Regional Inequality Based on Infrastructure Indicators Using Principal Component Analysis (PCA)

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ABSTRACT

This research aims to identify the development gap among 27 sub-districts in Banyumas Regency based on infrastructure indicators using Principal Component Analysis (PCA). The infrastructure indicators that we used are the quality of road, electricity, transportation, market, bridges and schools. Our analysis found that, the sub-districts in Banyumas Regency were divided into 4 clusters, there are Cluster I consist of 1 sub-district, Cluster II consists of 3 sub-districts, Cluster III consists of 3 sub-districts, and the remaining 20 sub-districts were in Cluster IV.

Keywords: Gap, Infrastructure, Principal Component Analysis (PCA).

ABSTRAK

Penelitian ini bertujuan untuk mengidentifikasi celah pembangunan diantara 27 kecamatan di Kabupaten Banyumas berdasar indicator-indikator infrastruktur dan dianalisa menggunakan Principal Component Analysis (PCA). Indikator-indikator infrastruktur tersebut meliputi kualitas jalan, listrik, transportasi, pasar, jembatan, dan sekolah. Hasil analisis yang kami lakukan menemukan bahwa kecamatan-kecamatan di Kabupaten Banyumas dibagi ke dalam empat kelompok/klaster. Klaster I terdiri dari satu kecamatan, Klaster II terdiri dari tiga kecamatan, Klaster III tediri dari tiga kecamatan, dan ke dua puluh kecamatan sisanya masuk ke dalam Klaster IV.

***Keywords**: Gap, Infrastruktur, Principal Component Analysis (PCA).*

INTRODUCTION

The main objective of national development is to promote common prosperity and to implement social justice. However, to pursue these goals is not an easy way. There are several problems faced by Indonesian to achieve its development goals. Differences in geographical conditions is one of them. It have caused imbalance development among regions, especially in infrastructure development. Previous research by Fleisher *et al.* (2010) who examined the growth pattern in China, found that regional inequality was influenced by regional differences in physical, human and infrastructure capital.

Study conducted by Del Bo and Florio (2012) who examined the European Union policy to boost infrastructure for the 2003 to 2013 period had found that there are significant and positive role of infrastructure investment to the level of GDP. Their findings was that the highest return on infrastructure investment were in the telecommunication and the quality and accessibility of transportation network.

Infrastructure is one indicator to determine the success of national development. If the infrastructure in a region is evenly built, then it can be said that development will be enjoyed by the whole community. Otherwise, if infrastructure development is unevenly built, then it can be said that there is imbalance development in the region.

Our research focused on the infrastructure development in Banyumas Region/Regency. This regency is strategic area because from accessibility view, it connects directly with West Java Province through main national road. Theoretically, the areas with access to main national road will have high economic growth compared to the remote areas. This regency is also as one of the regencies in southern part of Central Java Province that consists of 27 sub-districts with different geographical conditions. There are several sub-districts which located in the lowlands and other sub-districts located in mountainous areas. This geographical differences in sub-district of Banyumas Regency, encourage us to do mapping of some sub-districts in Banyumas Regency using some of infrastructure indicators.

The mapping of economic inequality among regencies and cities in Central Java was conducted to cluster the regencies/cities in Central Java Province based on the level of infrastructure development in regions. Through this mapping, we can determined which areas that fall into the category of developed, moderately developed or underdeveloped regions. Therefore, we were interested to examine Regional Inequality based on Infrastructure Indicators in Banyumas Regency.

In order to identify and clustering sub-district in Banyumas Regency, we use Principal Component Analysis. This analysis is multivariate technique that involved inter-related dependent variables and considered as non-parametric analysis (Abdi and Williams, 2010). PCA according to Abson *et al.* (2012) is ordination of observed data that converts some potentially correlated variables into set of uncorrelated variable that capture variability of the observed data.

PCA has been used to measure the degree of areas similarity among sub-districts in Banyumas in terms of social and economic indicators, where the areas will be clustered with the same degree of inequality (Windhani *et al*., 2016).

