CoMBInES
CONFERENCE ON MANAGEMENT, BUSINESS, INNOVATION, EDUCATION AND SOCIAL SCIENCES

Volume 1 No 1 (2021)

Received : February 01, 2021
Accepted : February 05, 2021
Published : February 24, 2021

Conference on Management, Business, Innovation, Education and Social Science
https://journal.uib.ac.id/index.php/combines

Building Regional Innovation Network: Evidence from Koridor Economic of Sumatra

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Abstract

The focus of this research is how to interrelate regional innovation products with regional trade and the creation of economic agglomerations in the economic corridor of Sumatra. The research approach used is the spatial lag model and the spatial error model using 2020 spatial data in 10 provinces in the economic corridor of Sumatra. The results show that first: Innovation products and regional trade are spatial variables because they have a greater Moran index value, with the centre of the cluster being Riau province, areas around the centre of the cluster, such as North Sumatra, West Sumatra, South Sumatra. The increase in regional trade intensity is able to encourage an increase in innovation products in the Sumatra economic corridor. On the other hand, the increase in innovation products by large industries has not had a significant impact on increasing regional trade in the Sumatra economic corridor. Second: The factors that affect the increase in innovation products in large and medium industries in the economic corridor of Sumatra are the increase in added value in the beverage industry, increase in added value in the computer and electronic goods industry, and the creation of agglomerations in the food and beverage industry. Meanwhile, an increase in government spending on increasing R&D and venture capital encourages a decline in innovation products in large and medium industries in the Sumatra economic corridor. Third: The factors that affect the increase in regional trade in the economic corridor of Sumatra are increased government spending on R&D, increased added value in the beverage industry, increased added value in the computer and electronic equipment industry, and regional innovation products. Fourth: The cluster centre for increasing the added value of the computer industry and the beverage industry as a very important variable in increasing regional innovation products and regional trade in the long term is the province of Riau and Aceh and this greatly impacts the hinterland area.

Keywords: Regional Product Innovation, Regional Trade, Economic Agglomeration

Introduction

Mainstream economics has long stated that innovation in the form of new products and services, as well as commercialized knowledge creation in competitive markets is a source of driving economic growth in the region. This interrelationship between innovation, knowledge and economic growth has long been built in economic thinking from Marshal (1890) to Kuznet (1971), (Howells, 2005),(Capello and Lenzi, 2014). Knowledge creation is able to change

economic activities and economic activities are able to change knowledge creation, so that in turn, changes in knowledge creation and changes in technology will encourage the production of new goods and services that lead to economic growth.

According to Schumpeter (1934), (Schumpeter, 2007) knowledge and innovation can be distinguished by illustrating that invention; in the form of new ideas, new piece of knowledge and the commercialization of new ideas and new piece knowledge are innovation, so that with such a distinction it is possible to conceptualize that R&D products and patents as sources of knowledge creation, are likely to give birth to innovations when commercialized. This distinction is made to describe the data at the company level that develops products, services and innovation processes at the regional level. Innovation is seen as the result of formal and informal knowledge embedded in human capital, or knowledge spillover.

This paper tries to analysis that knowledge and innovation are very important variables and become drivers to drive regional economic growth. The impact of knowledge creation and the impact of innovation on economic growth can be viewed spatially, because there can be benefits in an area from innovation without going through the knowledge creation process, because this region interacts with areas that have dense stock of knowledge creation, this is called knowledge spillover. even regional economies are also fortunate from dense knowledge creation, without having to develop towards innovation, resulting in transactions between regions in the use of knowledge creation and technological changes to produce new goods and services.

Knowledge creation plays a very important role in creative effort, learning processes, interactive and cooperative atmosphere and increasing productivity and strengthening economic performance at the micro, meso and macro levels (Capello and Lenzi, 2014), (Doloreux, 2002), (Harmaakorpi and Melkas, 2005), (Wong, Ho and Autio, 2005). This paper assumes that at the spatial level, creative knowledge and innovation are closely related, so that it has led to spatial interactions between adjacent areas, even though there are areas that do not formally have good capabilities in knowledge creation, or some other areas are not eligible for commercialization. knowledge creation or innovation, but because of the spatial interaction and the possibility of creating economic agglomeration, it is possible for the regional economy to grow more rapidly due to the occurrence of economic transactions from this knowledge creation factor.

Currently, the techno-economy paradigm emphasizes collective learning process in generating innovation. Knowledge is said to be the most important production factor, and learning is a more important process (Shavinnina, LV, 2019). At the regional level, focus has been placed on the regional innovation system, where different types of actors are involved in the innovation process, which have benefited from the emergence of externalities during collaboration.

The region faces new challenges as well as achieving its goal of creating competitive advantages and global competitiveness. The competitiveness factor is very strongly related to the ability of the region to create and process knowledge creation quickly in environmental changes. Knowledge is claimed to be the most important production factor and learning is the most important process today (Asheim and Coenen, 2005), (Camagni, 2002). In the concept of the learning economy, learning is structured in the same way as knowledge in creating competitiveness, because the real problem for economic performance is the ability to learn, not stock knowledge. Therefore it is necessary to have mutual interaction between regions in developing innovations so that the performance of economic growth can be improved.

