For example, the unique characteristics of West Sumatra [27] led the handlers to apply different strategies and policies in each region [22, 49]. Moreover, the diversity observed in the characteristics of the West-East Corridor is expected to be the prime mover for regional development and increased investment in this strategic economic area and West Sumatra in general.

The PCA analysis used 17 variables presented in Table 1 with a minimum factor filter of 70% as indicated in Figure 2 to determine the diversity of the characteristics and typologies of the study area. Moreover, the test conducted using eigenvalues was able to produce four factors as shown in Table 2. It is important to note that the eigenvalues show the reduction of all data matrices on each variable:

Table 2. Eigen value, variability, and cumulative values

	F1	F2	F3	F4
Eigenvalue	7.560	1.990	1.732	1.070
Variability (%)	44.469	11.703	10.188	6.294
Cumulative %	44.469	56.172	66.360	72.654

The diversity of the factors was described using the eigenvalues > 1. It was discovered that the eigenvalue of the first factor (F1), 7,560, was able to explain the diversity of data by 44,469%, the second factor (F2) with 1,990 was able to explain 11.703%, the third factor (F3) with 1,732 explained 10.188%, and the fourth factor (F4) with 1,070 only explained 6.294%. Moreover, the analysis of the main components reduced the 17 variables to 4 as indicated in the Scree plot graph presented in Figure 2. The reduction process led to the loss of information by 27.346% and this means a diversity of variation of 72.654% or >70% was produced by the main components [50]. This further shows that the minimization process of the principal component analysis method was able to maintain 72.654% of the variable attribute information for further analysis.

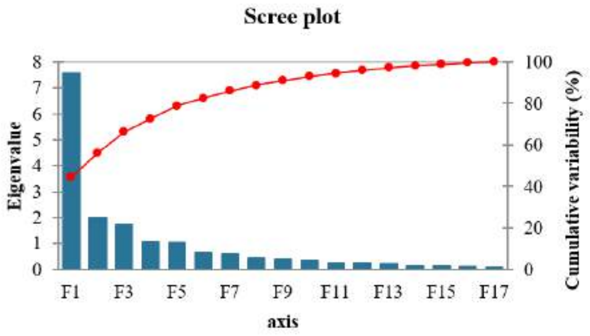

Figure 2. Scree plot uses a minimum filter factor of 70%

PCA analysis was also conducted using Bartlett's test and Kaiser-Meyer-Olkin values [51]. The aim of Bartlett's test was to determine the correlation between the variables, and the results obtained based on the following hypothesis are presented in Table 3.

H_0: There is no significantly different correlation with 0 between variables

H_1: At least one of the correlations between variables differs markedly by 0

The p-value result showed a value smaller than $\alpha = 0.05$ and this means H_0 was rejected while H_1 was accepted.

Table 3. Bartlett's test

Component	Value
Chi-square (Observed Value)	771.119
Chi-square (Critical value)	164.216
DF	136
p-value (Two-tailed)	<0.0001
alpha	0.050

The Kaiser-Meyer-Olkin value (KMO) was used to assess the overall adequacy of sampling and variables for each indicator using correlation values between the variables as indicated in Table 4. It is important to note that variables are usually scaled worthy of analysis when they have a KMO value ≥ 0.5 [51]. The average value recorded in this study was 0.839 and this indicates the variables can be analyzed.

Table 4. Kaiser-Meyer-Olkin test of each variable

Variable	KMO
Production of agricultural (ton)	0.854
Fishery production (ton)	0.512
Livestock and Poultry Population (head)	0.589
Tourist sites (unit)	0.692
Restaurants (unit)	0.913
Hotels (unit)	0.850
Inns/motels/guesthouses (unit)	0.914
Hospitals (unit)	0.933
Shops/traders (unit)	0.840
Banks(unit)	0.879
Cooperative (unit)	0.842
Agricultural harvest area (ha)	0.887
Tourist visit (person)	0.873
Population density (people/ha)	0.866
Clean water user households (KK)	0.790
Paddy Field Area (ha)	0.783
Forest area (ha)	0.746
KMO	0.839

The main components were grouped into four factors based on the weight of each variable as indicated in Table 5. The first factor (F1) consists of variables such as the numbers of restaurants, hotels, hostels/inns/guesthouses, hospitals, shops, banks, cooperatives, the population density, households using clean water, and the number of tourist visits. This F1 was grouped as trades and tourist services. The second factor (F2) includes the variables such as agricultural production, land harvest, rice field, and forest area, and was grouped as agriculture. The third factor (F3) consists of variables such as fishery, livestock, and poultry production, and was grouped as fisheries/livestock. Meanwhile, the fourth factor (F4) includes the number of tourist sites variable and was grouped as tourism.

Table 5. Eigenvalue score on each factor

Factors	Variables	Eigenvalue
Factor 1 (Trade and Tourism Services)	-Restaurants -Hotels -Inns/Motels/Guesthouses -Hospitals -Trades -Banks -Cooperatives -Tourist visits -Clean water user households	7,560
Factor 2 (Agriculture)	-Production of agricultural -Agricultural harvest area -Rice Field Area -Forest area	1,990
Factor 3 (Fisheries-livestock)	-Fishery production -Livestock and Poultry Population	1,732
Factor 4 (Tourism)	-Tourist sites	1,070

The spatial pattern indicates the independence of each factor [50]. It was also discovered from the grouping that the main components of each location have a different coefficient indicated by the spatial pattern of each factor as presented in Figure 3.

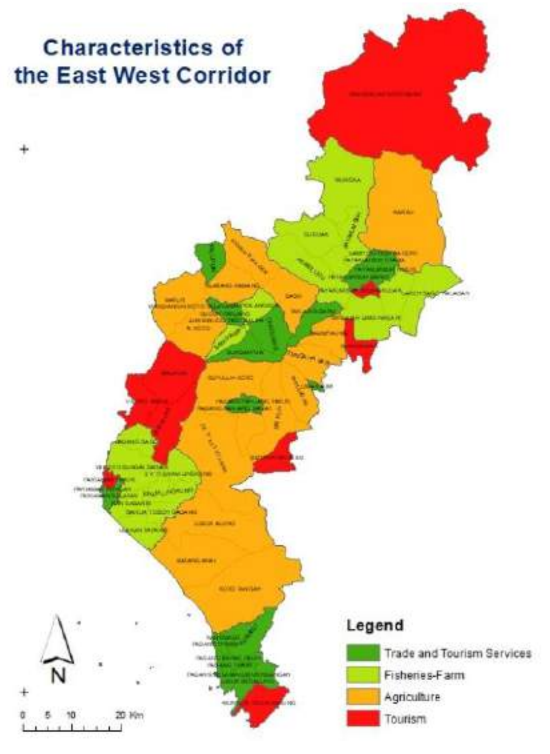

Figure 3. Characteristics of west-east corridor (PCA result)

The districts with trade and tourism services concentrated in the city area include Padang City, Pariaman, Padang Panjang, Bukittinggi, Payakumbuh, and Lima Kaum Sub-district of Limapuluh Kota Regency. Those with agriculture include Koto Tangah District, Batang Anai, Lubuk Alung, 2 x 11 Kayu Tanam, Sepuluh Koto, Batipuh, Pariangan Sungai Tarab, Salimpaung, IV Koto, Matur, Tilatang Kamang, Baso, Kamang Magek and Harau. Those related to livestock and fishery are Ulakan Tapakis District, Sintuak Toboh Gadang, Nan Sabaris, Enam Lingkung, 2 x 11 Six Lingkung, VII Koto Sungai Sariak, Padang Sago, Banuhampu, Ampek Angkek, Situjuah Limo Nagari, Aka-biluru, Payakumbuah, Luak, Lareh Sago Halaban, Guguak, and Mungka. Meanwhile, those observed to have tourism potential in the form of both natural and cultural tourist attraction sites include Bungus Teluk Kabung District, Pariaman Timur, Batipuh Selatan, Pattamuan, V Koto Timur, Malalak, Sungayang, South Payakumbuh, and Pangkalan Koto Baru.

3.2 Characteristics and typologies of the regions

The typologies were grouped through spatial clustering analysis using the results obtained from analyzing the main components. This spatial clustering method involves grouping objects into clusters based on their similarity [45]. For the purpose of this present study, the Fuzzy k-Mean (Fk-M) method which involves grouping data using the value of a certain degree of membership was applied [44].

The partition matrix in the form of n x m was also used where n is 65 which is the number of sub-districts and m is 4 which represents the main component of the PCA analysis. This means a 65×4 matrix was used with cosine dissimilarity which is the distance that characterizes the fuzzy k-means and is usually determined based on the cosine angle between the two observations. A wider angle usually has greater cosine dissimilarity approaching 1 which represents 90° and this signifies no variable is divided between the observations. It is important to note that the initial parameter values set in this study include 3 clusters which are considered the base for the hierarchy of the regions. Meanwhile, the maximum iteration was 100, the smallest expected error was 10^{-5}, and the initial iteration was 1. The elements of the initial partition matrix U65×4 (initial partition) were determined using random numbers (μ_{ik}, i=1, 2, ..., c; k=1, 2, ..., n).

Table 6 shows that the fuzzy grouping of k-means using 3 clusters and 9 iterations produced Wilks' Lamda value of 0.064. It is important to note that a smaller Wilk's Lamda value indicates a better cluster accuracy rate. Moreover, the grouping in each cluster based on the profile or mean plot presented in Figure 4 showed that the highest value of cluster 1 (red) was in F1, cluster 2 (blue) in F3, and cluster 3 (green) in F2.