RESEARCH METHOD

Our research was categorized as survey research. The data analyzed were mostly primary data from survey in all sub-districts in Banyumas Regency. Meanwhile, secondary data were sourced from Bank Indonesia, National Central Statistics Agency (BPS), BPS of Central Java Province and BPS of Banyumas Regency. This research was conducted in 27 sub-districts in Banyumas Regency divided into 5 research zones, namely City Zone: West Purwokerto, East Purwokerto, South Purwokerto, North Purwokerto, Kembaran, and Sokaraja; East Zone: Tambak, Sumpyuh, Kemranjen, Banyumas, Kalibagor, and Somagede; West Zone: Pekuncen, Ajibarang, Gumelar, Cilongok, and Karanglewas; North Zone: Baturaden, Sumbang and Kedungbanteng and South Zone: Wangon, Lumbir, Jatilawang, Rawalo, Kebasen, Purwojati, and Patikraja.

The variables measured in this research were:

(1) The level of infrastructure development gap among regions in Banyumas Regency.
(2) The map of infrastructure development gap among regions in Banyumas Regency.

The infrastructure indicators used as the basis for analysis were:

(1) Road quality: percentage of road length in all sub-districts.
(2) Lighting quality: total of sub-districts that have been electrified.
(3) Transportation quality: percentage of accessible villages by public transportation.
(4) Market quality: number of markets in all sub-districts.
(5) Bridge quality: percentage of bridges with good condition compared to damaged bridges in all the sub-districts.
(6) School quality: number of school buildings in a sub-district.

We used Principal Component Analysis (PCA) method in conducting our research. PCA is a method to identify patterns in data and then transforming the data into other form to show differences and similarities between the patterns (Jollife, 2002). PCA will analyze observed data table that described by several dependent variables which are inter-correlated and extract the important information into orthogonal variables called principal components or PC (Zhou *et al.* 2011).

However, reducing the dimensionality does not eliminate much information because PCA aims to obtain first principal component variable (PC_1) and second principal component variable (PC_2) which have the highest Eigen value, thus retaining the data characteristics. PCA has been used for pattern

recognition in high-dimensional data. From this final data, it was obtained the order of principal component that has been sorted from low to high order.

PCA analysis was used as a method to reduce variables from many variables into two main variables, including PC_1 and PC_2 through PCA method. The significance value of two main variables can be determined from variance value obtained. The map of regional gap in infrastructure development can be predicted by interpolating data of PC_1 and PC_2 variable groups in Cartesian coordinates. Furthermore, the interpretation of regions requiring special attention in infrastructure development was obtained from the analysis of PCA plot scores and k-means clustering.

Lee (2011) conducted a research on the pattern of development and economic inequality that occurred in 6 metropolitan cities in the United States since 1970-2000. Massive development of 6 metropolitan cities in the United States since 1970-2000 led to socio-economic inequality between rural and urban areas. Guo-yong (2010) conducted a research on mapping of inter-regional innovation network in the pattern of development in China using Principal Component Analysis (PCA). The indicators used to measure regional innovation in enhancing regional economic development include the number of universities in the region, regional per capita income, job vacancies, trade volume, and regional dependence on imported goods, money supply, and value of technology product trade contract. The analysis using PCA has managed to map non-innovative areas in an effort to drive the economy.

Qin-dong and Jing (2010) conducted a research on evaluation of regional innovation ability in the development process in China. The indicators used to measure regional innovation in the acceleration of development were community knowledge, advancement of science and technology in the local area, economic force, and performance of local government institutions. From the aspect of economic force, the variables used to measure local innovation ability to drive development included per capita income, number of heavy, medium and small industries, sales volume of technology products, and household income. PCA analysis has managed to cluster regions that were non-innovative and slow in the development process. Clausen (2010) conducted a research on economic globalization and inter-regional inequality occurred in the Philippines. Economic growth was centered only in major cities in the Philippines. There was a significant imbalance between the growth centers in big cities and rural areas in the Philippines. The indicators used to measure the inequality of inter-regional economic development were per capita income, Gross Regional Domestic Product (GRDP), population, volume of agricultural products, household income, volume of trade in goods and services.