In the interaction between regional economies, agglomeration and regional clusters are the result of regional development benefits due to the acquisition of externalities from geographic proximity, such as locally bounded knowledge spillover that leads to interactive learning processes (Krugman, 1991, and Lundvall (1992). emphasizes interactive and collective nature of learning. Synergy advantages arise because of knowledge spillover and increased trust in the collective learning process. The concept of learning economy also emphasizes innovation as an important source for regional competitiveness.

The characteristics of innovation as a social process, non-linear and interactive learning process, have raised questions about the role of socio-cultural structures in the innovation process. In regional view, innovation is often understood as locally embedded processes, which take place in regional innovation systems. The regional innovation system consists of various innovation networks that aim to increase the capacity of the innovation system. These networks have many different forms such as differences, origin, size, structure and purpose of the network. Regional innovation systems are often formed from heterogeneous groups such as firms, universities, technology centers, development organizations. The problem is how to create atmosphere trust in the network? Is the production of innovation able to drive economic growth in the economic corridor of the Sumatra region? Is the creation of regional economic agglomerations able to encourage greater production of innovations which in turn lead to economic growth? Does the increase in added value in industrial products affect product innovation and economic growth? What are the implications of the interrelation between economic agglomeration and innovation products and economic growth in the economic corridor of Sumatra?

This research takes place in the economic corridor of Sumatra, which consists of ten provinces on the island of Sumatra. Data on spatial regional innovation and economic growth from 10 provinces were taken from 2003-2020.

Research Methods

The standard model in the econometric literature on knowledge spillover analysis from the research results of universities and other research centres on regional innovation capacity has been derived from the knowledge production function (Anselin, et al, 2000). Basically by referring to the Cob-Douglas production function related to the measurement of knowledge creation that has been commercialized in the form of an innovation product, (K) with the following model:

$$Log(K) = \alpha + \beta Log\,(R) + \gamma Log(U) + \delta log(Z) + \varepsilon_K \qquad (1)$$

Where R is the measurement of industrial R&D and (U) is the research produced at universities in the form of knowledge creation, (Z) is the characteristic of the local economy which is often incorporated into models such as social capital and economic agglomeration, and εK is the stochastic error term. Economic agglomeration occurs because the impact of spatial externalities, increasing returns and spatial competitiveness tends to provide benefits to economic activities in neighboring areas. In this context, the role of research in tertiary institutions that results in knowledge creation, the importance of economic agglomeration aspects will trigger knowledge spillovers in adjacent areas. So that the model of knowledge creation as a regional innovation variable can be estimated using spatial econometrics.

Measurement of innovation carried out in research so far can be divided into 3 ways

(Carlino and Kerr, 2015), namely first: based on the inputs used in the innovation process such as regional expenditure for R&D such as spending on goods and services to produce marketed goods and services, or spending on assistance services for universities, and spending on consulting services and professional services, or investing in venture capital (VC). Second: based on intermediate output from innovation efforts such as the number of patents. The third is based on the final product of innovative work, such as the number of new products of goods and services produced and commercialized, such as added value to the goods and services produced. Meanwhile, the scope of measurement of innovation can also be differentiated based on the level of personality, situation and area or arena of commercialization of new product adoption and diffusion (Goldsmith and Foxall, 2003). This study tries to use the three measurement forms mentioned above and compare them at the regional level of innovation.

Spatial data analysis was carried out in several steps: first, this study used the Moran Index and Moran scatter plot to analyze global and local characteristics of spatial agglomeration and regional knowledge creation or innovation (Anselin et al., 2006; J & Cliff, 1975). Second; This study builds a spatial lag model (SLM) (Anselin, 2010), and a spatial error model (SEM) to analyze the interrelationship between the growth of innovation products among ten provinces in Sumatra with some of the social economic indicators mentioned above. This study built a shape file (shp.file) from the dependent variable and the independent variable in ArcGIS software and exported it to the Geoda software (Anselin, 2003). All analysis processes in the study were carried out using GEODA 1.14.

The spatial autocorrelation analysis built on variable knowledge creation in the province of Sumatra and the influencing socio-economic indicators is based on the first geographic law, which reflects the degree of data interdependence from two spatial locations (Anselin, 1988). Moran I statistics have been commonly used as an indicator of global spatial autocorrelation (Anselin, 1993; Anselin, 1990). The Moran index then takes the following form:

$$I = \frac{\sum_i \sum_j W_{ij}(X_i - \overline{X})(X_j - \bar{X})}{\sum_j (X_j - \bar{X})} \quad (2)$$

$$I_i = \frac{n(X_i - \bar{X})}{\sum_{i=1}^{n}(X_i - \bar{X})^2} \sum_{i=1}^{n} W_{ij}(X_i - \bar{X}) \quad (3)$$

Where I is the global Moran Index, whose value is between -1 and 1. If the value of I Moran Index is close to 1, then there is spatial autocorrelation, on the other hand, if the value of I is close to zero, there will be no spatial autocorrelation. According to Glazier (Glazier et al., 2004) Moran's I value> 0.2 or <-0.2 has implications for the significance of spatial autocorrelation.

