THE LINKAGE BETWEEN REGIONSTOWARD THE DEVELOPMENT OF URBAN AREASUSING TRANSPORTATION COSTS APPROACH IN ACEH

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Abstract

This study empirically examines the relationship between the regions and the development of urban areas within six (6) regionals ATDC (Aceh Trade and Distribution Center) that have been defined in the Spatial Plan (RTRW) Aceh. First model we employ in this article is aGravityModelwhich aims to observe the amount of linkage index (GI) between the central zone and the tested zone. Second method israndom effects regressionto find the effect of distance, travel time and cost of transport to the Gravity Index (IG).Third, mapping of the Arc-GISusing MDSA in viewing the development of the City. The results showthat the largest GI towards the center of the zone are the areas of; Central Zone (Banda Aceh City), North Zone (North Aceh District), East Zone (Langsa City), Southeast Zone (GayoLues district), South Zone (South Aceh) and West Zone (Nagan Raya). Random effects regression shows that between the travel time and transportation costs are significantly negative influence, while the distance is negative but not significant. MDSA test illustrates that there are three clusters can be developed in the Province of Aceh.

Keywords: Gravity Index Model, Random Regression Model, MDSA (Multi Dimensional Scaling Analysis), Arc-GIS (Geographic Information System).

1. INTRODUCTION

Regional development is intended as an attempt to equalize and disseminate development in the region with a purpose to harmonize and balance or minimize the difference in the level of growth rate among regions, as well as integrating all development activities in the region in order to support the successof the overall national development. Regional development is an integral part of national development. Economic development of a region is closely related to the economic potential and characteristics of the area along witha linkage between economic activities over the surrounding area.

Similarly, districts/cities in Aceh Provincehas diverses wealth of natural resources include oil and gas, agriculture, industry, plantations, inland and marine fisheries, and mining havea potential to be developed in accordance with the spatialplan of Aceh. Determination of the development of strategic areas of Aceh is divided into six (6) ATDC (Aceh Trade and Distribution Center) namely; Central Zone which is centered in Banda Aceh city, North Zone, which is centered in Bireuen city, East Zone, which is centered in Aceh Tamiang district, East Zone, which is centered in Kutacane city, South Zone, which is centered in Blangpidie city and the West Zone, which is centered in Meulaboh city.
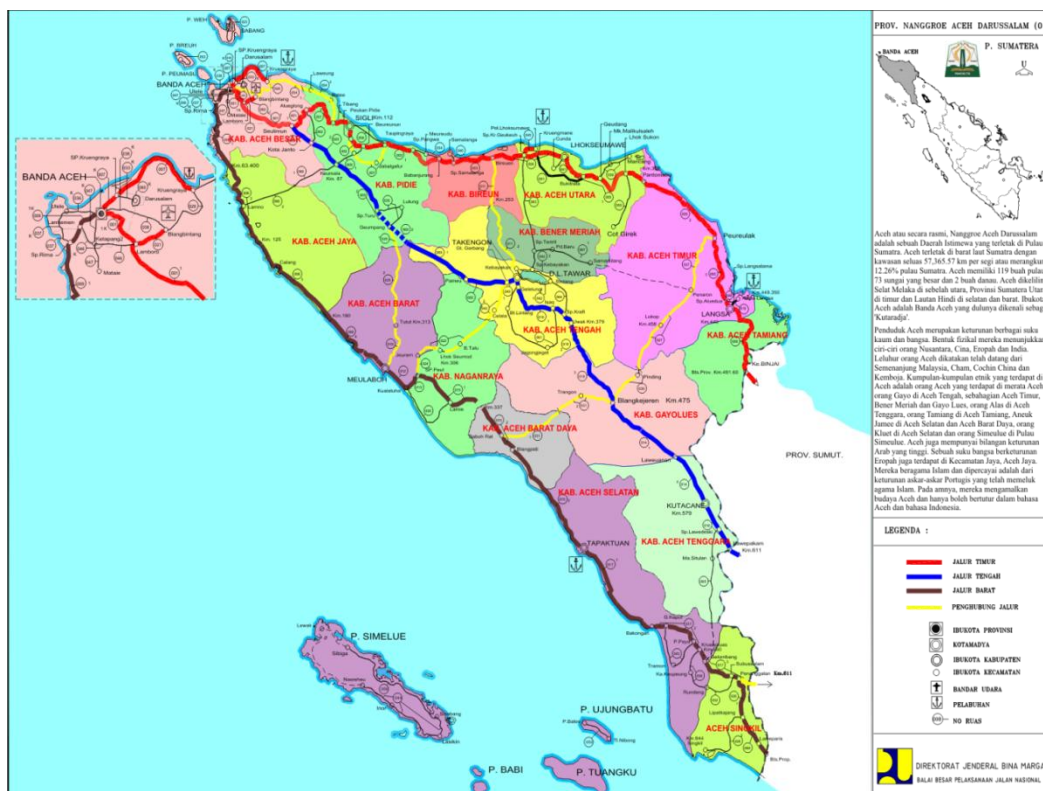