RESULT AND DISCUSSION

Profile of Infrastructure Development

The infrastructure development is an indicator of physical development in a region. Every year, the local government of Banyumas Regency allocates Regional Budget (APBD) for physical development in all sub-districts and villages spreading in Banyumas Regency areas. Physical development becoming the main target of villages and sub-districts infrastructure development examined by the researcher includes:

(1) Road construction measured from: road length (kilo meter); percentage of accessible road compared to the total road length in sub-district areas.
(2) Construction of electricity network measured from the percentage of total sub-districts that have been electrified.
(3) Construction of transportation means measured from: percentage of villages accessible by public transportation, including public transportation, motorcycle, car and truck; percentage of isolated villages which are barely accessible by public transportation, including public transportation, motorcycle, car and truck.
(4) Market development measured from: number of markets in all sub-districts of Banyumas Regency; percentage of market quality A (central market) with overview of (Wage Market and Ajibarang Market) compared to the number of markets in all sub-districts; percentage of market quality B (moderate market) with overview of (Manis Market and Pon Market)

compared to the number of markets in all sub-districts; percentage of market quality C (small market) with overview of (Glempang Market, Proliman Market, Cikebrok Market) compared to the number of markets in all sub-districts.

(5) Construction of bridge, measured from: number of bridges in a sub-district; percentage of bridges connecting to state roads (for example, Serayu River Bridge, Tajum River Bridge); percentage of bridges connecting to regency/sub-district road; percentage of bridges connecting to village road; percentage of bridges with good condition compared to damaged bridges in all the sub-districts.

(6) Construction of school buildings, measured from: the number of school buildings in a sub-district from primary, secondary and high schools both public and private; number of school buildings for early-childhood education institutions (PAUD); number of school buildings for primary school and equivalent; number of school buildings for high school and equivalent; number of school buildings for higher education; percentage of damaged and inadequate school buildings from primary, secondary to high schools both public and private.

Table 1. Progress of Infrastructure Development in 27 Sub-Districts in Banyumas Regency Based on Road and Lighting Indicators

Sub-District Code Number	Sub-District Name	Indicators of Infrastructure Development (Road and Lighting)			
		Road Length of Across Sub-District (km)	Percentage of Paved Road, Cement Concrete Road, etc. (%)	Percentage of Road Accessible by Light Vehicles (%)	Percentage of Areas with Electricity (%)
1	Ajibarang	228.58	75.00	0.00	100.00
2	Banyumas	102.25	87.67	0.00	100.00
3	Baturraden	58.77	80.00	0.00	100.00
4	Cilongok	76.64	85.00	0.00	100.00
5	Gumelar	64.70	70.00	0.00	100.00
6	Jatilawang	55.00	90.00	0.00	100.00
7	Kalibagor	34.72	80.00	0.00	100.00
8	Karanglewas	49,75	80.00	3.00	100.00
9	Kebasen	61.71	85.00	0.00	100.00
10	Kedungbanteng	43.31	80.00	0.00	100.00
11	Kembaran	32.54	90.00	0.00	100.00
12	Kemranjen	58.87	75.00	0.00	100.00
13	Lumbir	70.00	65.00	0.00	99.00
14	Patikraja	55.44	90.00	0.00	100.00
15	Pekuncen	39.00	62.00	10.00	95.00
16	Purwojati	70.00	50.00	2.00	90.00
17	West Purwokerto	24.03	95.00	0.00	100.00
18	South Purwokerto	33.16	95.00	0.00	100.00
19	East Purwokerto	33.71	95.00	0.00	100.00
20	North Purwokerto	17.47	95.00	0.00	100.00
21	Rawalo	30.41	80.00	0.00	100.00
22	Sokaraja	74.01	94.00	0.00	100.00
23	Somagede	30.81	80.00	0.00	100.00
24	Sumbang	72.33	80.00	0.00	100.00
25	Sumpyuh	101.84	90.00	0.00	100.00
26	Tambak	71.75	90.00	0.00	100.00
27	Wangon	140.25	90.00	0.00	100.00
Average of Banyumas Regency		67.20	82.54	0.50	99.40