Spatial econometrica focuses on interaction models between provinces in the Sumatra corridor that were the samples of this study. Spatial econometric studies have become important in regional development at this time. According to Anselin (Anselin, 1988), and Cliff and Ord (1973) research on cross sections, especially spatial lag models, has become an important issue in regional development research. This study will estimate standard regression using the ordinary least square (OLS) method by taking the following equation:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \varepsilon_i \quad (4)$$

Where Y is knowledge creation as a measure of innovation in the Sumatra region, Xi represents socioeconomic indicators that influence it, such as social capital and regional

economic agglomeration, β_0 represents constants, and β_1 and β_2 represent regression coefficients, and ε_i represents errors term

Furthermore, this study also analyzes the spatial lag model and the spatial error model. When compared with OLS, the spatial econometrica model considers spatial dependence in the regression model as OLS could not do before, to produce consistent estimators (LaSage, 2008; LeSage, 2009). The spatial lag model (SLM) (Griffith, Chun and Li, 2019), and the spatial error model (SEM) are part of the spatial econometric model that is commonly used in the analysis of regional development innovations. SLM assumes that there is a spatial dependence in the dependent variable, whereas SEM assumes that there is also a spatial dependence in the error term. The form of the derivative equation of SLM can be seen in the following equation:

$$Y = \rho WY + X\beta + \varepsilon_i \quad (5)$$

$$Y = (In - \rho W)^{-1} X\beta + (I_n - \rho W)^{-1} \varepsilon \quad (6)$$

$$\varepsilon \sim N(0_{nx1}, \sigma^2 L_n) \quad (7)$$

Where, Y is n x 1 the dependence variable vector, n, is the unit of observation, W is the spatial contiguity matrix which describes the neighborhood pattern of the spatial units in the sample, ▪ is the spatial auto correlation coefficient, X represents a matrix of explanatory variables, related to k x 1 the vector of the regression coefficient of ▪, and ▪, is the random error vector. The special form of SLM is:

$$Y_i = \alpha + \rho \sum W_{ij} Y_i + \varepsilon_i \quad (8)$$

Where Wij is an element of the spatial contiguity matrix. ▪Wij is a spatial variable built from a spatial contiquity matrix and the dependent variable and the system are stationary. So this model represents the spatial structure of the dependent variable Y, this is a model that considers the impact of spatial correlation on the dependent variable, while ▪ is a parameter related to the independent variable Y on the spatial weight variable Y

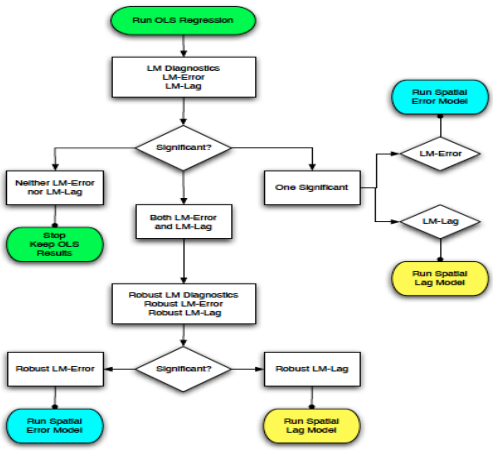

Figure 23.24: Spatial regression decision process.

Source: Anselin, (2014)

On the other hand, SEM considers the spatial dependence in the error process which can be represented by equations:

$$Y = X\beta + \mu \quad (9)$$

$$\mu = \lambda W\mu + \epsilon \quad (10)$$

Where · is the spatial autocorrelation coefficient. The estimation of the SLM and SEM coefficients can be done using the maximum likelihood (ML) as suggested by Ord (1953) and Anselin (1988). How the form of the process of determining the right spatial regression model from this model can be seen in Figure 1 above as stated in the Technical guide for using Geoda software in (Anselin, 2014; Luc Anselin, 2004; Anselin & Rey, 2012).

Furthermore, to measure the accuracy of spatial models, both SLM and SEM, 4 indicators are used which can be considered when the ML approach is used, the four indicators are: (1). Pseudo R2, (2) maximum likelihood (LIK), (3) Akaike information criterion (AIC) and Schwartz Criterion (SC). A good model (goodness of fit) is fulfilled if the Pseudo R2 value, the LIK value is higher, while for AIC and SC the small value is for a better model (Anselin, 2019; Putra et al., 2020).