Figure 5 shows the silhouette coefficient value. This silhouette coefficient is a method normally used to determine the quality and strength of clusters [52]. The value is between -1 to 1 and the closeness to 1 indicates better grouping of data in a cluster and vice versa. The values for the three established clusters in this present study were found to be close to 1 such that cluster 1 has 0.703, cluster 2 has 0.528, and cluster 3 has 0.435, thereby, leading to an average of 0.564. This means the data selected for the grouping were quite precise considering the fact that the average value is close to 1.

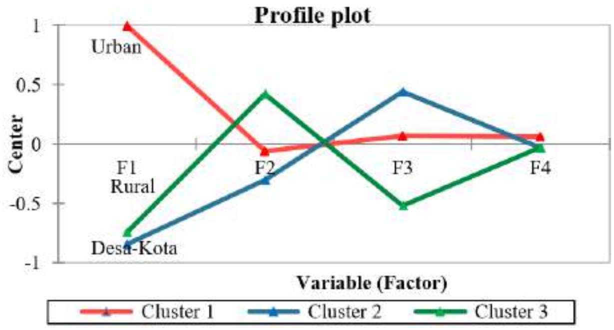

Figure 4. Profile or Mean Plot of each cluster, cluster 1 (red) has a maximum value at F1, cluster 2 (blue) has a maximum value at F3, and cluster 3 (green) has a maximum value at F2

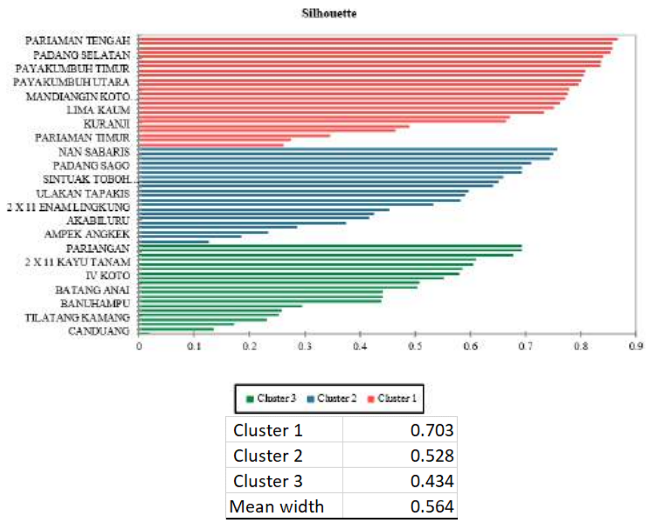

Figure 5. Silhouette coefficient per cluster with cluster 1 having 0.703, cluster 2 has 0.528, cluster 3 has 0.435, and the average is 0.564

The typologies were set to three clusters of urban, desa-kota, and rural areas based on regional characterizer variables [53]. The variables in Factor 1 (F1) include the number of restaurants, hotels, motels/guesthouses, hospitals, banks, cooperatives, tourist visits, as well as population density, and household water users. This means (F1) is an urban characterizer and this led to the grouping of cluster 1 (red) in urban areas. Moreover, the variables in Factor 2 (F2) include agricultural produce, agricultural harvest area, rice field area, and forest area, and this means F2 is a village characterizer, thereby leading to the grouping of cluster 3 (green) in the rural area while cluster 2 (blue) which mixes feeds between urban and rural is grouped in the desa-kota area [54]. The silhouette coefficient value in Figure 5 showed that cluster 1 which was grouped into urban areas is the best followed by cluster 2 in desa-kota, and cluster 3 in rural areas.

Table 6. Summary of Fk-M

Number of clusters	Iterations	Criterion (log)	Between-classes	Within-class variance	Wilks' Lambda test	Mean width
3	9	2.635	79.978	5.511	0.064	0.564

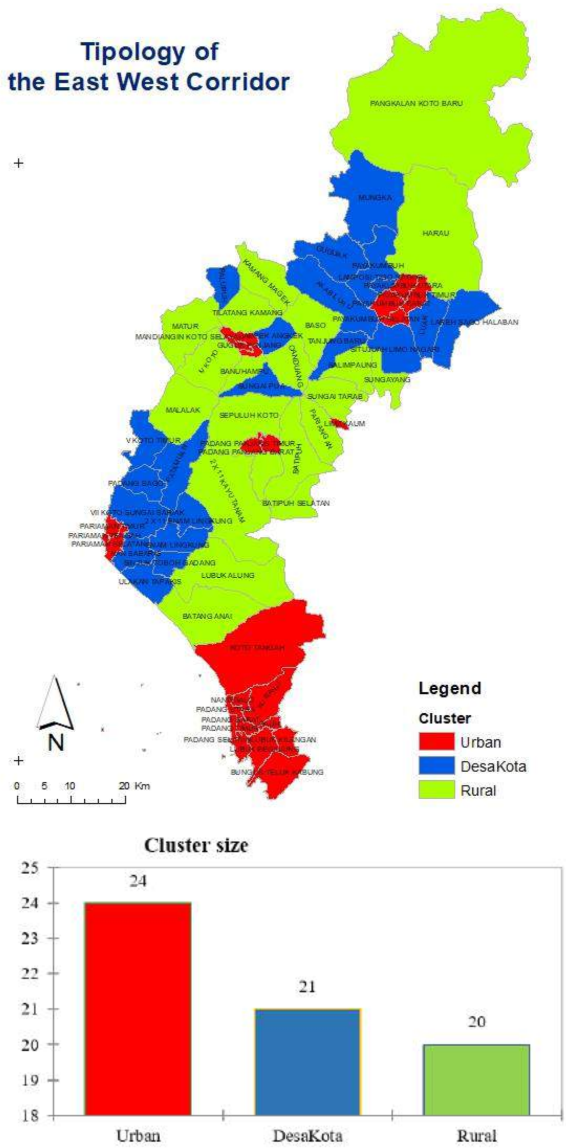

Figure 6. Typologies of west-east corridor (Fk-M analysis result)

Figure 6 shows the typological grouping of each cluster. It was discovered that cluster 1 typology which is an urban area consisting of 24 sub-districts is located in districts such as Padang City, Pariaman, Padang Panjang, Bukittinggi, and Payakumbuh with only one subdistrict in Tanah Datar Regency Lima Kaum District. Moreover, cluster 2 typology which is a desa-kota consisting of 21 sub-districts is generally located in the regency area while cluster 3 typology which is in rural areas has 20 sub-districts and is also generally located in the regency area.

The characteristics of each region were determined using PCA analysis in Figure 3 while the typologies were obtained from the Fk-M analysis as indicated in Figure 6. They were both further analyzed using overlay analysis methods to show the diversity in each region of the West-East Corridor.

The overlay analysis produced ten characteristics and typologies as indicated in Figure 7. It was discovered that trades and tourism services cluster 1 (urban) consists of 20 districts, cluster 2 (desa-kota) consists of 3 districts, and cluster 3 (rural) consists of 1 district. Moreover, agriculture cluster 1 (urban) consists of 1 district, and cluster 3 (rural) consists of 14 districts while fisheries/livestock cluster 2 (desa-kota) consists of 16 districts and cluster 3 (rural) consists of 1 district. The findings further showed that tourisms cluster 1 (urban) consists of 3 districts, cluster 2 (desa-kota) consists of 2 districts, and cluster 3 (rural) consists of 4 districts. The characteristics and typologies pattern showed that they are both spread evenly throughout the west-east corridor.

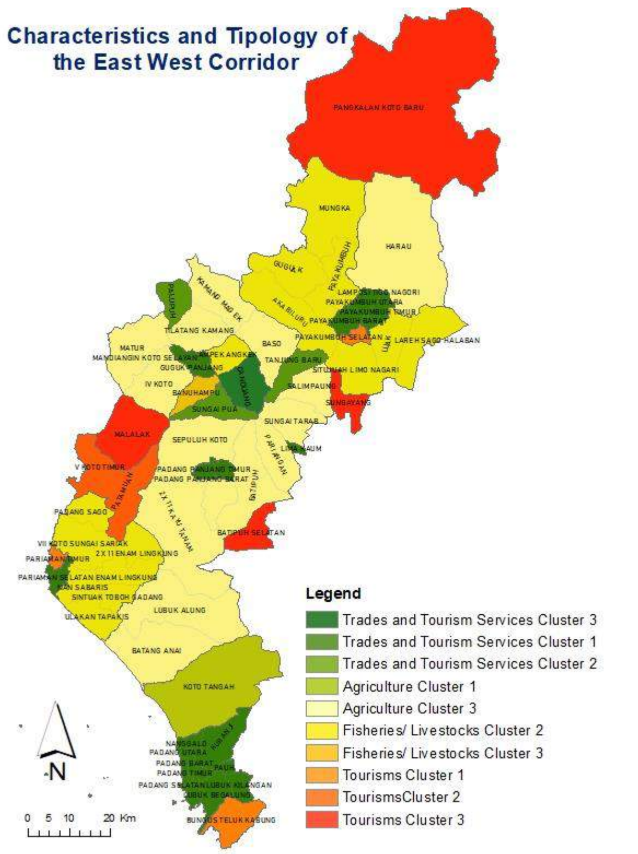

Figure 7. Overlay analysis between characteristic (PCA result) and typology (Fk-M analysis result) each region

4. DISCUSSION AND CONCLUSIONS

The terms used for strategic areas differ with countries as previously stated [14] such as industrial free zone, economic zone, special economic zone, specific economic zone [16], airport economic zone [8], potential border zone [9], river economic zone [10, 11, 12], special zone [13], special border economic zone [17], and heritage corridor [18]. It is also important to reiterate that the differences in the development potentials of each region lead to the need to implement specific strategies for the development process.