Source: Data Processed, 2016

From Table 1, it can be determined that based on the indicators of infrastructure development of road and lighting in 27 sub-districts in Banyumas Regency, the average length of road in Banyumas Regency is 67.20 Km. Ajibarang sub-district has the longest road length of 228.58 Km, followed by Wangon sub-district of 140 Km, Banyumas sub-district of 102.25 Km, and Sumpyuh sub-district of 101.84 Km. Meanwhile, the average paved road in Banyumas Regency is 82.54 percent, although the percentage indicates that most of the roads have been paved, but some sub-districts have a very far-reaching percentage of the average sub-districts in Banyumas in terms of paved road, such as Purwojati, Pekuncen and Lumbir sub-districts with percentage of paved roads only about 50 percent, 62 percent, and 65 percent, respectively. As for the lighting infrastructure in sub-districts of Banyumas Regency, electrical power has generally been brought to almost all areas. In terms of accessible road condition, in general almost all roads in sub-districts of Banyumas Regency can be accessed by vehicles. However, there are few sub-districts with road condition that cannot be accessed, such as 10 percent in Pekuncen sub-district and 2 percent of road condition in Purwojati sub-district that cannot be accessed by vehicles.

Table 2. Tabulation of Data on Progress of Infrastructure Development in 27 Sub-Districts of Banyumas Regency Based on the Indicators of Quality and Quantity of Transportation and Market

Sub-District Code Number	Sub-District Name	Indicators of infrastructure Development (Quality and Quantity of Transportation and Market)					
		T_1 (%)	T_2 (%)	M1	M_2 (%)	M_3 (%)	M_4 (%)
1	Ajibarang	100.00	0.00	1	100.00	0.00	0.00
2	Banyumas	100.00	0.00	1	0.00	100.00	0.00
3	Baturraden	100.00	0.00	2	0.00	50.00	50.00
4	Cilongok	100.00	0.00	2	50.00	50.00	0.00
5	Gumelar	100.00	0.00	2	0.00	50.00	50.00
6	Jatilawang	100.00	0.00	2	50.00	50.00	0.00
7	Kalibagor	100.00	0.00	1	0.00	100.00	0.00
8	Karanglewas	100.00	3.00	1	0.00	100.00	0.00
9	Kebasen	100.00	0.00	1	0.00	100.00	0.00
10	Kedungbanteng	100.00	0.00	1	0.00	100.00	0.00
11	Kembaran	100.00	0.00	1	0.00	100.00	0.00
12	Kemranjen	100.00	0.00	1	0.00	100.00	0.00
13	Lumbir	100.00	3.00	2	0.00	50.00	50.00
14	Patikraja	100.00	0.00	1	0.00	100.00	0.00
15	Pekuncen	97.00	3.00	3	0.00	100.00	0.00
16	Purwojati	100.00	2.00	2	0.00	50.00	50.00
17	West Purwokerto	100.00	0.00	4	25.00	75.00	0.00
18	South Purwokerto	100.00	0.00	2	0.00	50.00	50.00
19	East Purwokerto	100.00	0.00	4	25.00	50.00	25.00
20	North Purwokerto	100.00	0.00	1	0.00	100.00	0.00
21	Rawalo	100.00	0.00	3	33.00	66.70	0.00
22	Sokaraja	100.00	0.00	2	50.00	50.00	0.00
23	Somagede	100.00	0.00	1	0.00	100.00	0.00
24	Sumbang	100.00	0.00	1	0.00	100.00	0.00
25	Sumpyuh	100.00	0.00	2	0.00	50.00	50.00
26	Tambak	100.00	0.00	1	0.00	100.00	0.00
27	Wangon	100.00	0.00	2	50.00	50.00	0.00
Average of Banyumas Regency		99.89	0.41	2	14.20	77.47	12.10

Source: Data Processed, 2016

Description:
T_1 : Percentage of village accessible by public transportation
T_2 : Percentage of isolated villages barely accessible by public transportation
M_1 : Number of markets in all sub-districts
M_2 : Percentage of market quality A (central market)
M_3 : Percentage of market quality B (moderate market)
M_4 : Percentage of market quality C (small market)