Results and Discussion

Overview of Inputs, Processes and Innovation Products in Regional Economic Corridors Sumatra

Innovation is new products and services developed through new governance that can provide benefits and win the competition by users of these products. According to the OECD (2018) an innovation is a new product or a change in a product or process that is significantly different from the original product or a process that is made available to potential users of the product used by an organizational unit. Innovative products are the result of creating knowledge that comes from creativity and applied research that is continuously carried out in overcoming a problem in community organizations, corporate organizations, and government organizations, which make their work easier.

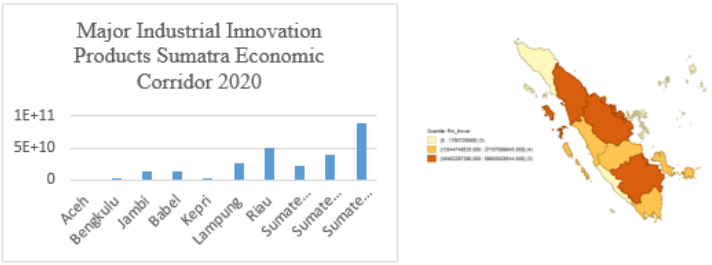

Figure 1: Distribution of Large Industrial Innovation Products in the Sumatra Economic Corridor

Innovation products from large and medium industries in the economic corridor of the Sumatra region are most dominant in 3 provinces, namely North Sumatra, Riau and South Sumatra. However, there are 2 regions that have the lowest major industrial innovation products, namely Aceh and Bengkulu provinces. The products of the major industrial innovations that are most dominant and have the most workers come from the food industry, the beverage industry and the rubber industry and rubber goods. It turns out that this coincides with areas that have the highest economic growth and the number of working people. This

means that the more dominant the product of an innovation is from a region, the higher the economic growth and the greater the number of people working.

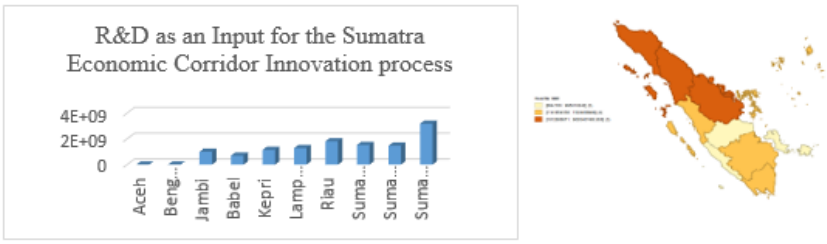

Figure 2: The distribution of the value of R&D as an input for the innovation process in the Sumatra Economic Corridor in 2020

The value of R&D as an input to the innovation process in the proxies of regional goods and services spending in an effort to encourage the improvement of the quality of tertiary institutions and regional research institutions is one of the variables that greatly influences the improvement of regional innovation products. The most dominant distribution of R&D data is in 3 provinces, namely Riau, North Sumatra and Aceh. Meanwhile, the provinces with the lowest R&D input were Jambi, Bengkulu, and Bangka Belitung. The two regions mentioned last turned out to have relatively small numbers of tertiary institutions and large industrial companies compared to the others. Universities and large companies are institutions that have great opportunities and tendencies to produce greater innovation products.

The regions that have the greatest potential for innovation products to continue to develop are North Sumatra, Aceh and South Sumatra (see Figure 3), because these three regions are the regions that have the most number of tertiary institutions. It is believed that the creation of commercialized knowledge creation will be preceded by research and community service activities carried out by academics in higher education who continuously produce research at the R&D level, innovative products and even produce patents.

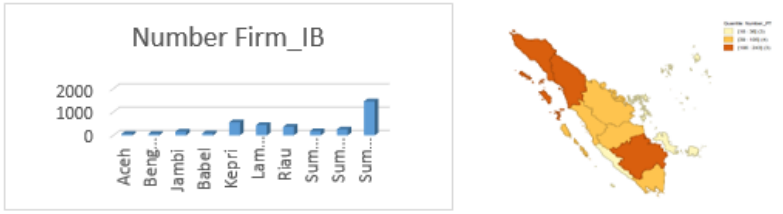

Figure 3: Areas that have high Product Innovation Potential

Figure 3 shows that the region with great potential in producing high innovation products is the one with the largest number of universities, because the opportunity to produce knowledge creation as the origin of innovation products is very high. This potential is also accompanied by the number of large and medium industrial companies that develop research results in the form of higher education R&D into patented industrial products, and even build prototypes of research products that can be commercialized a step after that. The regions of North Sumatra, the Riau Islands and Lampung are areas that have a very large number of large

and medium industrial companies, in addition to the large number of universities, so that in these two regions, North Sumatra and the Riau islands have a greater opportunity to produce innovative products. bigger anyway.