Figure 1. The Road System in Aceh
Source : Directorate General of Highways National Road Implementing AgencyI, 2014

Figure 1 demonstrates that in 2007 the total length of roads in the Province of Aceh is 18.682 km, then increaseto 22.457.3 km in 2012. It shows that there is a development of road infrastructure in the Province of Aceh during the period of 2007 to 2012. However, the linkage between the regions affected by the distance and transportation costs. Hence, the linkage betweenregions reflected the interaction between the regions. One indicator of the interaction between regions can be seen from the migration of the population.
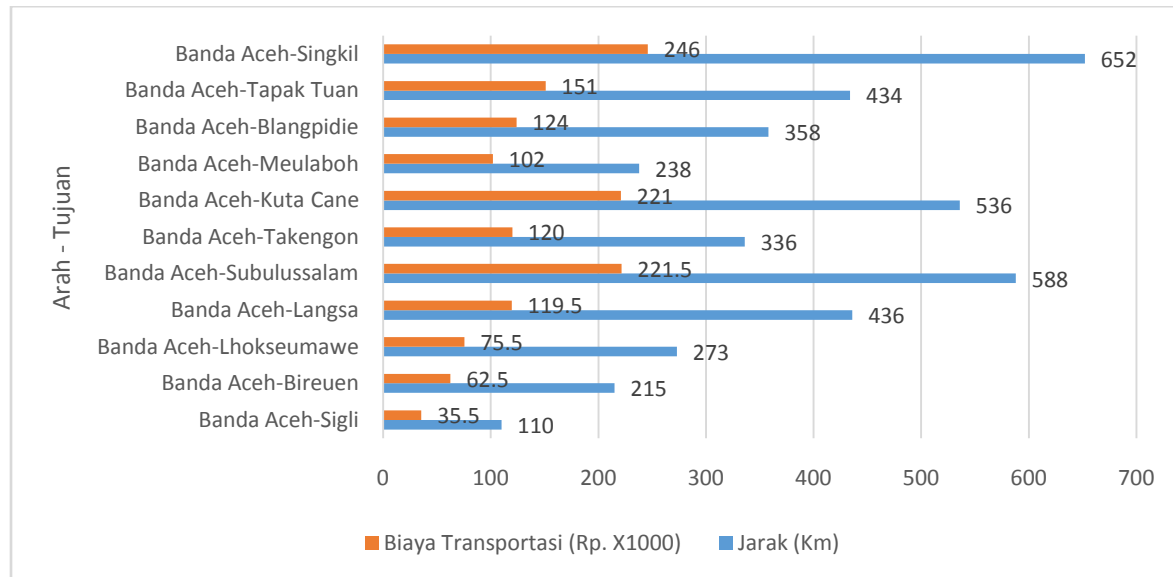

Figure 2. Distance& Transportation Costs from Banda Aceh to Several Cities in Aceh Province
Source: Organda Aceh, 2015

According to above figured,the distance, transportation costs and travel time among the areas in the province are also different from each other. For instance, the route ofBanda Aceh to the east coast of Aceh region and the transportation costs from Banda Aceh to the cities in the region are also different. Then, it isa similarity of thetransportation costs from Banda Aceh to the west coast of central and southern regions.