From Table 2, it can be seen the condition of infrastructure in sub-districts of Banyumas Regency in terms of quality and quantity of transportation and the number of existing markets. Almost all villages in sub-districts of Banyumas Regency are accessible by public transportation, while the roads they cannot be accessed by public transportation are only 0.41 percent. For existing market infrastructure in sub-districts of Banyumas Regency, the average market in the category of market quality A (central market) is 14.20 percent and mostly are located in Ajibarang sub-district, 77.40 percent in the category of market quality B (moderate market), and 12.10 percent in the category of market quality C (small market). The overview of infrastructure in terms of quality and quantity of bridges in sub-districts of Banyumas Regency can be seen in the following Table 3.

Table 3. Data on Progress of Infrastructure Development in 27 Sub-Districts of Banyumas Regency Based on the Indicators of Quality and Quantity of Bridge

Sub-District Code Number	Sub-District Name	Indicators of Infrastructure Development (Bridge Quality)				
		B_1	B_2 (%)	B_3 (%)	B_4 (%)	B_5 (%)
1	Ajibarang	17	1176.00	41.18	47.06	95.00
2	Banyumas	12	16.67	33.30	50.00	85.00
3	Baturraden	49	14.29	22.45	63.26	80.00
4	Cilongok	19	15.79	15.79	68.42	75.00
5	Gumelar	27	14.87	22.22	62.97	75.00
6	Jatilawang	25	16.00	36.00	59.00	90.00
7	Kalibagor	7	14.29	28.57	57.14	90.00
8	Karanglewas	10	30.00	20.00	50.00	80.00
9	Kebasen	27	11.11	14.81	74.08	90.00
10	Kedungbanteng	11	27.27	0.00	63.64	90.00
11	Kembaran	26	23.08	90.90	64.38	85.00
12	Kemranjen	6	16.67	33.33	50.00	75.00
13	Lumbir	30	13.13	33.33	53.34	90.00
14	Patikraja	17	17.65	11.76	70.59	95.00
15	Pekuncen	40	0.00	15.00	75.00	75.00
16	Purwojati	27	0.00	11.11	89.90	70.00
17	West Purwokerto	8	12.50	50.00	12.50	100.00
18	South Purwokerto	13	31.00	62.00	7.00	95.00
19	East Purwokerto	15	7.00	75.00	18.00	100.00
20	North Purwokerto	13	15.38	53.85	30.77	90.00
21	Rawalo	16	5.00	10.00	85.00	80.00
22	Sokaraja	6	33.30	50.00	16.67	95.00
23	Somagede	14	14.29	35.71	50.00	80.00
24	Sumbang	12	0.00	33.33	66.70	75.00
25	Sumpyuh	9	11.11	44.44	45.45	80.00
26	Tambak	6	16.67	33.30	50.00	80.00
27	Wangon	16	12.50	37.50	50.00	85.00
Average Banyumas Regency		18	57.98	33.88	53.00	85.19

Source: Data Processed, 2016

Description:

B1 : Number of bridges in a sub-district

B2 : Percentage of bridges connecting to state road (for example, Serayu River Bridge, Tajum River Bridge).

B3 : Percentage of bridges connecting to regency/sub-district road

B4 : Percentage of bridges connecting to village road

B5 : Percentage of bridges in good condition compared to damaged bridges in all sub-districts.

In Table 3, it can be seen that the average condition of bridge quality in sub-districts of Banyumas Regency has been in good condition with a value of 85.19 percent. The best condition of bridge quality is in West Purwokerto and East Purwokerto sub-districts. The average number of bridges in sub-districts of Banyumas Regency is 18 bridges. This means that each sub-district has about 18 bridges connecting to either state road, regency road or sub-district road and village road. The quality of bridge connecting to regency/sub-district road is very low with a value of 33.88 percent, meaning that the bridge quality with good condition is only 33.88 percent in the sub-districts of Banyumas Regency. While, the overview of school infrastructure in sub-districts of Banyumas Regency can be seen in table 3.4. The quality of school building is one of the infrastructure indicators used to see the regional inequality among sub-districts in Banyumas Regency using Principal Component Analysis.