The West-East Corridor is one of the strategic areas in West Sumatra. It consists of 9 regencies/cities and 65 sub-districts with different characteristics [49, 27]. The diversity of characteristics of the west-east corridor distinguishes the region from other areas in West Sumatra [22]. It was discovered that the characteristics and typologies of the corridor include trade zone and tourism services cluster 1 (urban), cluster 2 (desa-kota), and cluster 3 (rural) as well as agricultural zone cluster 1 (urban) and cluster 3 (rural). Moreover, it also has fisheries/livestock zone cluster 2 (desa-kota), cluster 3 (rural), and cluster 1 (urban) as well as tourist zone cluster 2 (desa-kota) and cluster 3 (rural). The problems associated with each of them vary and this leads to the differences in the strategies and policies to be applied in each region.

This means the development strategy to be implemented in a region needs to be in line with the characteristics of the region. For example, the special economic zone in India is characterized as an industrial area [19] and the regional development strategy in the zone was focused on infrastructure to support industrial development, netting private involvement in investment activities, technological development, and tax reduction. The potential border zone in Thailand is designated an industrial and trade zone [9], and the strategy for regional development was focused on promotion and investment policies, open economic activities in border areas, integration programs between centers and regions, the conduct of mutually inclusive growth, and development of economic cooperation between countries.

The strategic economic area in West-East Corridor is one of the regions expected to become a prime mover of the West Sumatra economy. The realization of this objective requires tailoring policies and strategies [55, 56] in line with the characteristics and typologies of each sub-district in the corridor. Therefore, the grouping conducted in this study is designed to assist local governments in making policies [57] to realize sustainable development [58] in the West-East Corridor and also makes it easier for investors [59] to make an informed investment decision.

This research becomes the basis for local governments to make policies and strategies to increase investment and develop the East-West Corridor. The policies and strategies implemented are adjusted to the characteristics and typology of each region. This study has limitations; the author does not consider some observed variables.

REFERENCES

[1] Saragih, J.R. (2015). Agricultural-Based Local Economic Planning and Development, Theory and Application. Yogyakarta: Pustaka Pelajar.

[2] Bozhko, L. (2018). Development scenarios for the interregional economic interaction in the context of economy clustering in the Republic of Kazakhstan. Energy Procedia, 147: 397-401. https://doi.org/10.1016/j.egypro.2018.07.109

[3] Sosnovskikh, S. (2017). Industrial clusters in Russia: The development of special economic zones and industrial parks. Russian Journal of Economics, 3(2): 174-199. https://doi.org/10.1016/j.ruje.2017.06.004

[4] Ministry of National Development Planning/, National Development Planning Agency, Kementerian PPN/Bappenas. (2016). A critical study on the determination of strategic areas in the RPJMN and RTRWN. Buku, p. 52. https://www.bappenas.go.id/files/kajian-trp/Kajian_Telaah_Kritis_Penetapan_Kawasan_Strategis_dalam_RPJMN_dan_RTRWN.pdf.

[5] Komarovskiy, V., Bondaruk, V. (2013). The role of the concept of "Growth Poles" for regional development. Journal of Public Administration, Finance and Law, 4(2013): 31-42.

[6] Glinskiy, V., Serga, L., Zaykov, K. (2017). Identification method of the Russian Federation Arctic Zone regions statistical aggregate as the object of strategy development and a source of sustainable growth. Procedia Manufacturing, 8: 308-314. https://doi.org/10.1016/j.promfg.2017.02.039

[7] Krishnasamy, K., Shepherd, C.R., Or, O.C. (2018). Observations of illegal wildlife trade in Boten, a Chinese border town within a Specific Economic Zone in northern Lao PDR. Global Ecology and Conservation, 14: e00390. https://doi.org/10.1016/j.gecco.2018.e00390

[8] Li, Y.J., Zhang, Z.Y. (2013). Technical methods of comprehensive transportation plans in the airport economic zone-taking Xiaogan airport economic zone as a case. Procedia-Social and Behavioral Sciences, 96: 182-187. https://doi.org/10.1016/j.sbspro.2013.08.024

[9] Uttama, N.P. (2014). Investment promotion policy in potential border zone. Procedia Econ Finance, 14: 615-623. https://doi.org/10.1016/s2212-5671(14)00750-3

[10] Jiang, Y.H., Lin, L.J., Ni, H.Y., et al. (2018). An overview of the resources and environment conditions and major geological problems in the Yangtze River economic zone, China. China Geology, 1(3): 435-449. https://doi.org/10.31035/cg2018040

[11] Guo, Y., Fu, B., Xu, P., Wang, Y., Liu, X. (2021). Mapping regional differences in payment for ecosystem service policies to inform integrated management: Case study of the Yangtze River Economic Belt. Journal of Environmental Management, 278: 111396. https://doi.org/10.1016/j.jenvman.2020.111396

[12] Chen, Y. (2020). Financialising urban redevelopment: Transforming Shanghai's waterfront. Land Use Policy, 112: 105126. https://doi.org/10.1016/j.landusepol.2020.105126

[13] Mohamed, A., Worku, H. (2019). Quantification of the land use/land cover dynamics and the degree of urban growth goodness for sustainable urban land use planning in Addis Ababa and the surrounding Oromia special zone. Journal of Urban Management, 8(1): 145-158. https://doi.org/10.1016/j.jum.2018.11.002

[14] Ezmale, S., Rimsane, I. (2014). Promoting the plurilingual awareness in business environment: Case of Rezekne Special Economic Zone. Procedia-Social and Behavioral Sciences, 110: 231-240. https://doi.org/10.1016/j.sbspro.2013.12.866

[15] Beliakov, S., Kapustkina, A. (2016). Analysis of performance indicators of functioning of territories with special economic status in the Russian Federation. Procedia Engineering, 165: 1424-1429. https://doi.org/10.1016/j.proeng.2016.11.874

[16] Noori, S., Korevaar, G., Ramirez, A.R. (2021). Assessing industrial symbiosis potential in Emerging Industrial Clusters: The case of Persian Gulf Mining and metal industries special economic zone. Journal of Cleaner Production, 280: 124765. https://doi.org/10.1016/j.jclepro.2020.124765

[17] Teangsompong, T., Sirisunhirun, S. (2018). Multi-level structural equation modeling for city development based on the expectations of the local population in a special border economic zone in Western Thailand. Kasetsart Journal of Social Sciences, 39(3): 534-541. https://doi.org/10.1016/j.kjss.2017.08.002

[18] Ji, X., Shao, L. (2017). The application of landscape infrastructure approaches in the planning of heritage corridor supporting system. Procedia Engineering, 198: 1123-1127. https://doi.org/10.1016/j.proeng.2017.07.154

[19] Anwar, M.A. (2014). New modes of industrial manufacturing: India's experience with special economic zones. Bull Geogr, 24(24): 7-25.