With regard to the explanation above, the first discussion of this study is the linkage between the regions in each development areas in Aceh in terms of transportation costs. Of course, an area with a small capacity would expect to the other areas to promote them. Second, researchers examine by looking at the influence of transportation costs, distance, and travel time to the linkages between the regions in the Aceh Province. Thus, the transportation costs, travel time and traffic flow of each development region in Aceh is relatively different from one another. Certainly, this is not only a point that can affect the interaction between regions, but also affect the development of the region. Finally, the third issue, we will seek a clarity on the characteristics of the region towards the development of urban areas.

2. LITERATURE REVIEW

The concept of development andregional linkage being ainfluence benchmark among region one another. Recently, only a few regions able to stand alone without the support of other regions. Whereas, the rest of them still stand beyond the potential from other areas, especially access to transportation. According toLeck, Shlomo and Naniel (2008), there is a relationship between accessibility (transportation) to the economic welfare of the societies. Furthermore, the development of transport can improve the efficiency, output, productivity and wages. Meanwhile, Pradhan and Tapan (2012) mentions thatit is a causal relationship between land transport infrastructure to the gross domestic capital formation. There is causality between economic growth and gross domestic capital formation. While the external factors, David and Pascal D (2004) describe that the regional economic integration through trade liberalization has a positive impact on economic growth.

Iek (2013) argues that thefirst, analysis results prove that the construction of the road as the main drivers of workforce growthout of agriculture side (non-farm) and it has an impact on variety to the source of public income. Second, the income difference test results prove that the construction of the road has a positive impact and significant changes in revenue. Meanwhile, Suparta (2009) conducted research related to the Spillover Effect stated that spatial spillover effect in the form of commodity price and income of the people in each region neighboring turns out the price level and income. Moreover, Suhonono (2008) applies MDSA model then concluding urban development is required to consider the economic environment strategic.

3. RESEARCH METHOD

The data that used in this reseach is panel data which is a combination of time series data for the period of 2006 to 2014 (cross section data) in each development region in the Aceh Province. The method applies for data analysis is accordances with the formulation of the problem and research objectives identified earlier, that is to analyse the relationship between regions and regional development. Firstly, the linkage between the regions are measuredfrom the Gravity Index (GI), a function which consists of indicators Gross Regional Domestic Product (GRDP), population, and distance. The structural form of the equations that describe the functional relationship between the variables expressed in the following equation (Wiyadi and Trisnawati, 2002):

3.1 Gravity Index Model:

$$GI_{ij} = \frac{a\ (W_i P_i)(W_j P_j)}{D_{ij}^b} \qquad (3.1)$$

Where : GI_{ij} = Gravity Index Modelregioniand j, W_i = GRDP per capitaregioni, W_j = GRDP per capitaregion j, P_i = Total Population regioni, P_j = Total Population region j, Dij = distance regionito region j, a = Constants, the value is 1.

3.2 Average of Gravity Index

Furthermore, in order to perceive the average of gravity index model it can be written in the equation as below:

$$\bar{X}GI_{ij} = \frac{\sum GI_{ij}}{n} \qquad (3.2)$$

Where : $\bar{X}GI_{ij}$ = Avegare of Gravity Index Model regioniand j, GI_{ij}= Gravity Index Model regioniand j, n= Total Data

3.3 Panel Regression Model

Thus,mathematically the relationship between these variables is expressed as follows:

$$GI = f\,(\text{JT, WT, OT}) \qquad (3.3)$$

The results of Gravity Index (GI) can be exertedas a development model from the relations of transportation aspects to the interactions between regions that can be stated to the equation (3.2), the regression model as follows:

$$GI_{ij} = \alpha + \beta_1 TC_{ij} + \beta_2 TT_{ij} + \beta_2 D_{ij} + \varepsilon \qquad (3.4)$$

Where : GI_{ij} = Gravity Index Model, TC_{ij} = Transportation Costs,TT_{ij} = Travel Time, D_{ij} = Distance,α = constant, β = slope, ε = residual.

