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Analysis of regional growth center and hinterland in Bantul regency

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ABSTRACT

Increasing regional economic efficiency can be done through accelerated regional growth. Growth acceleration is known to produce two groups of regions, namely the growth center and Hinterland (supporting areas). This study aims to analyze the sub-districts that become growth centers and determine the value of community interaction between regions in Bantul Regency through comparative data in 2020 and 2022. In this study, secondary data is obtained through BPS Bantul Regency, which includes data, government facilities, education facilities, health facilities, worship facilities, economic facilities, communication facilities, tourism facilities, population, and distance between sub-districts. The analysis method used in this research is scalogram and gravity analysis, which was processed using Microsoft Excel. The results of the scaling analysis show that in 2020, there are five regional growth centers in Bantul Regency, which include Kasihan Subdistrict, Sewon Subdistrict, Banguntapan Subdistrict, Jetis Subdistrict, and Bambanglipuro Subdistrict. Meanwhile, in 2022, the scaling analysis shows that there are five regional growth centers in Bantul Regency, which include Banguntapan Sub-district, Sewon Sub-district, Jetis Sub-district, Kasihan Sub-district, and Kretek Sub-district. Then, the results of the gravity analysis show that there are different interaction values. The research results show that local governments need to prioritize the development of sub-districts that are still Hinterland by the RPJMD of Bantul Regency.

1. Introduction

Increase in efficiency in a region is actually an encouragement for regional governments to build development schemes that are based on the welfare of society at large. In practice, regional development is in fact inseparable from the regional autonomy mechanism, which means that any ongoing development process or increase in regional economic capacity can be carried out independently by the regional government. This condition is strengthened through Law no. 32 of 2004 concerning regional government where existing regional autonomy is able to increase motivation and development outcomes through policies for managing regional growth patterns in order to produce efficient economic markets for the community (Putra et al., 2020).

Regional development patterns are part of the policy formulation process designed by regional governments with an emphasis on macroeconomic problems that have a direct impact on society, one of which is related to infrastructure development. The suistability of the infrastructure in an area is one of the indicators that states that the development policies that have been designed by the government have achieved significant success (Putra et al., 2020). Regional development can be

carried out by accelerating growth in a region which can be further identified by determining the regional center (growth pole). The regional center is defined as the axis of all economic activity with an orientation towards achieving high productive output in each sector and high efforts to create a high innovation region (Sitepu & Rahmawati, 2022).

Table 1. Population Density per Km^2 in 2020 and 2022

No	Subdistrict	Population Density (People per Km^2)	
		2020	2022
1	Srandakan	1672.00	11715.28
2	Sanden	1336.79	1364.25
3	Kretek	1132.50	1154.91
4	Pundong	1478.97	1526.44
5	Bambanglipuro	1797.31	1850.75
6	Pandak	2119.26	2177.12
7	Bantul	2931.89	3015.13
8	Jetis	2389.54	2474.83
9	Imogiri	1148.67	1187.06
10	Dlingo	695.6	716.48
11	Pleret	2168.87	2255.99
12	Piyungan	1667.92	1724.28
13	Banguntapan	4374.82	4460.29
14	Sewon	4027.03	4113.14
15	Kasihan	3553.12	3622.21
16	Pajangan	1150.23	1198.98
17	Sedayu	1481.52	1539.41

Source: Badan Pusat Statistik (2022)

Table 1 shows the increase in population is considered capable of producing new policies for local governments related to the development of public facilities, especially in areas where the availability of facilities is still minimal. The construction of public facilities in supporting areas can be used as an alternative solution to produce a positive direction of growth (Divergent Growth) (Iskandar & Saragih, 2018). As is known, the construction of facilities is able to encourage institutional arrangements, accommodation, communication between regions, and even full investment in underdeveloped regions or Hinterland (Nurlina & Ginting, 2018). Azadi et al (2021) explains that regions with different amounts of population growth can lead to regional economic inequality. On the other, population density is not only caused by high fertility rates, but also by high population migration. One of the regional cohesion strategies implemented in Europe explains that migration is able to increase regional economic growth across the hierarchy of cities and villages, thus creating human capital (Giannakis & Bruggeman, 2020).