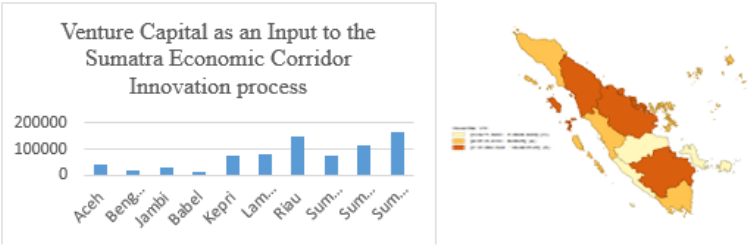

Figure 4: Condition of the Distribution of Venture Capital as an Input to the Innovation Process in the Sumatra Economic Corridor

The condition of venture capital is the potential investment value owned by the economic corridor area that can be used to encourage investment development by large companies and industry, together with the government which has the task of investing in public goods, which is related to the provision of higher education services and development centers. research, as the center of innovation creation. In Figure 4 above, there are three areas in the economic corridor of Sumatra that have the greatest potential for venture capital, namely North Sumatra, Riau and South Sumatra. It turns out that this is in line with the resulting innovation products, because these three regions also have the most dominant innovation products from large and medium industries. If the venture capital, which means the availability of large business capital in large and medium industries, is getting bigger, it is expected to have a positive relationship with the increase in product innovation. However, if venture capital is dominated by investment by the government as an autonomous investment, of course in the provision of public goods, it has not been able to encourage increased product innovation.

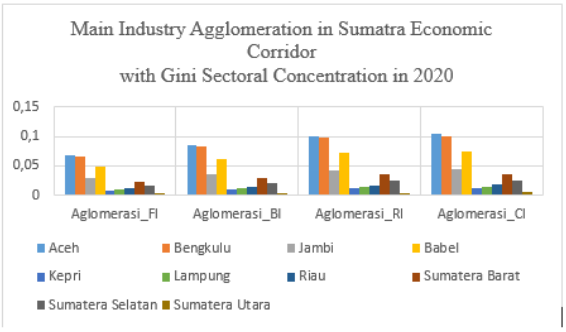

Figure 5: The distribution of economic agglomeration in the main large industries in the Sumatra Economic Corridor

Agglomeration is a grouping of economic activities that occurs because companies experience several advantages from being located close to one another (Frenken, Van Oort and Verburg, 2007). The source of economic agglomeration due to economic localization of several large and medium enterprises is due to externalities (Marshallian externalities). These Marshallian externalities come from labour market pooling, the creation of specialized suppliers

and the existence of knowledge spillovers. In Figure 5 above shows the results of agglomeration measurements using the traditional Gini sectoral concentration measurement, the greater the Gini sectoral concentration, which is closer to 1, the morefull concentration of industrial products occurs in the area, and vice versa, the Gini concentration number is the same with 0, then the distribution is uniform. There are 4 regions that have high Gini index numbers, namely Aceh, Bengkulu, Babel and Jambi, this implies that the potential for economic agglomeration is greater in the main industrial business fields, namely the food and beverage industry, the rubber industry and the computer industry. Furthermore, there are 6 regions that have a Gini index that is less than 1, or close to 0, meaning that the distribution of industrial labor in the food, beverage, rubber and computer equipment industries is evenly distributed in this region.

Factors that influence product innovation in the Sumatra Economic Corridor

Regional trade and innovation products from large and medium industries are spatial variables, meaning that these innovation products have a spatial effect on the surrounding area in the form of these variables containing spatial autocorrelation problems. Changes in this variable will have an impact on the surrounding area (queen contiguity). This is evidenced by the Moran I Index value which is greater than 0.02 or -0.02.

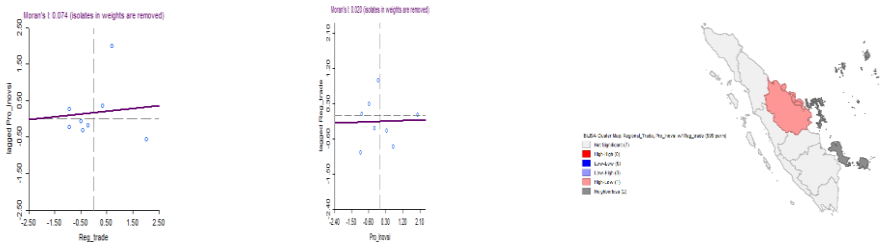

Figure 6: Value of Moran Index and Lisa Index for Regional Trade Variables and Innovation products in Sumatra Economic Corridor.

Innovation products as independent variables are able to influence regional trade spatially, with the cluster centre in Riau province, which has links with other regions as indicated by the significance of LISA Map in the High-Low category. This means that if the province of North Sumatra is the region that produces the highest innovation products, then the 1% confidence interval is significantly related to the Riau region. In addition, Figure 6 shows that there are 7 regions that do not have significant neighbors in regional trade for innovation products, and there are even two regions that have no neighbors at all (neighborless), namely the Bangka Belitung islands and the Riau Islands. In Figure 6a. Currently, regional trade is a variable with Moran I index value of 0.07 > 0.02, significant as a spatial variable. On the other hand, the innovation product itself has not been able to encourage regional trade to become a spatial variable, because the Moran Index value is equal to 0.02. This means that to strengthen the economy in the economic corridor of Sumatra, it is necessary to increase regional trade, through increasing trade accessibility, so that regional trade intensities are higher.