https://doi.org/10.2478/bog-2014-0011
[20] Nurzaman, S.S. (2012). Regional Planning in the INDONESIAN CONTExt. 1st ed. Bandung: Penerbit ITB, pp. 1-464.
[21] Babkin, A., Vertakova, Y., Plotnikov, V. (2017). Study and assessment of clusters activity effect on regional economy. In SHS Web of Conferences, 35: 01063. https://doi.org/10.1051/shsconf/20173501063
[22] Rustiadi, E., Saefulhakim, S., Panuju, D.R. (2018). Regional Planning and Development. 4th ed. Jakarta: Yayasan Pustaka Obor.
[23] Lipták, F., Klasová, S., Kováč, V. (2015). Special economic zone constitution according to cluster analysis. Procedia Economics and Finance, 27: 186-193. https://doi.org/10.1016/s2212-5671(15)00988-0
[24] Lee, G.G., Kim, M.S., Lee, J.H., Kim, J.J. (2014). Zoning management by quantitative landscape assessment for forest pathway–the case of forest paths of the Mt. Jiri national park, South Korea. Forest Science and Technology, 10(4): 179-189. https://doi.org/10.1080/21580103.2014.891538
[25] Chulaphan, W., Barahona, J.F. (2018). Contribution of disaggregated tourism on Thailand's economic growth. Kasetsart Journal of Social Sciences, 39(3): 401-406. https://doi.org/10.1016/j.kjss.2017.07.012
[26] Regional Development Planning Agency of West Sumatra Province. (2009). Rencana Tata Ruang Wilayah (RTRW) Provinsi Suatera Barat 2012-2032. Padang: Regional Secretary of West Sumatra Province, pp. 1-217.
[27] Asrina, M., Gunawan, A., Aris, M. (2017). Identification of Minangkabau landscape characters. In IOP Conference Series: Earth and Environmental Science, 91(1): 012018. https://doi.org/10.1088/1755-1315/91/1/012018
[28] Sawicki, David, S. (1988). Policy Analysis. In: Urban Planning. 2nd ed. Jakarta: Penerbit Erlangga, pp. 63-90.
[29] Zasada, I., Weltin, M., Reutter, M., Verburg, P.H., Piorr, A. (2018). EU's rural development policy at the regional level—Are expenditures for natural capital linked with territorial needs? Land Use Policy, 77(3): 344-353. https://doi.org/10.1016/j.landusepol.2018.05.053
[30] West Sumatra Statistical Agency. (2020). Kecamatan Dalam Angka 2020. Padang: West Sumatra Statistical Agency Press.
[31] Hu, Z., Wang, Y., Liu, Y., Long, H., Peng, J. (2016). Spatio-temporal patterns of urban-rural development and transformation in east of the "Hu Huanyong Line", China. ISPRS International Journal of Geo-Information, 5(3): 24. https://doi.org/10.3390/ijgi5030024
[32] Ohana-Levi, N., Bahat, I., Peeters, A., Shtein, A., Netzer, Y., Cohen, Y., Ben-Gal, A. (2019). A weighted multivariate spatial clustering model to determine irrigation management zones. Computers and Electronics in Agriculture, 162: 719-731. https://doi.org/10.1016/j.compag.2019.05.012
[33] Wang, D., Zhou, Q.B., Yang, P., Chen, Z.X. (2018). Design of a spatial sampling scheme considering the spatial autocorrelation of crop acreage included in the sampling units. Journal of Integrative Agriculture, 17(9): 2096-2106. https://doi.org/10.1016/S2095-3119(17)61882-3
[34] Duarte, J., Vieira, L.W., Marques, A.D., Schneider, P.S., Pumi, G., Prass, T.S. (2021). Increasing power plant efficiency with clustering methods and Variable Importance Index assessment. Energy AI, 5: 100084. https://doi.org/10.1016/j.egyai.2021.100084
[35] Kjærulff, T.M., Ersbøll, A.K., Gislason, G., Schipperijn, J. (2016). Geographical clustering of incident acute myocardial infarction in Denmark: A spatial analysis approach. Spat Spatio-Temporal Epidemiol, 19: 46-59. https://doi.org/10.1016/j.sste.2016.05.001
[36] Syms, C. (2019). Principal components analysis. Encyclopedia of Ecology (Second Edition), 3: 566-573. https://doi.org/10.1016/B978-0-12-409548-9.11152-2
[37] Juaeni, I. (2014). Dampak penerapan principal component analysis (PCA) Dalam clustering Curah Hujan di Pulau Jawa, Bali, Dan Lombok. J Sains Dirgant, 11: 97-108.
[38] Yang, W., Zhao, Y., Wang, D., Wu, H., Lin, A., He, L. (2020). Using principal components analysis and idw interpolation to determine spatial and temporal changes of Surfacewater quality of Xin'anjiang river in Huangshan, China. International journal of environmental research and public health, 17(8): 2942. https://doi.org/10.3390/ijerph17082942
[39] Vyas, S., Kumaranayake, L. (2006). Constructing socio-economic status indices: How to use principal components analysis. Health Policy and Planning, 21(6): 459-468. https://doi.org/10.1093/heapol/czl029
[40] Soedibjo, B.S. (2008). Analisis Komponen Utama Dalam Kajian Ekologi. Oseana, 33(2): 45-53.
[41] Kellow, J.T. (2006). Using principal components analysis in program evaluation: Some practical considerations. Journal of MultiDisciplinary Evaluation, 3(5): 89-107.
[42] Han, J., Pei, J., Kamber, M. (2012). Data Mininng Concept and Techniques. Third. New York: Morgan Kaufmann Publishers-Elsevier, pp. 1-740.
[43] Tan, P.N., Steinbach, M., Kumar, V. (2006). Introduction to Data Mining. Inggris: Pearson Addison-Wesley, pp. 1-169.
[44] Gorsevski, P.V., Gessler, P.E., Jankowski, P. (2003). Integrating a fuzzy k-means classification and a Bayesian approach for spatial prediction of landslide hazard. Journal of Geographical Systems, 5(3): 223-251. https://doi.org/10.1007/978-3-642-03647-7
[45] Aldstadt, J. (2010). Spatial Clustering. In: Fisher MM, Getis A, editors. Handbook of Applied Spatial Analisis Software Tools, Methods and Applications. New York: Springer, pp. 279-300.
[46] Ducret, R., Lemarié, B., Roset, A. (2016). Cluster analysis and spatial modeling for urban freight. Identifying homogeneous urban zones based on urban form and logistics characteristics. Transportation Research Procedia, 12: 301-313. https://doi.org/10.1016/j.trpro.2016.02.067
[47] Wang, Z., Cui, T., Wang, Y., Yu, Z. (2012). Flood season division with an improved fuzzy C-mean clustering method in the Taihu lake basin in China. Procedia Engineering, 28: 66-74. https://doi.org/10.1016/j.proeng.2012.01.684
[48] Zhu, J., Sun, Y. (2017). Building an urban spatial structure from urban land use data: An example using automated recognition of the city centre. ISPRS International Journal of Geo-Information, 6(4): 122. https://doi.org/10.3390/ijgi6040122
[49] Murao, S. (2013). A cultural anthropological study of body techniques for protection: The case study of

Indonesian Minangkabau. Ars Vivendi Journal, 3: 51-68.
[50] Pribadi, D.O., Rustiadi, E., Panuju, D.R., Pravitasari, A.E. (2018). Regional Development Planning Modeling. Bogor: Crestpent Press. http://repository.unib.ac.id/id/eprint/1234.
[51] Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E. (2014). Multivariate Data Analysi. Seventh. England: Pearson Education Limited, pp. 1-739. www.pearsoned.co.uk.
[52] Anitha, P., Patil, M.M. (2019). RFM model for customer purchase behavior using K-means algorithm. Journal of King Saud University-Computer and Information Sciences. https://doi.org/10.1016/j.jksuci.2019.12.011
[53] Jamaludin, A.N. (2015). Urban Sociology Understanding Urban Society and Its Problems. Vol. 2. Bandung: CV. Pustaka Setia, pp. 1-454.
[54] Rustiadi, E., Panuju, D.R. (2002). Spatial pattern of suburbanization and land-use change process: Case study of Jakarta Suburb. Land-use changes in comparative perspective, 33-52.
[55] Fang, C., Luo, K., Kong, Y., Lin, H., Ren, Y. (2018). Evaluating performance and elucidating the mechanisms of collaborative development within the Beijing–Tianjin–Hebei region, China. Sustainability, 10(2): 471. https://doi.org/10.3390/su10020471
[56] Park, S.H. (2016). A strategic approach to policy tasks for the development of Korea's island areas. Journal of Marine and Island Cultures, 5(1): 14-21. https://doi.org/10.1016/j.imic.2016.04.003
[57] Yamane, T., Kaneko, S. (2022). The Sustainable Development Goals as new business norms: A survey experiment on stakeholder preferences. Ecological Economics, 191: 107236. https://doi.org/10.1016/j.ecolecon.2021.107236
[58] Benites, A.J., Simoes, A.F. (2021). Assessing the urban sustainable development strategy: An application of a smart city services sustainability taxonomy. Ecological Indicators, 127: 107734. https://doi.org/10.1016/j.ecolind.2021.107734
[59] Adair, A., Berry, J., McGreal, S., Deddis, B., Hirst, S. (2000). The financing of urban regeneration. Land Use Policy, 17(2): 147-156. https://doi.org/10.1016/S0264-8377(00)00004-1

Journal of Socioeconomics and Development. 2022. 5(1): 53-63

Journal of Socioeconomics and Development

https://publishing-widyagama.ac.id/ejournal-v2/index.php/jsed

Spatial analysis of region interaction of West-East corridor's strategic economic area of West Sumatera Province, Indonesia

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ARTICLE INFO

►**Research Article**

Article History
Received 14 December 2021
Accepted 12 January 2022
Published 22 February 2022

Keywords
gravity model; infrastructure completeness; regional development; spatial interactions

JEL Classification
O10; R12; R19

ABSTRACT

The West-East corridor is one of the main gateways to enter West Sumatra Province. The West-East corridor, which passes through 65 districts, has a variety of potentials and problems. This means, the growth rate of each district will be different. The growth rate and strength of the relationship among regions can be observed through the gravity model's spatial interactions. The gravity model can calculate the relative strength of the relationship between regions. To see the strength of the relationship among regions in the West-East corridor, strategic economic areas were taken into considerations based on their distance and several observational variables, which were the total population variable, infrastructure completeness, level of security, and investment value. Observation analysis units consisted of sixty-five sub-districts along the West-East corridor. Mass 1 (M1) was the central government, West Padang district, and mass 2 (M2) was the other 64 sub-districts. The analysis results show that the total population, infrastructure completeness, level of security, and investment value are not only influenced by their closeness to the government/city center. The infrastructure completeness factor can influence the total population in a region. Likewise, the investment value can be influenced by the infrastructure completeness and the level of security in a region.

To cite this article: Amelia, S., Rustiadi, E., Barus, B., & Juanda, B. (2022). Spatial analysis of region interaction of West-East corridor's strategic economic area of West Sumatera Province, Indonesia. Journal of Socioeconomics and Development, 5(1), 53-63. https://doi.org/10.31328/jsed.v5i1.3247

ISSN 2615-6075 online; ISSN 2615-6946 print

INTRODUCTION

Balanced development is the fulfillment of development potential in each region (Rustiadi et al., 2018). If this condition is associated with the stages of economic growth put forward by Rostow, it is related to the take-off precondition. This stage is a transition period in which society prepares itself or is prepared from the outside to achieve growth with continuous development (self-sustained growth). This stage is the transition period in which the conditions for self-help growth are built or created (Jhingan, 2016).