Table 2 shows the economic growth rate of Bantul Regency during 2018-2022 is 3.8% and is smaller than Kulonprogo Regency and Yogyakarta City. This condition is allegedly an effect of the many areas in Bantul Regency which do not yet have high regional growth activity, so that the Hinterland area in Bantul Regency has not been able to encourage economic activity in the regional center. This is in accordance from Guo et al (2023) which states that the existence of hierarchies between regions can increase regional economic cooperation. In this case, it is necessary to have a spread effect from the first regional growth center to develop the Hinterland region, so that related research in analyzing regional growth centers is very necessary to identify the economic support centers of Bantul Regency. Nitsche (2021) states that research on hinterland can identify the comparative advantages from subdistrict and led to export. Schiller et al (2020) argue that geographical link between the demand for building materials in urban areas and the material supply in the hinterland leads to massive interventions in the natural environment and landscape. Another study identify the classification of fast-growing and growing quadrant areas in East Kalimantan Province from Wijaya et al (2020) The results of the empirical study show that there is one area in East Kalimantan Province that is classified as Quadrant I (Fast Forward and Growing Area), namely East Kutai Regency, and there are dominant seven regions classified in Quadrant III (Rapid

Developing Areas), and none occupy Quadrant I (Disadvantaged Region). The area is the center of growth in East Kalimantan Province, namely Berau Regency.

Table 2. Growth Rate Based on Constant Prices 2010 According to Regency/City in DIY Province 2018 – 2022 (in Percent)

Regency/City	Year					Average
	2018	2019	2020	2021	2022	
Kulonprogo	10.83	13.49	-3.45	4.37	6.57	6.362
Bantul	5.47	5.53	-1.65	4.99	5.1	3.888
Gunungkidul	5.16	5.34	-0.68	5.29	5.37	4.096
Sleman	6.42	6.48	-4.05	5.61	5.15	3.922
Yogyakarta	5.49	5.96	-2.42	5.16	5.12	3.862

Source: Badan Pusat Statistik (2022)

Basically, this study refers to Solow's theory which explains that there is a need for physical capital in supporting regional economic growth. The development of physical capital is also associated with fiscal and savings channels that compete with each other for output that is inputted into aggregate production (Aniket, 2021). As explained in the introduction, it is known that Bantul Regency which has a low growth rate allegedly not achieved equitable physical development. This makes research to determine regional growth centers very interesting. On the other, regional growth is dynamic process and needs to be analyzed throughout the period to see shifts in its structure. The sustainability of this research is to produce regions that still have Hinterland to be able to experience a shift into regional growth centers, so that regional economic activity can achieve maximum results.

2. Literature Review

Research related to regional growth centers was carried out by Priyadi & Atmadji (2017) who analyzed growth centers and Hinterland in DIY Province using the Geographic Concentration (CG) analysis method, Scalogram Analysis and Gravity Analysis. The research results show that the regencies/cities that were the centers of regional growth in DIY Province in 2013 included Sleman Regency, Bantul Regency, Gunungkidul Regency and Yogyakarta City with the Hinterland area being in Kulonprogo Regency. Then, the results of the analysis in 2016 showed that the growth centers were in Sleman Regency, Bantul Regency and Yogyakarta City. Yusliana & Devi (2020) shows that there are three sub-districts that have the potential to become growth centers in the coastal areas of DIY, including: Wates Sub-district has the potential to become a primary growth center, Kretek Sub-district which is located in Bantul Regency has the potential to become a secondary growth center , and Saptosari District which is located in Gunungkidul Regency has the potential to become a tertiary growth center.

Sitepu & Rahmawati (2022) who conducted a study of regional growth centers in DIY Province explained that during the last 5 years the growth centers were in Sleman Regency, Gunungkidul Regency, and Yogyakarta City with Hinterland being in Bantul Regency and Kulonprogo Regency . On the other hand, there are two highest interactions between the Hinterland region and the center of growth, namely, Bantul Regency interacting with Yogyakarta City and Kulonprogo Regency interacting with Sleman Lalu Regency. Sari (2021) explained that the growth centres are located in Siak and Tualang Sub-districts which have the greatest potential to become growth centres with Hierarchy 1 and Hierarchy 2. Then, the results also showed that Siak Sub-district has the potential to become a growth centre for the Hinterland of Siak Regency in the east and north. Then, Tualang Sub-district has the potential to become a growth centre for the Siak District Hinterland in the west and south.