Table 1: Regression Results Factors that affect product innovation in the Sumatra Economic corridor

No	Variabel	OLS		Spatial Lag Model		Spatial Error Model	
		Coefficient	t-Statistic	Coefficient	z-Statistic	Coefficient	z-Statistic
1.	W_Pro_Inovation	-	-	0,6617***	3,1567	0,6617	3,1567
2.	Constant	-6,7474	-0,4812	-1,0893	-2,6963	-4,6813***	-3,4023
3.	R&D	-0,4673	-0,1219	-7,5837***	-3,1854	-8,1122***	-4,3005
4.	VC	-8571,68	-0,5742	-12458,4***	-2,9315	-4689,71***	-3,9025
5.	VA_Food	3,8529	0,8122	4,7746***	3,5594	3,3087***	6,8644
6.	VA_Beve	82,9616	0,7934	128,101***	4,1327	70,9946***	6,8428
7.	VA_Comp	15,6777	0,1653	34,1359	1,2577	67,1122***	5,5369
8.	Aglo_FI	1,064	0,4859	1,4395**	2,3377	7,2583***	3,1479
	Breusch-Pagan Test	5,2014		5,2014		8,4403	
	Moran I	-0,1513					
	Robus LM	8,0000***					
	Robus LM error	7,4144***					
	Langrange Multiplayer	8,2471**					
	R^2	0,9592		0,9745		0,9993	
	R^2 Adjusted					-	
	Likelihood Ratio test			2,1481		7,7442***	

Source: Own Analysis Results

The accuracy of the innovation product model in the economic corridor of Sumatra is shown by Moran I's statistic of -0.1513> -0.02 indicating that this innovation product model is a spatial autocorrelation model, so it is best estimated with a spatial lag model (SLM) with regional trade variables. as spatial dependence for weight matrix. Robust LM and robust LM errors are also significant at the 5% confidence level. The Breusch-Pagan test value for testing the heteroscedasticity problem was not significant. So the diagnostic test for the accuracy of the model used shows that the model is categorized as robust LM and Robust LM errors, so it can be used to analyze and interpret the innovation product model in the economic corridor of Sumatra. In total, all the variables included in the model that are related and have an impact on increasing the innovation product in the economic corridor area of Sumatra are 97.45%, which can be explained by the remaining model, explained by other variables that have not been included in this model. Likewise in SEM, the accuracy of the model is more evident, it is able to provide an explanation of 99.93% of the variation of the independent variable.

In SLM and SEM, it can be seen that the R&D and VC variables have a negative coefficient sign that is not as expected, which means that the smaller the R&D and VC, the more the innovation product increases. This is because the R & D proxies used are regional government expenditures in the form of capital expenditures in which there is a portion of assistance to universities by the regional government. It is suspected that local government assistance for the improvement of tertiary institutions in the area is used for scholarships for further study by lecturers and, for physical investment such as building buildings, land, and other physical infrastructure, so that if the use of this local government assistance is increasingly used for scholarships for further study of lecturers for campus physical development. , of course, it will reduce the innovative products produced by higher education institutions through increasing research activities and scientific publications, and even producing higher education products in the form of patents and prototypes. It is better if government spending in the form of research funds for universities to produce output in the form of R&D, even patents and prototypes as goods and services that can be commercialized by entrepreneur groups.

Furthermore, the added value creation variable in the food industry (VA_Food), the

creation of added value in the beverage industry (VA_Beve), the creation of added value in the computer and other electronics industry and agglomeration in the food industry, has a positive coefficient sign, is in accordance with the theory, which is increasingly the high added value of each of the food, beverage, computer and other electronic industries will further encourage added value to regional innovation products. Likewise, in the creation of the food industry agglomeration, the economic agglomeration in the food industry will further increase the ability to encourage an increase in regional innovation products. Among the independent variables that have a very strong influence on increasing regional innovation products in the Sumatra economic corridor is the increase in added value in the beverage industry. This is in line with the emergence of a new trend in the urban lifestyle that has grown massively in beverage businesses such as coffee shops and the canned beverage industry.

The creation of agglomeration in the food industry, beverage industry, rubber industry, computer and electronics industries can significantly lead to increased regional innovation. The creation of industrial agglomerations that have the greatest impact on the encouragement of regional innovation products is found in the agglomeration of the rubber industry and other computer and electronic industries, which are indicated by their coefficient values of 9,7244 and 9,4029, respectively. This means that to encourage an increase in regional innovation products, agglomeration must be created in the rubber industry and the computer and electronics industry in the economic corridor of Sumatra. Currently, the largest number of rubber and computer and electronic equipment industries are in the provinces of North Sumatra, South Sumatra and Lampung. The largest area of land for the rubber industry is in the province of South Sumatra, followed by Jambi, Riau and North Sumatra provinces. Meanwhile, the largest number of workers in the rubber industry is in the provinces of North Sumatra and South Sumatra. So it can be said that the potential for the creation of the rubber industry agglomeration lies in these two areas.