Regional development is aimed to formulate and apply a theoretical framework to economic policies and programs by integrating social and environmental aspects to achieve optimal and sustainable welfare (Nugroho & Dahuri, 2004). Friedmann dan Alonso (1964) posited that the development of a region or district in the long term is more emphasized by introducing natural resources and regional local development potentials. The potential that can support economic growth, social welfare, poverty alleviation, and efforts to overcome development obstacles in order to achieve development goals is strongly influenced by the components of local resources, markets, labor, investment, government capacity, transportation, and communication and technology.

As stated in Indonesian Law No. 26/2007 concerning Spatial Planning, one of the efforts to accelerate development by utilizing local resources is by identifying strategic districts. A strategic economic area potentially has a significant multiplier effect that is cross-sectoral, cross-spatial (cross-regional), and cross-performer (Bappenas, 2014). Strategic economic areas are areas prioritized for development. According to Sosnovskikh (2017), the area clustering policy is the key and one way to attain local and regional economic development. The strategic economic area as a territory region distinguishes this region from the other regions (Komarovskiy & Bondaruk, 2013). A strategic district is a district prioritized for development where its commodities are developed to improve the community's welfare in the region (Bozhko, 2018).

The strategy to increase economic growth is by developing strategic areas or developing economic corridors. An economic corridor is an integrated infrastructure network in a geographic district designed to stimulate economic development (Brunner, 2013). The economic corridor approach views the transportation network as a tool for transporting goods and services or as a gateway and as a tool to stimulate socio-economic development around the network (Mulenga, 2013). Thus, the corridor economic approach transforms the transportation corridor into a driving engine for socio-economic development. In line with research conducted by Ji & Shao (2017) regarding the Heritage Corridor, a comprehensive action towards conservation and development originating from the 'green way' prioritizes cultural-related conservation and focuses on economic revitalization and environmental protection.

Regional development and superior commodities development are carried out to accelerate regional economic development (Muta'ali, 2015). Conceptually, the role of the strategic area may boost the economy in the region (Ezmale & Rimsane, 2014; Glinskiy et al., 2017) and improve the regional economy (Anwar, 2014; Babkin et al., 2017). Strategic economic areas are expected to act as a growth center or a growth corridor to drive economic growth in the surrounding region (hinterland). As an implementation of the growth center or growth corridor concept, the strategic economic area is expected to be the prime mover of development, capable of driving economic development in the surrounding region. Therefore, the strategic economic area in which the residents are concentrated with various economic and social activities has a quite strong influence on the development of the surrounding regions.

The West-East corridor is one of eleven strategic economic areas in West Sumatera Province. The West-East corridor is one of the axes that connects West Sumatera Province with other regions in the Eastern part of Sumatera. The West-East corridor is one of the main corridors and the gateway of the West Sumatera province in the East region. It is a corridor that has the highest frequency of trade and services. Therefore, based on Governor Regulation No. 73/2013 concerning the West Sumatra Economic Development Master Plan 2013-2025, the West-East corridor is included in one of the economic development regions.

The strength of the relationship among regions in the West-East corridor is based on distance and several dimensions of observation. The strength of the relationship and the level of development of the strategic economic area in the West-East corridor can be observed by looking at the spatial interactions between regions using the gravity model. The basic concept of the gravity model is to analyze the size and distance between one region to another. This model can calculate the relative strength of the relationship between the regions (Muta'ali, 2015). In the gravity model, regions are considered as a mass. Therefore, the relationship between regions can be equated with the relationship between masses. The region's mass also has an attraction which affect each of the two regions with the said attractive strength. This model follows Newton's law of gravity applied and developed in socio-economic interactions, in which there is a parallel relationship between community migration (Rustiadi et al., 2018).

The research aims to study the interaction and the strength of relationship between regions in the West-East corridor in West Sumatra Province.

RESEARCH METHOD

This research was conducted at The West-East corridor, which is one of the main gateways passing through nine regencies/cities, i.e. Padang Pariaman Regency, Agam Regency, Tanah Datar Regency, Lima Puluh Kota Regency, Pariaman City, Padang City, Padang Panjang City, Bukittinggi City, and Payakumbuh City.

Data collection

For examining the strength of the relationship and the level of regional development in the strategic economic area of the West-East corridor, this research employed a combination of qualitative and quantitative methods. The qualitative method involved direct observation in the field by extracting information from various sources related to the development of the West-East corridor. The collected data and information were related to population, crime rate, number of industries, the completeness of infrastructure (the number of markets, sports facilities, banks, hospitals and health centers, hotels, inns/motels/guest houses/hostels, senior high schools, and universities), and investment in the development of the strategic economic area of the West-East corridor. In addition, qualitative data processing was carried out by examining various research results related to regional development. Sources of data used in this research came from the Central Bureau of Statistics (BPS) in the form of *Kabupaten and Kecamatan dalam Angka* (literally meaning Regency in Figures and District in Figures) data in 2020. The investment data were taken from the Agency of Capital Investment and One-Stop Service (DPMPTSP) in each regency or city. Data analysis was performed using the gravity model as an analysis tool. The units of analysis involved in this research were the districts along with the West-East corridor delineation. Analysis of interaction patterns in the analysis unit was carried out using the maximum and minimum clusters, where the grouping was done based on the maximum-minimum value concentration at the observation location (Scott & Janikas, 2004).

The Region Interaction

The basic concept of the gravity model is to study the size and distance from one region to another (Muta'ali, 2015). The use of gravity techniques allows this study to calculate the relative strength of the relationship between regions. In addition to the distance between regions, the potential for interaction between regions was determined by the region's "attractiveness", such as population, economic potential, natural and environmental resource potentials, and regional facilities. The gravity model in this research was used to view the role or strength of strategic economic areas in regional development and enhancement of the regional economy. The measurements were based on the distance of each provincial strategic economic area to the center of government with the district analysis unit.

In this research, to view the interaction of each strategic district in West Sumatra province with the district analysis unit, various combinations of gravity models were produced. The calculation of the interaction between regions used mass 1 and mass 2. Mass 1 is considered unchanged, which is the center of government, while mass 2 varies (Muta'ali, 2015), comprising the districts along the West-East corridor. The calculation and analysis of this gravity model showed which strategic district would provide a more remarkable influence based on several variables. The formula used in the gravity analysis is shown in equation 1,

$$I_{12} = g\frac{m_1 m_2}{r^b{}_{12}} \quad (1)$$

in which I_{12} equals attraction potential and interaction between regions 1 and 2, m_1 and m_2 equal the mass of region 1 and 2, r_{12} is distance between regions 1 and 2, and g equals proportional constant (for example, the value is 1).

Meanwhile, b is distance constant, which depends on the district accessibility value—the better the accessibility, the smaller the constant, thus the interaction potential is more remarkable. Based on the research results conducted by Vooheers (Muta'ali, 2015), a distance rank constant is based on the purpose of the trip, wherein work = 0.5, social = 3, and shopping, business, recreation, and others = 2.

I_{12} value shows the potential of a close relationship between region one and region two. The higher the I_{12} value, the closer the relationship between the two regions; there would be more trips for economic activities or the flow of goods and services between these regions as a consequence of the interaction between regions within one district. Regions with the highest I_{12} score have the characteristics of a central region, a strategic position, and a high level of region connectivity (Andriyani & Utama, 2011).

$$Interval\ Class = \frac{\sum data}{\sum class} \quad (2)$$

The formula of the class interval is determined by the number of data divided by the number of levels, as shown in equation 2.

RESULT AND DISCUSSION

Interaction of West-East Corridor

The West-East corridor is one of the main corridors connecting West Sumatra Province with the other regions, and it is the gateway to West Sumatra from the Eastern part. A strategic area has characteristics that distinguish the region from the others (Komarovskiy & Bondaruk, 2013). This research aims to view the interaction, linkages, or strength of the relationship between the central area and the others. In this study, the distance measurement between the central region and the other 64 observation regions was carried out using the Euclidean distance method with the assistance of the ArcGIS software (Figure 1). Euclidean distance is a calculation of the distance between individuals based on their geometric distance or straight-line distances in a multidimensional space (Pribadi et al., 2010). This was used to obtain the distance of each district to the center of the observation object (West Padang district). The measurement of the distance between observation objects was carried out on the centroid of each observation object.

In this research, the center of observation was the West Padang district considering that the governor's office and various government offices are located in the region. Therefore, based on the measurement of the distance from the observation center (M1) to 64 other observation areas, the closest distance is North Padang district at 3 km and the furthest distance is Pangkalan Koto Baru district at 121.6 km.