Table 4. Tabulation of Data on Progress of Infrastructure Development in 27 Sub-Districts in Banyumas Regency Based on the Indicators of Quality and quantity of School Buildings

Sub-District Code Number	Sub-District Name	Indicators of Infrastructure Development (Quality and Quantity of School Buildings)					
		S_1	S_2	S_3	S_4	S_5	S6 (%)
1	Ajibarang	76	29	33	2	1	0.00
2	Banyumas	53	9	34	6	0	2.00
3	Baturraden	46	15	27	2	0	1.00
4	Cilongok	98	45	45	3	0	5.00
5	Gumelar	57	19	32	1	1	5.00
6	Jatilawang	73	27	36	5	0	0.00
7	Kalibagor	46	18	21	1	0	0.00
8	Karanglewas	45	16	22	2	0	2.00
9	Kebasen	53	17	29	3	0	0.00
10	Kedungbanteng	59	23	28	3	0	5.00
11	Kembaran	70	35	30	3	0	0.00
12	Kemranjen	69	22	34	8	0	2.00
13	Lumbir	54	15	35	1	0	3.00
14	Patikraja	46	12	28	8	0	0.00
15	Pekuncen	68	26	35	0	0	3.00
16	Purwojati	39	14	20	2	0	1.00
17	West Purwokerto	45	16	23	0	1	0.00
18	South Purwokerto	76	23	30	1	0	0.00
19	East Purwokerto	74	9	36	9	2	0.00
20	North Purwokerto	36	10	22	1	0	0.00
21	Rawalo	52	19	24	2	0	0.00
22	Sokaraja	77	32	33	9	2	0.00
23	Somagede	39	15	19	1	0	0.00
24	Sumbang	70	25	37	9	0	0.00
25	Sumpyuh	60	17	30	9	0	0.00
26	Tambak	46	10	28	3	0	0.00
27	Wangon	65	10	45	1	0	0.00
Average of Banyumas Regency		59	20	30	4	0	1.07

Source: Data Processed, 2016

Description:

S_1 : number of all school buildings in a sub-district from primary, secondary and high schools both public and private.
S_2 : number of school buildings for early-childhood education institution (PAUD)
S_3 : number of school buildings for primary school and equivalent
S_4 : number of school buildings for high school and equivalent
S_5 : number of school buildings for higher education
S_6 : percentage of damaged and inadequate school buildings for primary, secondary and high schools both public and private.

Analysis of Inequality of Infrastructure Development

Cluster analysis is the organization of a collection of members of data set having similar patterns or properties into cluster (groups) based on the similarity of patterns and properties possessed by members of data set. Members of data set clustered in a cluster will have similar characteristics. Meanwhile, members of data set that do not have same properties/patterns will be clustered into different cluster. Clustering is useful for analyzing existing patterns. In the field of engineering science, cluster analysis is commonly used in image segmentation, pattern classification, and data mining (Pan *et al*., 2005).

The result of cluster analysis of regional inequality among sub-districts in Banyumas Regency can be explained in the following table 3.5 and clustering based on Principal Component Analysis can be seen in the Figure 1.

Table 5. Results of Cluster Analysis of 27 Sub-Districts Based on Indicators of Infrastructure Development in Banyumas Regency

Cluster Number	Sub-District Name as Cluster Member	Cluster Type
I	Ajibarang	Number of road length is very high (228 km), the indicators of the quality of road, lighting, transportation, market, bridge and school are very good.
II	Banyumas, Sumpiuh, Wangon	The indicators of the quality of road, lighting, bridge, market are good, but number of school buildings for secondary and high schools is lower than Ajibarang.
III	Karanglewas, Pekuncen, Purwojati	There are unpaved roads and can not be accessed by light vehicles, some areas in Pekuncen have not been electrified, number of markets needs to be added, number of school buildings for secondary and high schools needs to be added.
IV	Baturaden, Cilongok, Gumelar, Jatilawang, Kalibagor, Kebasen, Kedungbanteng, Kembaran, Kemranjen, Lumbir, Patikaraja, West Purwokerto, South Purwokerto, East Purwokerto, North Purwokerto, Rawalo, Sokaraja, Somagede, Sumbang, Tambak	Number of road length is high (70 km in average), the indicators of the quality of road, lighting, transportation quality, market, bridge, and school are very good.