Next, it is also seen how the impact of increased product innovation and several variables that lead to increased regional trade is the same as efforts to encourage increased regional trade. Regional trade is the biggest driving force for increasing regional innovation products compared to increased innovation products to boost regional economy. This is indicated by the value of the Moran index for regional trade which is much higher than the value of the Moran index for innovation production in the economic corridor of Sumatra so far.

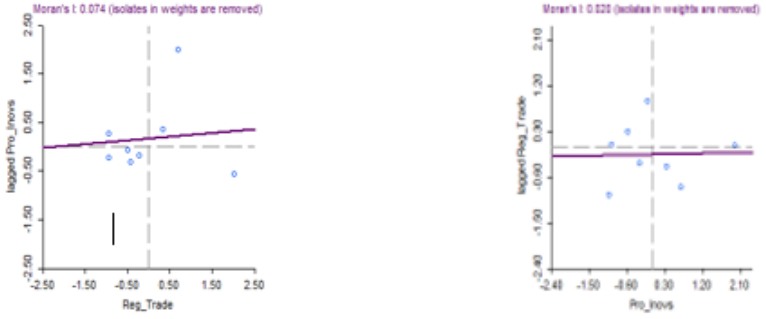

Figure 7: Moran's index of regional trade and innovation products in the Sumatra Economic Corridor

Figure 7 above shows that regional trade is a more spatial variable compared to regional

innovation products, so that if there is a change in regional trade as a result of changes in innovation products, it will have a spatial impact on the surrounding area.

Regional trade is positively and strongly influenced by input innovations in the form of spending and spending on R&D development, increasing the added value of the beverage industry, increasing the added value of the computer and electronic equipment industry and the production of innovations produced by large and medium industries in the economic corridor of Sumatra. So that all the variables mentioned will encourage increased regional trade in the economic corridor of Sumatra. This regional trade variable is also spatial, so if there is a change in the center of the cluster, namely the province of Riau, it will have an impact on the buffer areas.

On the other hand, regional trade is inversely proportional to the variable venture capital, increased value added of the food industry, increased value added of the beverage industry, and added value of the rubber industry. If there is an increase in the above variables, it will encourage regional trade to decline. It is interesting to observe that the variable Venture capital is cooperation between large industrial companies in capital in developing large industrial products, increasing this capital cooperation in the form of building joint business ventures or producing jointly will actually encourage less regional trade. Usually large and medium industrial companies that carry out cooperation in the form of venture capital are ultimately oriented towards increasing the export of their goods and services abroad, as has happened in various industrial areas in each region.

Table 2: Results of the Regional Trade Spatial Model Regression and its relation to innovation products

No	*Variabel*	*OLS*		*Spatial Lag Model*		*Spatial Error Model*	
		Coefficient	t-Statistic	Coefficient	z-Statistic	Coefficient	z-Statistic
1.	W_Reg_Trade	-	-	0,8675***	11,0561	-	
2.	Constant	2026,7	-0,1762	-15573,4	-6,7692	-2023,74	-0,6565
3.	R&D	7,8107	2,2378	1,1138***	17,5138	6,3586***	2,7372
4.	VC	-0,0079	-2,5725	-00031***	-5,0826	-0,0104***	-10,0164
5.	VA_Food	-3,2533	-2,1807	-6,6186***	-18,1696	-2,8403***	-28031
6.	VA_Beve	6,2634	1,2945	-2,6408***	-2,4913	9,3427***	7,3552
7.	VA_Comp	6,9214	0,9373	4,1307***	3,4441	3,8881	1,5272
	Va Rubber	-1,2857	-1,1990	-7,3718	-4,1180	-3,3547	-0,6591
8.	Prod_Inov	2,3874	2,7139	4,1374**	20,5448	1,8642***	4,0962
	Breusch-Pagan Test	10,0821	-	8,87,01	-	3,8893	-
	Moran I	-0,0342					
	Langrange Multiplier (lag)	5,2956**					
	Robus LM	9,3188***					
	Robus LM error	4,0430**					
	Langrange Multiplayer	9,3386**					
	R^2	0,9302		0,9912		0,9855	
	R^2 Adjusted	0,6861				-	
	Likelihood Ratio test			16,9757***		2,4443	

Source: Own analysis result

The R & D variable is a spatial variable which is indicated by the positive Moran index value reaching 0.425. The centre of the research and development development cluster in the

Sumatra economic corridor that encourages increased regional trade is the provinces of North Sumatra, South Sumatra and Bengkulu. If there is an increase in R&D spending in these three regions, it will have an impact on increasing changes in regional trade in neighboring regions as their hinterland areas.