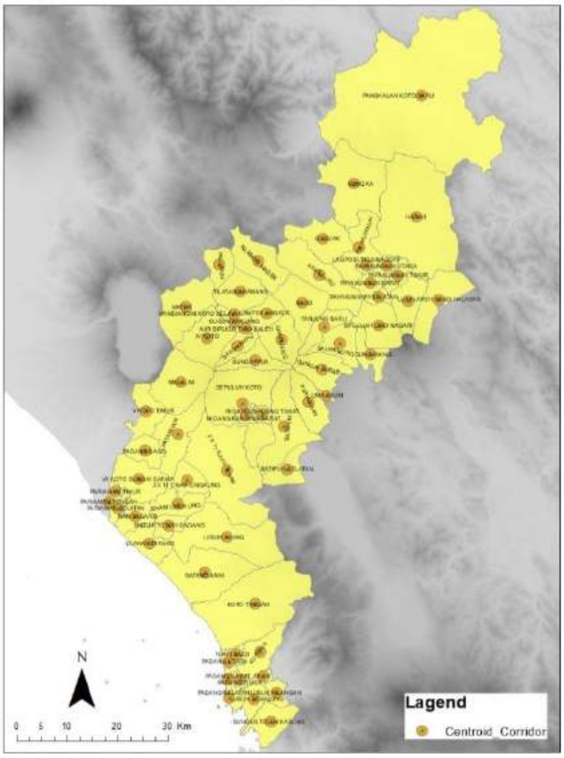

Figure 1. Centroid of corridor

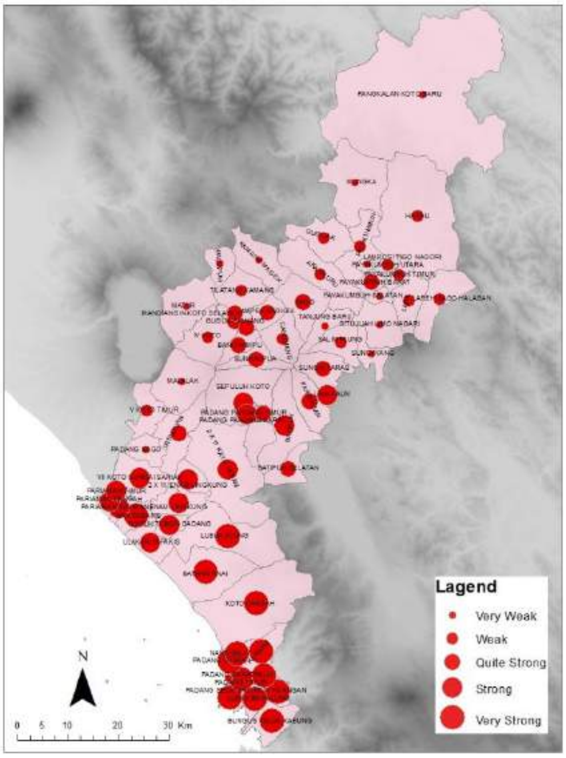

Figure 2. Regional interaction of population

The mass used to observe the interaction of regions in the gravity model is very dependent on the purpose of the analysis (Muta'ali, 2015). Based on research, in general, the mass of an area is the total population. In looking at the economic interactions (equation 1), the variables of GRDP, GRDP per capita, job opportunity, tourism potential, investment, and various other economic variables were used. This research compared the interaction among population variables, investment, number of large/medium/small industries, the completeness of infrastructure (the number of markets, banks, hospitals, health centers, sports facilities, hotels, hostels/motels/guest houses, high schools, and universities), and crime rate.

The observation variables using the gravity model formula (equation 1) produced various interpretation results. To identify the interaction between regions based on the results of previous research studies, the regions were grouped into four to seven classifications. In this study, regional interactions were grouped into five classes, which were very strong, strong, quite strong, weak, and very weak. The classification of the region's strength in this research used the quantile method (Kurniati & Rahardjo, 2015). The quantile method is suitable for data with a linear distribution, where the division of the members of each class is equal. As shown in equation 2, the formula of the class interval determines the number of data divided by the number of levels. Data classification was performed using the ArcGIS 10.3 software. Thus, regional interactions were obtained from classifying each observation dimension.

Figure 2 shows the strength of the relationship between the regional center (M1) and the other regions (M2). The results show that the region interaction was very diverse. Not all areas close to the center had very strong or strong interactions. Some areas that are far from the center also had strong interactions. That happens due to various reasons why people stay in the region, which is not only based on proximity to the center. The completeness of infrastructure (Martinez & Masron, 2020) causes people to stay in the area.

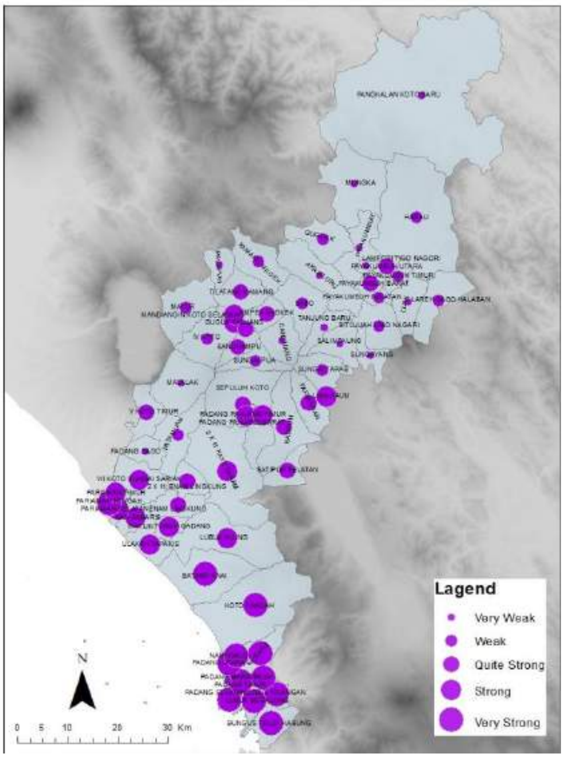

Figure 3. Regional interaction of infrastructure completeness

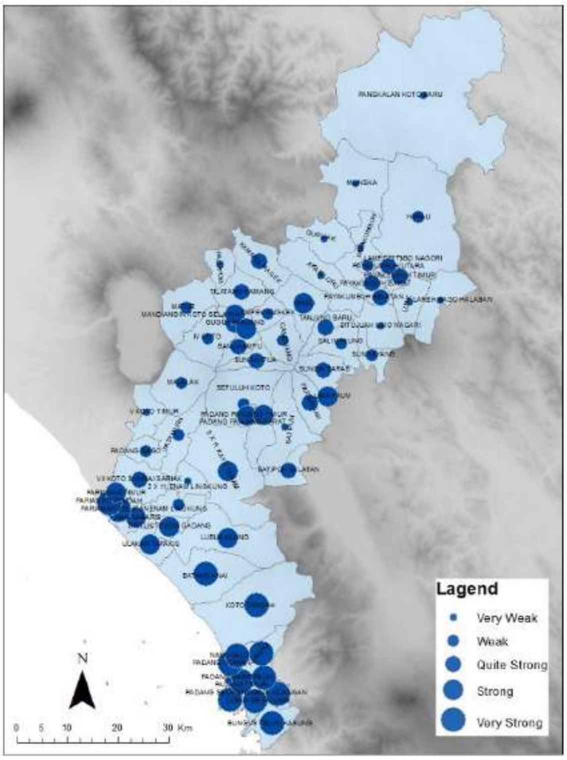

Figure 4. Regional interaction of crime rate

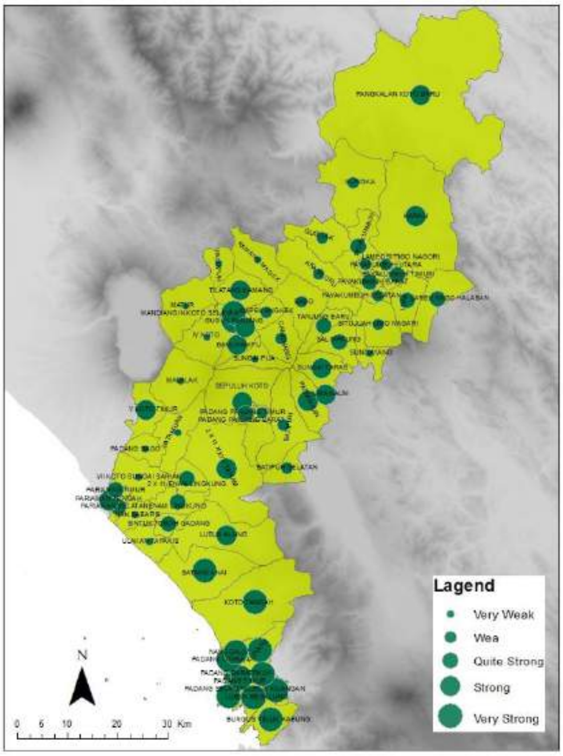

Figure 5. Regional interaction of investment

Environmental quality is also a reason for choosing a place to live (Prayitno et al., 2021). Based on the observation results of the population variable, Padang Sago district, 48 km away from the center of government, had a very weak interaction, while Lima Kaum district that is 59.3 km from the center had a strong interaction. Payakumbuh Barat district is 83 km from the center of government and it had a strong enough interaction. Pangkalan Koto Baru district is the farthest from the center of government (121.6 km) and it had a very weak interaction with the central government.