Sumartini & Muta'ali (2015) explained that there are four sub-districts that are the growth centres of all economic activity in Bantul Regency, consisting of Kasihan Sub-district, Sewon Sub-district, Banguntapan Sub-district, and Bantul Sub-district. Wahyudin (2022) explained that almost all villages in Balikpapan City are growth centres. Then, villages located in Kutai Kartanegara Regency and Penajam Paser Utara Regency are still minimal to become growth centres. The results of the research through the centrality index also produce the same conclusion for the growth centres in the three districts. Isyandi & Trihatmoko (2022) explained that the economic conditions of Riau Regency still rely on natural resources without increasing the existing regional fiscal capacity, so that it will affect

the projected economic growth rate to be very slow. The results also explain that government spending is one of the instruments capable of increasing the existence of the regional economy, one of which is through financing for productive industries.

Azadi et al (2021) explained that there are several groups of provinces in Iran, where 1 province is a highly developed province, 6 developed provinces 11 provinces with moderate development, 12 undeveloped provinces and 1 was considered as a deprived province. The division of these provincial groups is considered to be able to reflect the interactions that occur between provinces with the highest population growth and provinces with low population growth. Aniket (2021) explained that there is an elaboration between fiscal and savings channels in shaping output that can affect marginal productivity performance. The results also explain that infrastructure development is one of the indicators reflected by Solow theory to increase regional economic capacity. Then, research conducted by Klapka & Erlebach (2021) explains that the functional areas formed in Astro Hungary were not too influenced by socio-political interactions or the development of previous constituent areas.

3. Method

This research is a descriptive quantitative type of research which emphasizes the interpretation of data description without going through the formulation of hypotheses or being deterministic. The basis when using this method is to refer to the calculation of the number of types of facilities that exist in each region to determine the regional growth center. The type of data used in the research refers to secondary data obtained through the official BPS website of Bantul Regency and DIY Province in 2020 and 2022. The data used relates to the number and type of facilities, population, and distance between sub-districts in Bantul Regency. The analytical method used was processed by Microsoft Excel 2013. Table 3 the definition variables used in the study.

Table 3. Definition of Variables

Variable	Definition	Unit
Total population	Projection of total domiciled population in every sub-district in Bantul Regency	Thousand Inhabitants
Distance between Districts	The measure of the distance between two sub-districts is determined using the closest point as a reference	Kilometers
Government Facilities	Includes District office, Sector Police, and Village Hall	Units
Educational Facilities	Includes Kindergarten, RA, SD, MI, SMP, MTS, SMA and SMK	Units
Medical facility	Includes Hospitals, Polyclinics, Community Health Centers, Supporting Community Health Centers, Pharmacies, Posyandu, and Pratama Clinics	Units
Worship Facilities	Includes mosques, prayer rooms, churches and temples	Units
Economic Facilities	Includes KUD, KPRI, and other cooperatives	Units
Communication Facilities	In the form of a Sub-Post Office	Units
Tourism Facilities	Includes restaurants/restaurants and non-starry hotels	Units

Source: Badan Pusat Statistik and DIY Government (2022)

This research uses two main methods, namely Scalogram Analysis and Gravity Analysis. Scalogram analysis is an analysis method that aims to determine regional growth centers based on indicators of the number and type of facilities available in the region (Noviyanti et al., 2020) . Through the number and type of facilities owned by a region, the order or hierarchy of a region as a center of growth can be determined. Determining the order or hierarchy of regions can be done by classifying the types of existing facilities. When conducting scalogram analysis, all data originating from the type of facility will be converted into the numbers "0" and "1", where the number "0" means that there are no facilities in the study area while the number "1" means that there are facilities in the study area.

study area. Then, changing these numbers produces a regional hierarchy which is calculated through the following stages:

$$k = 1 + 3.3\log(n) \quad (1)$$

Where k is the number of classes and n is total sub-district. After determining the number of classes or sturges method and has to determining the class intervals with the equation as follows:

$$Interval = \frac{A - B}{k} \quad (2)$$

Where A is the highest number of facililty values; B is the lowest number of facility values and k is the number of classes. Scalogram equation is:

$$CR = 1 - \frac{\sum \varepsilon}{N.K} \quad (3)$$

Where CR is the coefficient of reproducibility; $\sum \varepsilon$ is the number of errors; N is the number of facilities and K is the total sub-districts. Then, Gravity Analysis is the value of the magnitude of attraction that occurs as a result of the potential at a location where this is related to the area area that can have an effect on society (Utoyo, 2009). This analysis emphasizes the element of distance as the main indicator that influences the value of interactions between regions, where relatively close regional distances will increase people's mobility to other regions, while long regional distances will reduce people's mobility (Putra et al., 2020). The gravity analysis calculation is formulated as follows:

$$A_{ij} = k\frac{p_i, p_j}{dij^b} \quad (4)$$

Where A_{ij} is the interaction value between region i and region j; k is the empirical constant with a value of 1; p_i is the number of residents in region i, expressed in units of thousands of people; p_j is the number of residents in region j, expressed in units of thousands of people; dij is the distance between region i and region j, expressed in kilometers and b is the Power number d_{ij}, the value often used is b=2.

4. Results and Discussion

4.1 Scalogram Analysis

Scalogram analysis plays an important role in determining the hierarchy of an area which is determined by the number of types of facilities found in the study area. The region that has the highest number of types of facilities will occupy Hierarchy I or Hierarchy II, while the supporting region (*Hinterland*) will occupy the lowest Hierarchy. In carrying out scalogram analysis, there are several stages that need to be carried out to produce basic Hierarchy provisions.

Table 4. Range and Hierarchy of Regional Growth Centers in Bantul Regency in 2020

Range	Hierarchy	Information
27-28	Hierarchy I	Main Regional Growth Center (Primary)
25-26	Hierarchy II	Second Regional Growth Center (Secondary)
23-24	Hierarchy III	Hinterland (Supporting Region)
21-22	Hierarchy IV	Hinterland (Supporting Region)
19-20	Hierarchy V	Hinterland (Supporting Region)

Source: Data processed

Table 4 it is known that regional growth centers are divided into two, namely primary growth centers (Hierarchy I) and secondary growth centers (Hierarchy II) with three Hinterland regions. In this study, conducting scalogram analysis served to assess the facility of government (District Office, Sector Police, and Village Hall), educational (Kindergarten, RA, SD, MI, SMP, MTS, SMA and SMK), medical facility (Hospitals, Polyclinics, Community Health Centers, Supporting Community Health Centers, Pharmacies, Posyandu, and Pratama Clinics), worship facility (mosques, prayer rooms, churches and temples), economic facility (KUD, KPRI, and other cooperatives), communication facility (Sub-Post Office) and tourism facility (restaurants/restaurants and non-starry hotels).

Table 5. Regional and Hinterland Growth Centers in Bantul Regency Based on the 2020 Scalogram Analysis Results

No	Subdistrict	Total population	Total Facility Based on Type	Total Facility Units	Regional Hierarchy
1	Kasihan	115.050	28	602	Hierarchy I
2	Sewon	109.370	28	585	Hierarchy I
3	Banguntapan	124.600	27	715	Hierarchy I
4	Jetis	58.470	27	420	Hierarchy I
5	Bambanglipuro	40.800	27	367	Hierarchy I
6	Bantul	64.360	26	535	Hierarchy II
7	Kretek	30.320	26	420	Hierarchy II
8	Imogiri	62.590	26	408	Hierarchy II
9	Dlingo	38.860	26	409	Hierarchy II
10	Piyungan	54.270	26	406	Hierarchy II
11	Pleret	49.820	26	363	Hierarchy II
12	Pandak	51.500	26	335	Hierarchy II
13	Pajangan	38.250	24	341	Hierarchy III
14	Pundong	35.020	24	221	Hierarchy III
15	Sedayu	50.910	23	381	Hierarchy III
16	Sanden	30.960	23	311	Hierarchy III
17	Srandakan	30.630	23	239	Hierarchy III

Source: data processed

Table 5 shows there are 3 regional hierarchies in Bantul Regency in 2020 including, Hierarchy I, Hierarchy II, and Hierarchy III. The availability and distribution of facilities in each of the 17 sub-districts has quite varied differences. The explanation of the four regional hierarchies can be described as follows:

- Hierarchy I is a region that is the center of primary growth or the main supporter of regional economic activity in underdeveloped areas. In the scalogram analysis results table, it is known that there are 5 sub-districts that occupy Hierarchy I positions, including Kasihan District with 28 types of units, Sewon District with 28 types of units, Banguntapan District with 27 types of units, and Bambanglipuro District with 28 types of units.
- Hierarchy II is an area that is the center of secondary growth. In the table of scalogram analysis results, it is known that there are 7 sub-districts that occupy Hierarchy II positions including Bantul Sub-district, Kretek Sub-district, Imogiri Sub-district, Dlingo Sub-district, Piyungan Sub-district, Pleret Sub-district, and Pandak Sub-district which in total have 26 types of facility units.
- Hierarchy III is a supporting area or Hinterland that really needs the Spread Effect from the growth center area to increase economic activity. In the table of scalogram analysis results, it is known that there are 5 sub-districts that occupy Hierarchy III positions including, Pajangan District, Pundong District, Sedayu District, Sanden District, and Srandakan District.