The variables of increasing the added value of the beverage industry and increasing the added value of the computer industry and electronic goods, respectively, are the centers of the cluster which are Aceh province and Riau province, so if there is a change in this variable it will encourage changes in neighboring areas. All of these spatial variables greatly affect the increase in regional trade in the economic corridor of Sumatra. Especially the added value for the beverage industry, the added value for the computer industry and other electronic equipment which is a spatial variable, in the long term it will have an impact on increasing regional trade in the economic corridor of Sumatra. Therefore, to increase regional trade among regions in the economic corridor of Sumatra, efforts to increase the added value of the beverage industry, computer industry and electronic equipment can be made, in order to create an increase in regional trade. In addition, the creation of agglomeration in the beverage industry and the computer and electronic equipment industry, it turns out, also in the long run leads to an increase in regional innovation products (see table 1), indicated by the largest coefficient value in the spatial error model.

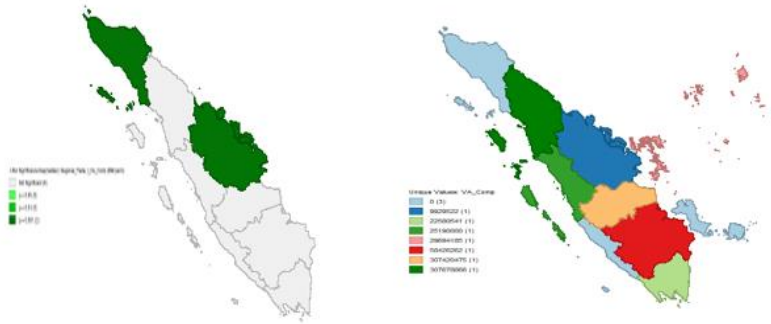

Figure 8: Cluster Center for Increasing Value Added of the Computer and Electronic Goods Industry in the Sumatra Economic Corridor

Figure 8 above shows the cluster centres for increasing the added value of the computer and electronic goods industry in the provinces of Riau and Aceh and their closest neighbors are the provinces of North Sumatra, West Sumatra and Jambi, and South Sumatra. If an increase is made in the added value of this industry at the centre of the cluster, it will have an impact on neighboring areas. This can build economic agglomeration between Sumatra's economic corridors going forward.

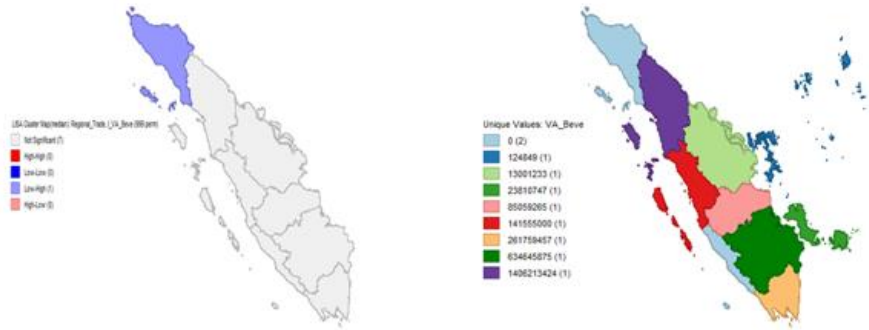

Figure 9: Cluster Center for Increasing Value Added of Beverage Industry in Sumatra Economic Corridor

Figure 9 above shows the cluster centre of the increase in the added value of the beverage industry which is spatial and has the greatest impact on the increase in regional innovation products in the long term, the cluster centre in the Low-High category is in Aceh province, while the neighboring areas are North Sumatra, West Sumatra, and South Sumatra. If the increase in the added value of the beverage industry at the centre of this cluster will have an impact on this neighboring area.

Conclusions

Based on the problems and discussion carried out, the following conclusions can be drawn:

1. Regional innovation and trade products are spatial variables because they have a larger Moran index value, with the centre of the cluster being the province of Riau, so changes to innovation products and regional trade will have an impact on areas around the centre of the cluster, such as North Sumatra, West Sumatra, Sumatra. South. The increase in regional trade intensity is able to encourage an increase in innovation products in the Sumatra economic corridor. On the other hand, the increase in innovation products by large industries has not had a significant impact on increasing regional trade in the Sumatra economic corridor.
2. Factors that affect the increase in innovation products in large and medium industries in the economic corridor of Sumatra are the increase in added value in the beverage industry, increase in added value in the computer and electronic goods industries, and the creation of agglomerations in the food and beverage industry. Meanwhile, an increase in government spending on increasing R&D and venture capital encourages a decline in innovation products in large and medium industries in the Sumatra economic corridor.
3. Factors that affect the increase in regional trade in the economic corridor of Sumatra are increased government spending on R&D, increased added value in the beverage industry, increased added value in the computer and electronic equipment industry, and regional innovation products.
4. The cluster centre for increasing the added value of the computer industry and the beverage industry as a very important variable in increasing regional innovation products and regional trade in the long term is the provinces of Riau and Aceh and this greatly impacts the hinterland region.

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