Source: Data Processed, 2016

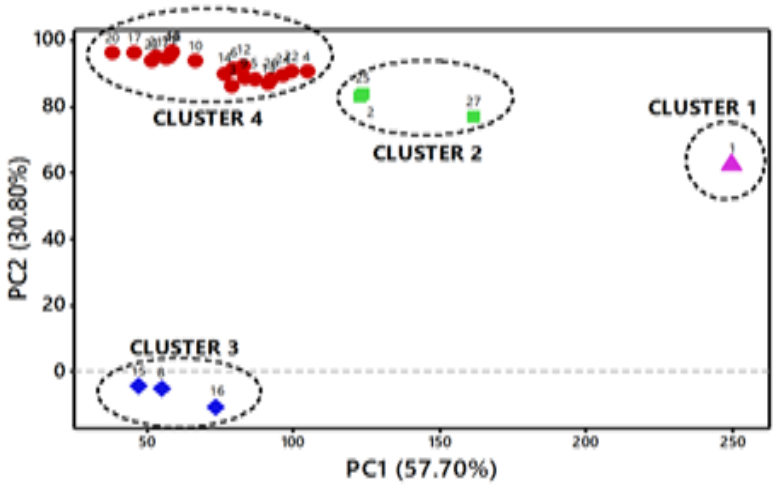

Figure 1. Clustering of 27 Sub-Districts of Banyumas Regency Based on Similarity of Indicators of Infrastructure Development

In terms of infrastructure development indicators, 27 sub-districts can be clustered into 4 clusters. Ajibarang is included in the first cluster because the sub-district has good quality of road, bridge, lighting, market and school buildings. The total length of roads in Ajibarang sub-district is 228.58 km which is the longest among all sub-districts in Banyumas Regency. Banyumas, Wangon, Sumpiuh sub-districts are included in the second cluster. These three sub-districts have good quality of road, lighting, bridge, market and buildings, but the percentage are lower than Ajibarang sub-district. Meanwhile, Karanglewas, Pekuncen and Purwojati sub-districts require more attention from the Government of Banyumas Regency because these sub-districts have higher percentage of unpaved roads than other sub-districts. In addition, there are some isolated villages in Karanglewas and Pekuncen sub-districts due to barely accessible roads by light vehicles such as motorcycles, cars, rural transportations and trucks. Geographical factor is the main factor of these isolated areas.

Baturaden, Cilongok, Gumelar, Jatilawang, Kalibagor, Kebasen, Kedungbanteng, Kembaran, Kemranjen, Lumbir, Patikaraja, West Purwokerto, South Purwokerto, East Purwokerto, North Purwokerto, Rawalo, Sokaraja, Somagede, Sumbang, Tambak sub-districts are included in the fourth cluster. Generally, all indicators of infrastructure development in 20 sub-districts are almost the same as infrastructure development indicators in sub-district included in cluster I (Ajibarang sub-district), the only difference is the length of road in all sub-district which is only 70 km. Particularly for Lumbir sub-district, eventhough the development indicators in Lumbir sub-districts are in good category, there are some villages that need special attention in improving the infrastructure development of lighting because the villages have not been electrified.

CONCLUSION AND SUGGESTION

The profile of infrastructure development indicates that 27 sub-districts have good quality of infrastructure development. Special attention to infrastructure development needs to be given to several sub-districts, including:

(1) Karanglewas, Pekuncen and Purwojati sub-districts have higher percentage of unpaved roads than other sub-districts. In addition, there are some isolated villages in Karanglewas and Pekuncen sub-districts due to barely accessible roads by light vehicles such as motorcycles, cars, rural transportations and trucks. Geographical factor is the main factor of these isolated areas.

(2) There are some villages that need special attention in improving infrastructure development of lighting because the villages have not been electrified.

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