Typology of socio-economic characteristics of municipalities and regencies in West Java Province

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Abstract. For years, the Province of West Java has been facing several development challenges, such as poverty, malnutrition, low access to education, etc. It is assumed that the characteristics are patterned. The aim of this paper to present the typology of socio-economic characteristic of municipalities and regencies in West Java Province. By combining cluster and spatial cluster analysis, we figured out that the three cluster of areas represented the domination of examined regional development variables. Spatial cluster analysis employs the spatially weighted variables to form a homogenous cluster of each region in West Java. The first cluster can be classified as peri-urban area (area surrounding urban region) with average-sized population, unemployment, and malnutrition size. The second cluster can be classified as rural area with small population, unemployment, and malnutrition size. The third cluster can be classified as urban area with high-sized population, unemployment, and malnutrition size. We concluded that well-developed municipalities and regencies are concentrated in the western part of West Java, a particular area that is has a close proximity to the capital city of Indonesia.

1. Introduction

The Province of West Java is the province with the highest number of populations. Administratively, the province is composed by 18 regencies and 9 municipalities. Per 2020, the National Agency of Statistics (2019) projected that the number of populations in West Java will approximately reach 49.9 billion populations. During the past three years, the top three sectors that dominate the province’s economic structure, as represented by the province’s gross domestic regional product, are manufacturing, agriculture, and wholesale (National Agency of Statistics, 2017; National Agency of Statistics 2018; National Agency of Statistics 2019).

In attaining its mission, the province of West Java is facing several crucial development issues. The provincial government of West Java through the Regional Law of West Java Number 22/2010 addressed these following issues in the regional spatial plan: (1) jobless and poor population; (2) low provincial competitiveness due to the high dependency towards imported raw goods and low skill in technological development; (2) unsynchronized relation between the farm subsystem, from local, regional, to national level; (3) low synergy of policy in utilizing science and technology; (4) non-
optimum supply and service of settlement facilities. Other than that, we also notice that poverty itself should be taken into priority.

In order to structure a small part of the province’s development issue, this paper aims to present the typology of the socio-economic characteristics of regencies and municipalities of West Java. In a practical context, the result can provide a specific insight on the current progress of development and gaps between the regencies and/or municipalities. The analysis will be presented in two folds: by using the cluster analysis and contiguous spatial clustering analysis.

2. Methods

2.1. Hierarchical Cluster Analysis

The hierarchical cluster analysis is a method that is intended to group data into based on their polarization of characteristics. The HCA involves the following steps: (1) computation of similarity of one item to another; (1) the iterative points are being paired to each other; (3) the grouping process (Gries, 2015). Variables used on this analysis are population size \((z_1)\), poverty line \((z_2)\), unemployment rate \((z_3)\), and malnutrition rate \((z_4)\). The variables on this analysis are chosen to represent social-economic condition in West Java Province with city/regency as its data unit. In this case, we pulled out the data from West Java in Numbers 2019, which is published by the National Agency of Statistics (2019).

2.2. Contiguous Spatial Clustering Analysis

Spatial clustering analysis on this paper used as the basis to quantitatively forms several homogenous zones in West Java Province. Clustering methods on this paper is derived from Rustiadi and Kobayashi (2000), which uses euclidian distance on observed variables, also weighting the spatial attributes of each city/regency. Moreover, the clustering result will also be interpreted to represent the regional typology of West Java Province. Mathematically, the formulation used on this analysis is as follows:

\[
D_{ij} = \sqrt{(z_{1i}' - z_{1j}')^2 + (z_{2i}' - z_{2j}')^2 + \cdots + (z_{ni}' - z_{nj}')^2 + \beta((X_i' - X_j')^2 + (Y_i' - Y_j')^2)}
\]

Where:
\[D_{ij}\] = Euclidean distance value;
\[z\] = Standardized value of the variables.
\[X\] and \[Y\] = Spatial coordinate of each observed region
\[\beta\] = Spatial contiguity weight. Contiguity factor will be stronger if \(\beta > 1\), meaning that the cluster will be formed in a neighbored region in one contiguous cluster. While \(\beta < 1\) means that the cluster will be less contiguous and dispersed, considering more of the variable value than the contiguity factor.

Neethu dan Surendran (2013), stated that the more homogeneous a cluster is, the better the cluster will be. Homogeneity level in a cluster is measured using Coefficient of Variation (CV), which is calculated using this formulation:

\[
CV = \left( \frac{\sigma^2}{\bar{x}} \right)
\]

Where:
\(\sigma^2\) = standard deviation of distance value \((D_{ij})\)
\(\bar{x}\) = mean of distance value \((D_{ij})\)
3. Result and Discussions

3.1 Clusters of Regional Development

By undergoing the cluster analysis, the result shows that the regencies and municipalities of West Java are polarized into three different clusters, in which each cluster has its own tendency of characters. The number of clusters are decided normatively, regarding the difference of characteristics that can be extracted. Among the three clusters below, the higher the ordinal of the cluster, the significant of its disparity among other areas. The characteristics of each cluster is presented in Table 1.

| Attributes          | Cluster 1                                                                 | Cluster 2                                                                 | Cluster 3                                                                 |
|---------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Cluster members     | Ciamis, Kuningan, Majalengka, Sumedang, Indramayu, Subang, Purwakarta, Bandung Barat, Pangandaran, Bandung Municipality Sukabumi Municipality, Cirebon Municipality, Cimahi Municipality, Tasikmalaya Municipality | Sukabumi, Cianjur, Bandung, Garut, Cirebon, Karawang, Bekasi, Bandung Municipality, Bekasi Municipality, Depok Municipality | Bogor                                                                     |
| Significant         | Poverty line tends to be below median and average; high number of jobless | Poverty line tends to be slightly above median and average; jobless population tends to be slightly above median and average; number of infants with malnutrition are below median and average | Poverty line tends to be above median and average; other characteristics are identified above median and average |
| characteristics     | populations; high number of infants with malnutrition                     |                                                                          |                                                                           |

3.2 Spatial Typology of West Java Province

This study employs three spatial contiguity weight scenarios to be carried on spatial clustering method, which are $\beta=0.5$; $\beta=1$; $\beta=2$. These three different spatial contiguity weights simulate the different take on how spatial/geographical location of each region will affect the typological result of socio-economic condition of West Java Province. $\beta=0.5$ simulate that spatial aspect will weigh less than other variable, while $\beta=1$ simulate equal treatment on both spatial and non-spatial variable, and $\beta=2$ will put spatial variable above non-spatial variable in the clustering algorithm.