Figure 3 shows the strength of the relationship between the center (M1) and other regions (M2) based on the infrastructure completeness variables. In this study, the completeness of infrastructure was based on the number of markets, banks, hospitals, health centers, hotels, hostels/motels/guest houses/ inns, high schools, and universities. Pangkalan Koto Baru district is 121.6 miles from the central government, and the infrastructure variable had very weak relationship strength for having relatively little infrastructure completeness. This is in line with research conducted by Martinez & Masron (2020), stating that one of the reasons for someone to live in an area is the completeness of infrastructure in the region. Padang Sago district is 48 km from the government center and had a very weak relationship with the central government, in the sense that the Padang Sago district had relatively little infrastructure. This finding shows that the relationship between populations is directly proportional to the completeness of infrastructure in a region. The Mandiangin Koto Selayan district has a distance of 72.1 km from the central government and had a very strong relationship with it, showing adequate completeness of the existing infrastructure in the district.

Figure 4 shows that several regions close to the central government and low in crime rate had a very weak interaction. For example, 2x11 Enam Lingkung district and V Koto Timur district, which are 40 km and 55 km away from the center of government respectively and low in crime rate, had a very weak relationship strength with the crime rate variable. On the other hand, Baso district and Mandiangin Koto Selayan district had a high crime rate.

The proximity of a region to the central government/city center influences crime rates. In addition, inadequate facilities such as damaged road networks, the lack of communication infrastructure (Arisukwu et al., 2020), community income, and literacy rates may lead to high crime rate (Hajela et al., 2020).

Figure 5 shows the interaction of the center with the other regions based on the investment variable. The Ulakan Tapakis district, which is close to the central government (31 km away) and received small amount of investment value, had a very weak relationship strength. Likewise, Nan Sabaris district which is 37 km away from the central government had a very weak interaction. On the other hand, the Tilatang Kamang district, which is 76.5 km away from the central government and had quite large amount of investment, had a strong interaction with the central government. Both Pangkalan Koto Baru district, the farthest from the central government at 121.6 km, and Harau district almost as far at 98.6 km, had a strong interaction. The results show that the region's proximity to the center does not influence the amount of investment value.

Many factors influence investors' interest in making investments. Several factors include economic stability, ease of bureaucracy, investment-related policies (Hanim & Ragimun, 2015; Melliger & Lilliestam, 2021), institutions (Kuncoro & Rahajeng, 2005), security (Martinez & Masron, 2020; Glinskiy et al., 2017), infrastructure completeness (Kuncoro & Rahajeng, 2005), the availability of supporting technology (Melliger & Lilliestam, 2021), and the provision of incentives (Limanlı, 2015).

The results of the analysis show that the level of security affects investors' interest in making investments. As seen in Ulakan Tapakis and Nan Sabaris districts, both of which are close to the central government, have low investment values and almost high crime rates. Pangkalan Koto Baru and Harau districts are both far from the center but have high investment values and low crime rates. Thus, the level of security in a region becomes a factor to be considered when investing. This is in line with research conducted by Martinez & Masron (2020) and Glinskiy et al. (2017).

Research Implication

The gravity model in this study is used to see the role or strength of each region in the west-east corridor in regional development and improving the economy of the west-east corridor and the province of West Sumatra in general. The use of gravity techniques will calculate the relative strength of the relationship between regions (Leigh & Blakely, 2016). The basic concept of the gravity model is to discuss the size and distance between one area and another. This model can calculate the relative strength of the relationship between regions (Muta'ali, 2015). In the gravitational model, the area is a mass, so the relationship between sites is the same as the masses'. The mass of a region has an attraction, so there is mutual influence between areas which is the force of attraction between areas. This model follows Newton's law of gravity which is applied and developed in socio-economic interactions, where there is a parallel relationship between community migration (Rustiadi et al., 2018). Research carried out using this gravity model includes a study conducted by Thompson et al. (2019). His research examines the effectiveness of predicting two-way traffic volumes in the United States using annual average daily traffic data for various states. Bialynicka-Birula (2015) research which looks at the influence of the art market in European countries on the total exports and imports of works of art, examines the trade in the art using Eurostat international trade data and distances between countries.

The province of West Sumatra, which has large enough local potential compared to national per capita income, has a relatively small Gross Regional Domestic Product (GRDP) per capita. The comparison of the GRDP per capita between the Province of West Sumatra and other provinces on the island of Sumatra is also relatively small. The development of the provincial GRDP per capita on the island of Sumatra for the 2014-2020 period is far below the province of Riau, Riau Islands, North Sumatra, and Jambi. GRDP per capita of West Sumatra Province based on 2010 constant prices was 25.98 million in 2014, and 30.82 million in 2020. The province of West Sumatra has a per capita income that is not too large but a higher value of the Human Development Index (IPM) compared to other provinces in the island of Sumatra.

The HDI value of West Sumatra Province is even above the national HDI average. In 2020 the HDI value of West Sumatra Province was 72.38. The HDI value of West Sumatra province was even higher than the HDI value of North Sumatra province (Figure 1). The potential of West Sumatra's human resources is relatively high, occupying the third position among the regions in the island of Sumatra, which reached 72.38 in 2020. The HDI value of West Sumatra province was even higher than the HDI value of North Sumatra province (Figure 6). The potential of West Sumatra's human resources is relatively high, occupying the third position among the regions on the island of Sumatra.

The big potential of West Sumatra's resources is not matched by the value of the investment. If we look at the investment in the provinces on the island of Sumatra, West Sumatra occupies the bottom two positions of the investment amount after Aceh. The amount of investment in West Sumatra in 2020 was 3,106.20 billion rupiahs for PMDM (domestic investment) and 1,758.40 billion rupiah for PMA (foreign investment). The amount of investment in West Sumatra for PMDN is in the lowest two positions after Bangka Belitung Islands. Meanwhile, PMA occupies the bottom four positions after Jambi, Bangka Belitung Islands, and Aceh. This small investment causes uneven development in West Sumatra.

The uneven development can be seen from the availability of infrastructure in each district/city. Complete and adequate infrastructure is due to the relatively high investment in urban areas. Increased investment can support regional economic development. Uneven development can also cause a backwash effect, leading to regional leakage in several regions of West Sumatra. According to Rustiadi et al. (2018), the pattern of population movement from underdeveloped areas to developed areas where economic development in developed areas is an attraction for quality workforce migration. This pattern causes those living in less developed areas to be unproductive people. Uneven development can also cause a backwash effect that creates regional leakage in several regions of West Sumatra.

Economic growth in urban areas is more varied in development than in rural areas. Investors are interested in investing in urban areas because they already have urban infrastructure and utilities. The concentration of economic activity that is more concentrated in urban areas than in rural areas supported by a more significant allocation of development budgets in urban areas also causes a gap. The gap causes trouble in the mobilization of goods and services due to limited transportation and communication, so the income per capita of the community is low. Good infrastructure development will ensure efficiency, facilitate the movement of goods and services, and increase the added value of the economy (Skorobogatova & Kuzmina-Merlino, 2017; Hasselgren & Englén, 2016; Sutriadi et al., 2015; Jurgelane-Kaldava et al., 2019).

To create equitable development in the west-east corridor and West Sumatra in general, it is necessary to establish new growth centers. The findings of this study form the basis for local governments to determine new growth centers. According to Perroux's theory of growth pole, in overcoming development inequality, the building new growth pole may function as intermediary development centers and prepare for the development of migration-receiving areas. The existence of a new growth pole can affect the development of the surrounding area. The growth pole acts as a service center for the surroundings.

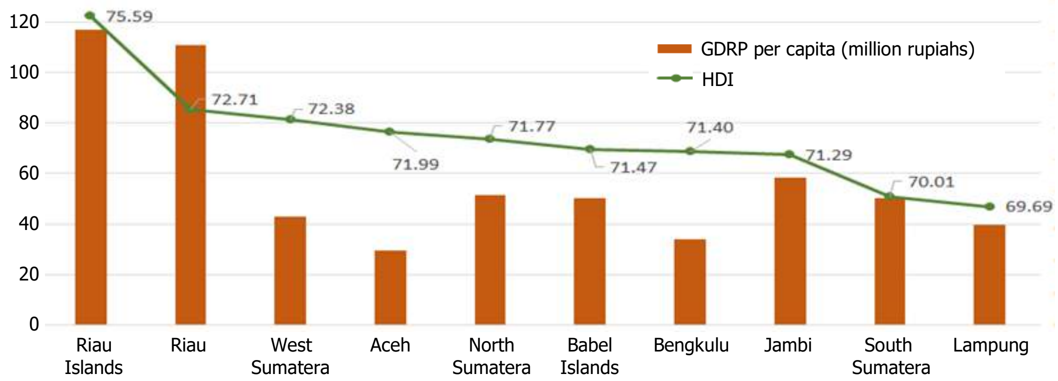

Figure 6. GRDP per capita (at 2010 constant price) and provincial HDI in Sumatra Island in 2020

CONCLUSION AND SUGGESTION

This research attempts to identify the regional interaction/ relationship strength between the central government and the other 64 districts along the West-East corridor. The variables used in this observation comprise population, infrastructure completeness, rate of crime, and investment value. The strength of regional relations and the level of regional development are influenced by the region's proximity to the regional center. One of the reasons people live in an area is the completeness of infrastructure in that particular area.

Padang Timur district, which is 2.4 km away from Padang Barat, is the closest district to the central government. The district interaction of Padang Timur district and the population variable has an intense relationship. The regional interaction of variables infrastructure completeness, level of security, and investment value also has a strong relationship with the central government. The proximity of the regions to the center does not influence investment value. Instead, it is likely influenced by government policies, the completeness of infrastructure, the level of security, and the availability of supporting technology.