4. RESULTS AND DISCUSSIONS

The gravity index is the amount of value added in order to establish linkages between the two regions that interact with each other economically. This index is obtained by matrix technique from 23 districts/cities in nine years time series by using a variable of distance, transportation costs, travel time, the number of residents in the city of origin and destination cities, as well as the GRDP in both regions. Then the magnitude of the index is defined as the value of the Inter-regional linkage index.

Figure 3indicates that the six zones in Provinceof Aceh. However, Aceh Utara districis centered in Lhokseumawe or otherwise amounted to 4,372,254, followed by the East Aceh district, North Aceh regency or otherwise amounted to 4,054,894 and Aceh Besaralso Banda Aceh cities or otherwise amounted to 1,264,264. Based on the information above, the largest

region of linkage indices were in the area north and east. It is apparent that the South West region has very small linkage index.
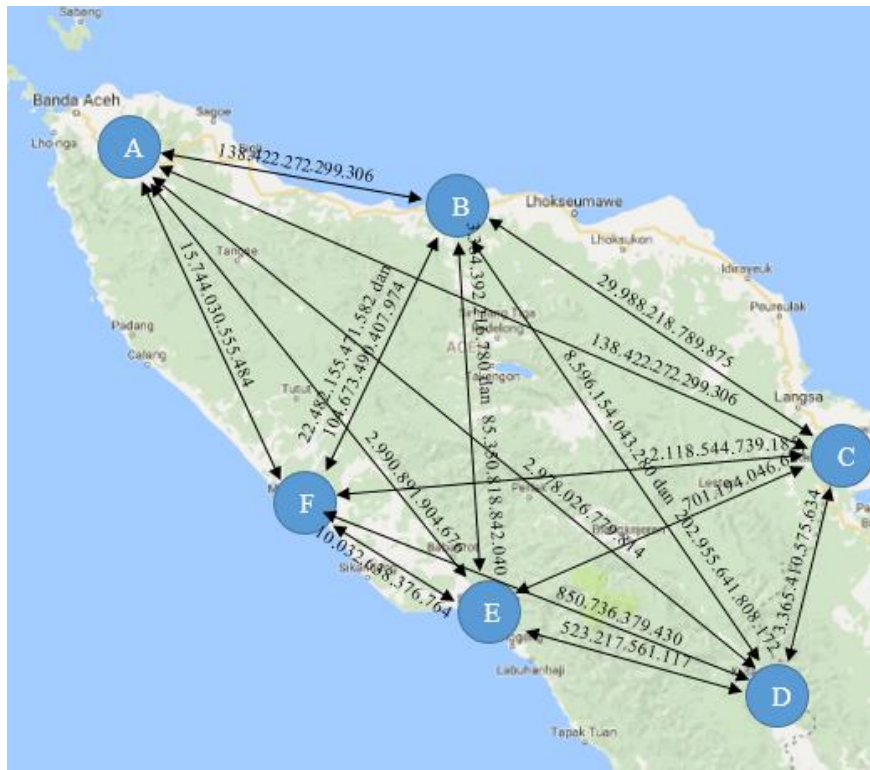

Figure3. Average of Gravity Index among the zones

4. 1 Regression Analysis Model for Regional Linkage Index

After the analysis process, the results obtained by Random Effect Method expressesin the table belows:

Table1.Estimated Regression Panel Gravity Index using Random Effect Model

Variable	Coefficient	Std. Error	T-Statistic	Prob.	Durbin-Watson
C	2.99E+14	1.21E+14	2.4657	0.0143	
JT	-83883997	1.07E+08	-0.7868	0.432	2.214
WT	-2.84E+09	1.36E+09	-2.0843	0.0381**	
OT	-6.73E+08	3.06E+08	-2.2010	0.0286**	

*Source: Panel Estimation result using Weight SUR (Seeming Unrelated). R-Square = 0.06509. F –Statistic = 5.842 (0.0000). Description: * = 10% ** = 5% *** = 1%*

Based on table Table 1 above points that using the model Pooled Least Square with cross-Section SUR (seeming Unrelated), variable D, TT and TC has a negative sign and significant (probability less than 5 percent but the probability of 0.0777 TC more less than 10 percent) to the gravity index. Among these three variables, the influence of travel time has very high coefficient effect on the index of gravity. The possibility of inter-regional mobility is faster when compared with the cost of transportation. Therefore, it can be concluded that within a determinant acceleration of structural change and economic growth across a region, proving that spatial spillover effect can occur with travel time.