Figure 1 shows the plot of means for each cluster on each spatial contiguity weight. Every increase in spatial contiguity weight almost always result in the decrease of non-spatial variable (z1-z4) variability between cluster and more focused on its spatial contiguity to form a cluster. Based on said plot, the characteristic of each cluster can be explained as following Table 2.
Figure 1. Plot of Means for Each Cluster; a) $\beta=0.5$; b) $\beta=1$; c) $\beta=2$
Table 2. Clusters Characteristics on Each Spatial Contiguity Weight

| Variables | $\beta=0.5$ | $\beta=1$ | $\beta=2$ |
|-----------|-------------|-------------|-------------|
|           | Cluster 1 | Cluster 2 | Cluster 3 | Cluster 1 | Cluster 2 | Cluster 3 | Cluster 1 | Cluster 2 | Cluster 3 |
| $z_1$= population size | Mod | Low | High | Mod | Low | High | High | Mod | Low |
| $z_2$= poverty line | Low | Mod | High | High | Low | High | High | Mod | Low |
| $z_3$= unemployment | Mod | Low | High | Mod | Low | High | High | Mod | Low |
| $z_4$= malnutrition | Mod | Low | High | Low | Mod | High | High | Low | Mod |
| CV | 35.71% | 24.97% | 36.19% | 30.45% | 33.33% | 38.22% | 18.09% | 27.82% | 44.98% |
| Average CV | 34.07% | 36.19% | 30.29% |

To determine the best cluster results from the three cluster analysis scenarios, an analysis of the CV values was carried out. The lower CV value indicates that in one cluster, the characteristics are more uniform (Tan et al., 2013). That means that the characteristic of said cluster will be able to represent all of its member characteristics. Analysis result have shown that the best clustering scenarios on this study is $\beta=2$ (Table 2).

Figure 1 shows the maps of spatial clustering result. Using $\beta=2$ spatial contiguity weight as the chosen scenario, the members of each cluster as follows:

- Cluster 1: Bogor, Sukabumi, Cianjur, Bandung, Subang, Purwakarta, Karawang, Bekasi, Bandung Barat Regency; Bogor, Sukabumi, Bandung, Bekasi, Depok, and Cimahi City.
- Cluster 2: Kuningan, Cirebon, Majalengka, Sumedang, Indramayu Regency; and Cirebon City.
- Cluster 3: Garut, Tasikmalaya, Ciamis, Pangandaran Regency; Tasikmalaya, and Banjar City.

Based on its spatial and non-spatial characteristics, Cluster 1 can be referred as Metropolitan Cluster or Western Cluster as its geographical location is close to Jabodetabek Metropolitan Area and Bandung Metropolitan Area. Also, those regions are also projected to merge into Jakarta-Bandung Mega Urban Region (Dorodjatoen, 2009). Cluster 2 can be referred as Ciayumajakuning or North-East Cluster as the members of its cluster are identical to the West Java spatial planning development area or “Wilayah Pengembangan”. Its characteristic are that of peri-urban area with moderate population size, and agroindustry economic activities. While Cluster 3 can be referred as Priangan or South-East Cluster with the characteristic more towards that of rural area (low population size and agriculture-based economic activities).
Figure 2. Result of Spatial Clustering Analysis

4. Conclusions
Based on the two layers of analysis, it can be concluded that disparity of development among municipalities and regencies of West Java Province is still identified. Without regarding the spatial context, the highest developed area is located in the western cluster, which has a high proximity to the capital of Indonesia. Compared to the second analysis that consider the spatial context, in which the proximity of similar area is calculated, the well-developed municipalities and regencies are concentrated in the western part of West Java, a certain area that has a proximity to Jakarta, the capital city of Indonesia. Hence, we suggested that the impact of development in West Java has not distributed equally yet.

5. References
[1] Dorodjatoen, Agung. (2009). THE EMERGENCE OF JAKARTA-BANDUNG MEGA-URBAN REGION AND ITS FUTURE CHALLENGES. Jurnal Perencanaan Wilayah dan Kota. 20. 15-33.
[2] Gries, S. T. (2015). Quantitative Linguistics. In J. D. Wright, International Encyclopedia of the Social &
[3] Neethu, C. V., Surendran, S. (2013). Review of Spatial Clustering Method. *International Journal of Information Technology Infrastructure*, 2, 15 – 24.

[4] National Statistics Agency. (2017). West Java in Numbers 2017 (Provinsi Jawa Barat dalam Angka 2017).

[5] National Statistics Agency. (2018). West Java in Numbers 2018 (Provinsi Jawa Barat dalam Angka 2018).

[6] National Statistics Agency. (2019). West Java in Numbers 2019 (Provinsi Jawa Barat dalam Angka 2019).

[7] Rustiadi, E., & Kobayashi, S. (2000). Contiguous Spatial Classification: A New Approach on Quantitative Zoning Method. *Journal of Geography Education, 43*, 122 – 136.