The findings of this study form the basis for local governments to determine new growth poles. The existence of a new growth pole will be able to influence the development of the surrounding area. The growth pole acts as a service center for its surroundings. The existence of new growth poles can reduce regional inequality.

This study has limitations, one of which is the establishment of the distance between districts. The distance calculation in this study uses the Euclidean distance as the straight-line distance between the regional centers. The distance calculation in this study does not use distance based on travel time and mileage.

ACKNOWLEDGEMENT

This research is a part of dissertation research. My highest gratitude goes to PhD program, IPB University, Bogor, Indonesia. We would like also to express our gratitude to the West Sumatra government for their support for this research activities, especially in the West-East corridor area.

REFERENCES

Amelia, S. (2019). The stimulant assistance program of self-help housing in attempts to improve the living quality of middle-class in Indonesia. IOSR Journal of Humanities And Social Science (IOSR-JHSS), 24(August), 55–64. https://doi.org/10.9790/0837-2408035564

Andriyani, N. N. S., & Utama, M. S. (2011). Analisis pusat pertumbuhan di kabupaten Karangasem. Jurnal EP Unud, 4(4), 220–229. Retrieved from https://ojs.unud.ac.id/index.php/eep/article/view/11381

Anwar, M. A. (2014). New modes of industrial manufacturing: India's experience with special economic zones. Bulletin of Geography, 24(24), 7–25. https://doi.org/10.2478/bog-2014-0011

Arisukwu, O., Igbolekwu, C., Oye, J., Oyeyipo, E., Asamu, F., Rasak, B., & Oyekola, I. (2020). Community participation in crime prevention and control in rural Nigeria. Heliyon, 6(9), e05015. https://doi.org/10.1016/j.heliyon.2020.e05015

Babkin, A., Vertakova, Y., & Plotnikov, V. (2017). Study and assessment of clusters activity effect on regional economy. SHS Web of Conferences, 35, 01063. https://doi.org/10.1051/shsconf/20173501063

Bappenas. (2014). Kajian Evaluasi Program Pembangunan Dan Pengembangan Kawasan Khusus dan Daerah Tertinggal. Retrieved from http://kawasan.bappenas.go.id/images/data/Produk/Kajian/Laporan_Kajian_2014.pdf

Bialynicka-Birula, J. (2015). Modelling international trade in art – modified gravity approach. Procedia Economics and Finance, 30(15), 91–99. https://doi.org/10.1016/s2212-5671(15)01258-7

Bozhko, L. (2018). Development scenarios for the interregional economic interaction in the context of economy clustering in the Republic of Kazakhstan. Energy Procedia, 147, 397–401. https://doi.org/10.1016/j.egypro.2018.07.109

Brunner, H. (2013). What is Economic Corridor Development and What Can It Achieve in Asia's Subregions? ADB Working Paper Series on Regional Economic Integration. 117. Retrieved from https://aric.adb.org/pdf/workingpaper/WP117_Brunner_What_is_Economic_Corridor_Development.pdf

Ezmale, S., & Rimsane, I. (2014). Promoting the plurilingual awareness in business environment: Case of Rezekne special economic zone. Procedia

- Social and Behavioral Sciences, 110, 231–240. https://doi.org/10.1016/j.sbspro.2013.12.866

Friedmann, J., & Alonso, W. (1964). Regional Development and Planning: A Reader. The MIT Press. https://books.google.co.id/books?id=9EghMQAACAAJ

Glinskiy, V., Serga, L., & Zaykov, K. (2017). Identification method of the Russian federation arctic zone regions statistical aggregate as the object of strategy development and a source of sustainable growth. Procedia Manufacturing. 8, 308-314. https://doi.org/10.1016/j.promfg.2017.02.039

Hajela, G., Chawla, M., & Rasool, A. (2020). A clustering based hotspot identification approach for crime prediction. Procedia Computer Science, 167, 1462–1470. https://doi.org/10.1016/j.procs.2020.03.357

Hanim, A., & Ragimun, R. (2015). Analysis of factors affecting investment interest in the region: A case study in Jember Regency, East Java. Kajian Ekonomi Dan Keuangan, 14(3), 3–20. https://doi.org/10.31685/kek.v14i3.55

Hasselgren, B., & Englén, T. (2016). Challenges for transportation planning and organization in the Stockholm region. Transportation Research Procedia. 14, 538-546 https://doi.org/10.1016/j.trpro.2016.05.109

Jhingan, M. L. (2016). Ekonomi Pembanguan dan Perencanaan (Translate). RajaGrafindo Persada. https://books.google.co.id/books?id=17vRvgEACAAJ

Ji, X., & Shao, L. (2017). The application of landscape infrastructure approaches in the planning of heritage corridor supporting system. Procedia Engineering, 198, 1123–1127. https://doi.org/10.1016/j.proeng.2017.07.154

Jurgelane-Kaldava, I., Ozolina, V., & Auzina-Emsina, A. (2019). Modeling the influence of transportation and storage industry on the economic development of Latvia. Procedia Computer Science. 149, 450-456 https://doi.org/10.1016/j.procs.2019.01.161

Komarovskiy, V., & Bondaruk, V. (2013). The role of the concept of "growth poles" for regional development. Journal of Public Administration, Finance and Law, 4, 31–42. Retrieved from https://www.jopafl.com/uploads/issue4/THE_ROLE_OF_THE_CONCEPT_OF_GROWTH_POLES_FOR_REGIONAL_DEVELOPMENT.pdf

Kuncoro, M., & Rahajeng, A. (2005). Daya tarik investasi dan pungli di DIY. Ekonomi Pembangunan, 10(2), 171–184.

Kurniati, E., & Rahardjo, N. (2015). Evaluation of Classification Methods in Making Population Density Map of DIY with Statistical Surface and Proportion Test. Bumi Indonesia.

Limanlı, Ö. (2015). Determinants of R&D investment decision in Turkey. Procedia - Social and Behavioral Sciences, 195, 759–767. https://doi.org/10.1016/j.sbspro.2015.06.471

Leigh, N. G., & Blakely, E. J. (2016). Planning Local Economic Development: Theory and Practice. SAGE Publications. https://books.google.co.id/books?id=kX5ZDwAAQBAJ

Martinez, R., & Masron, I. N. (2020). Jakarta: A city of cities. Cities, 106(July). https://doi.org/10.1016/j.cities.2020.102868

Melliger, M., & Lilliestam, J. (2021). Effects of coordinating support policy changes on renewable power investor choices in Europe. Energy Policy, 148, 111993. https://doi.org/10.1016/j.enpol.2020.111993

Mulenga, G. (2013). Developing Economic Corridors In Africa. Rationale for the Participation of the African Development Bank. AfDB Regional Integration Brief. Retrieved from www.afdb.org https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/Regional_Integration_Brief_-_Developing_Economic_Corridors_in_Africa_-_Rationale_for_the_Participation_of_the_AfDB.pdf

Muta'ali, L. (2015). Teknik Analisis Regional untuk Perencanaan Wilayah, Tata Ruang dan Lingkungan (1st ed.). Badan Penerbit Fakultas Geografi (BPFG) UGM.

Nugroho, I., & Dahuri, R. (2004). Pembangunan Wilayah Perspektif Ekonomi, Sosial dan Lingkungan (Cet.1). LP3ES. https://books.google.co.id/books?id=Un3aAAAAMAAJ

Prayitno, G., Rukmi, W. I., & Ashari, M. I. (2021). Assessing the social factors of place dependence and changes in land use in sustainable agriculture: Case of Pandaan District, Pasuruan Regency, Indonesia. Journal of Socioeconomics and Development, 4(1), 8. https://doi.org/10.31328/jsed.v4i1.1720

Pribadi, D. O., Rustiadi, E., Panuju, D. R., & Pravitasari, A. E. (2010). Permodelan Perencanaan Pengembangan Wilayah. Crestpent Press.

Rustiadi, E., Saefulhakim, S., & Panuju, D. R. (2018). Perencanaan dan Pengembangan Wilayah (4th ed.). Yayasan Pustaka Obor. https://books.google.co.id/books?id=dfZiDwAAQBAJ

Scott, L. M., & Janikas, M. V. (2010). Spatial Statistics in ArcGIS. In Handbook of Applied Spatial Analysis (pp. 27–41). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-03647-7_2

Skorobogatova, O., & Kuzmina-Merlino, I. (2017). Transport infrastructure development performance. Procedia Engineering, 178, 319–329). Elsevier Ltd.. https://doi.org/10.1016/j.proeng.2017.01.056

Sosnovskikh, S. (2017). Industrial clusters in Russia: The development of special economic zones and industrial parks. Russian Journal of Economics, 3(2), 174–199. https://doi.org/10.1016/j.ruje.2017.06.004

Sutriadi, R., Safrianty, A. A., & Ramadhan, A. (2015). Discussing cities and regencies in the context of regional rating system. promoting communication, reaching sustainable growth. Procedia Environmental Sciences, 28, 166–175. https://doi.org/10.1016/j.proenv.2015.07.023

Thompson, C. A., Saxberg, K., Lega, J., Tong, D., & Brown, H. E. (2019). A cumulative gravity model for inter-urban spatial interaction at different scales. Journal of Transport Geography, 79(June), 102461. https://doi.org/10.1016/j.jtrangeo.2019.102461