4.2. Analysis of Multi Dimensional Scaling In Developing of Urban Area Policy

The competionof the data processed by MDSA (Multi Dimensional Scaling Analysis) willshow the coordinates of stimulus, two-dimensional image into four quadrants (ecludean distance model) and clustering (cluster) of each district/city. These results will then be mapped to the application of arch-GIS (Geography Information System) in order to exhibitthat the developmentof urban area is polygonal. Regarding to the description of the mapping using MDSA (appendix 1), the coordinates of the stimulus information obtained as follows:
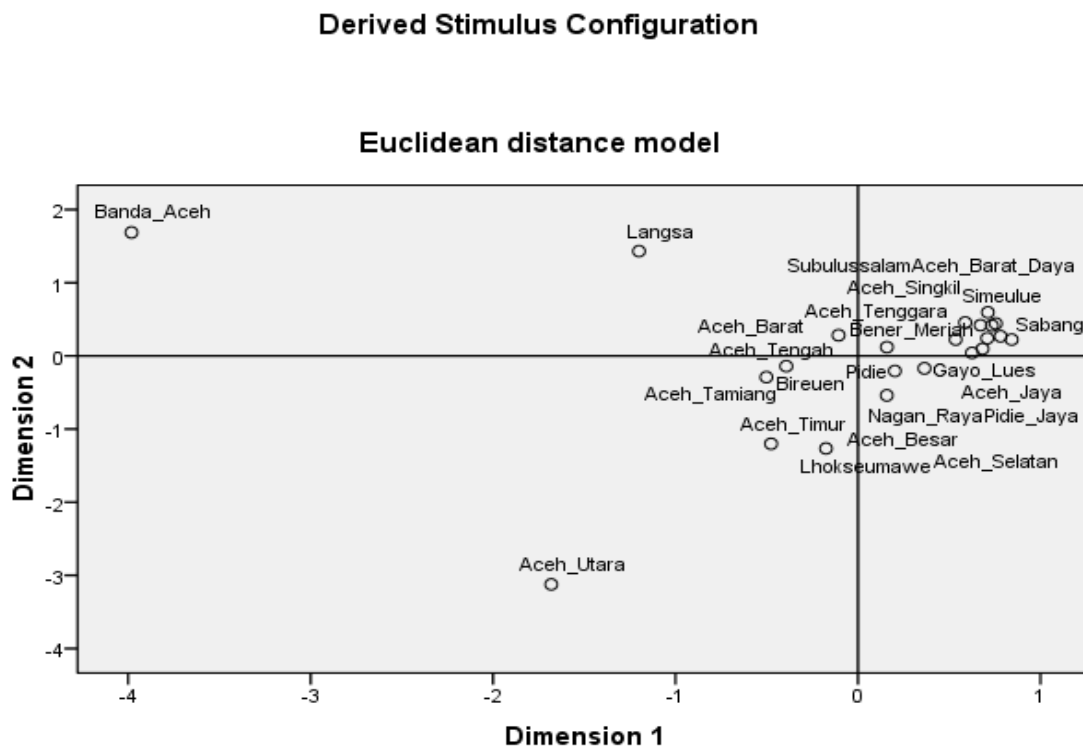
Derived Stimulus Configuration

Figure 4. Mapping of the Regional Development

From the output of the map Multi Dimensional Scaling Analysis above displays that there are two dimensions categorizethe variables based on the dimensions of the basis for establisment of the grouping. The variables in this grouping are regional budget of districts/cities in Aceh Province, the number of non-agricultural labor force, and undeveloped land in urban and population density in regency/city in the Province of Aceh. For example, sabang coornidate and Simelue coordinate are coincidented with each other means that the development of the region both resemble.

In terms of economic, land area and undeveloped land and the number of non-agricultural workers will increase. In fact the public earlier in the agricultural sector earning a lower income. When the development of the territory turned bring new jobs that enable movement of workers from agriculture to services. Even, it is possibblethat the ownership of agricultural land converted into building land.

For analogy, in the explanation based on the output map Multidimensional scaling with the function of classifying objects regard to the similarity and dissimilarity, it is known that the city of Banda Aceh and Langsa is located in the same quadrant, that is quadrant I, though distant from each other. But this is points that the object of Banda Aceh has many similarities to Langsa. Likewise for other districts/cities that are in a particular group.
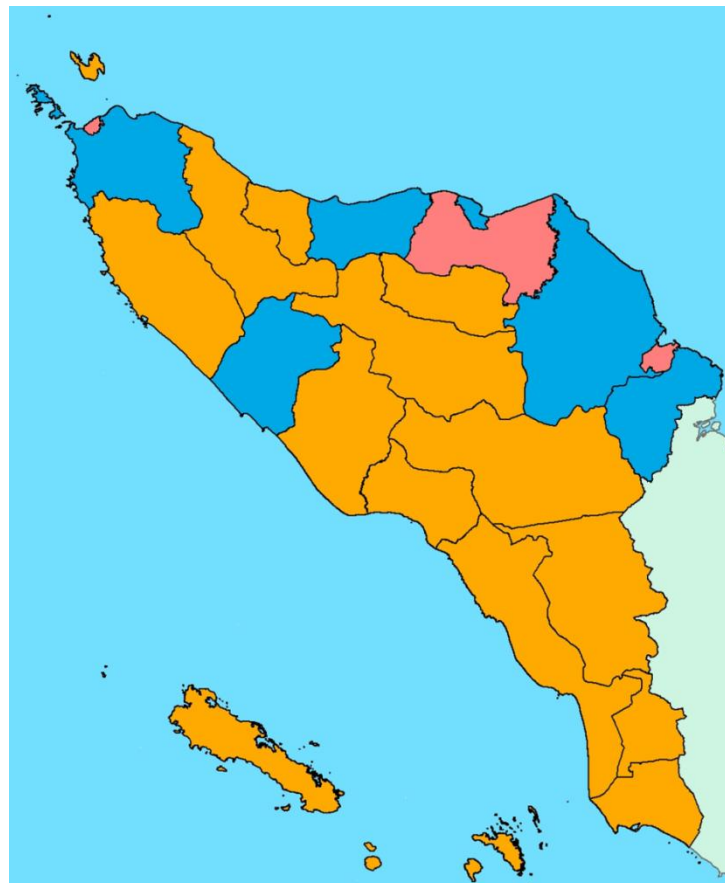

Figure 5. Cluster MappingArc-GIS

Coresponding to the figure 5, regionalcluster I is the development of a livable city with the structure of non-agricultural workers and there are more building area has been built, that is in Banda Aceh, Aceh Utara, and Langsa city. Then, this situation allows cluster I for growing much more rapidly. After that, second cluster describes this area as a developing area and toward to developed, it consists of Aceh Tamiang, East Aceh, Bireuen, Lhokseumawe, Aceh Barat and Aceh Besar. The latter is a region of cluster third describes 14 areas, namely the Southeast Aceh, Pidie, Nagan Raya, Aceh Tengah, Aceh Singkil, South Aceh, Simeulue, True Meriah, Pidie Jaya, Aceh Barat Daya, Subulussalam, Sabang, GayoLues, Aceh Jaya. Those areas have not developed yetas a urban sector.

5. CONCLUSION

The results of this analysis concluded thatthe closer a districts/cities to the central area of a particular zone, the greater a linkages between regions index generated by the gravity model. Then, that distance, travel time and transportation costs between regions negative effect on the index resulting linkages between regions. The smaller the distance, time and cost, the greater the gravity index. Finally, the development of urban areas is reflected in the vast and undeveloped land and non-agricultural workforce. The trajectory of the area is able to boost the regional economic structure, and has a greater ability to changes neighbor city if the distance of area A to area B or vice versa shorter, then despite an increase in the cost of the region corresponding to the economic circumstances.

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