Table 6 there are 4 regional hierarchies in Bantul Regency in 2022 including, Hierarchy I, Hierarchy II, Hierarchy III, and Hierarchy IV. The availability and distribution of facilities in each of the 17 sub-districts has quite varied differences. The explanation of the four regional hierarchies can be described as follows:

- Hierarchy I is the center of primary regional growth which supports all economic activities for the surrounding region, especially the Hinterland region. In the table of scalogram analysis results, it is known that there are 5 sub-districts that occupy the Hierarchy I position, including Banguntapan Sub-district with 28 types of units, Sewon Sub-district

with 28 types of units, Jetis Sub-district with 27 types of units, Kasihan Sub-district with 27 types of units, and Kretek Sub-district with 27 types of units.

- Hierarchy II is the center of secondary regional growth. In the table of scalogram analysis results, it is known that there are 8 sub-districts that occupy Hierarchy II positions including Pleret District, Bantul District, Imogiri District, Dlingo District, Bambanglipuro District, Piyungan District, Pajangan District, and Pandak District.

Table 6. Regional and Hinterland Growth Centers in Bantul Regency Based on the 2022 Scalogram Analysis Results

No	Subdistrict	Total population	Total Facility Types	Total Facility Units	Territory Hierarchy
1	Banguntapan	127.029	28	1.256	Hierarchy I
2	Sewon	111.713	28	742	Hierarchy I
3	Jetis	60.559	27	750	Hierarchy I
4	Kasihan	117.287	27	694	Hierarchy I
5	Kretek	30.917	27	458	Hierarchy I
6	Pleret	51.820	26	1.023	Hierarchy II
7	Bantul	66.182	26	788	Hierarchy II
8	Imogiri	64.683	26	481	Hierarchy II
9	Dlingo	40.030	26	606	Hierarchy II
10	Bambanglipuro	42.012	26	585	Hierarchy II
11	Piyungan	56.108	26	565	Hierarchy II
12	Pajangan	39.866	25	639	Hierarchy II
13	Pandak	52.904	25	437	Hierarchy II
14	Srandakan	31.424	24	248	Hierarchy III
15	Sedayu	52.894	22	378	Hierarchy IV
16	Sanden	31.596	22	316	Hierarchy IV
17	Pundong	36.146	22	277	Hierarchy IV

Source: data processed

- Hierarchy III is a supporting area or Hinterland. In the scalogram analysis results table, it is known that there is only 1 sub-district that occupies Hierarchy III position, namely, Srandakan Sub-district with 24 types of units.
- Hierarchy IV is a supporting area or Hinterland. In the table of scalogram analysis results, it is known that there are 3 sub-districts that occupy Hierarchy IV positions including, Sedayu District, Sanden District, and Pundong District, which overall have the same number of types of facilities, namely 22 types.

All sub-district areas, both those that are growth centers and the Hinterland, should be able to produce regional development priority scales. This is not without reason considering that the dynamics of the average GRDP rate in Bantul Regency over the last 5 years has tended to decrease compared to other regencies/cities in DIY Province. The formation of regional development priorities can be synchronized with the targets stated in the 2021-2026 Bantul Regency RPJMD document. Referring to the results of the scalogram analysis in Table 5 and 6, there are some hierarchical groups in Bantul regency where each hierarchy reflects economic and development conditions. As is known, infrastructure and investment are one of the main factors that determine regional economic growth, where in the short term it is expected that growth will accelerate while in the long term there will be a buildup of capital (Naftaly, 2021). This condition is also emphasized by Aniket (2021) where physical capital is able to influence the performance of regional marginal output. On the other hand, the quality of human resources in each region is also a determining factor in the creation of regional growth. When a poor or underdeveloped region is able to experience high economic growth, it will create an economic convergence (Alataş, 2023).

Table 7. Grouping of Cultivation Areas Based on Regional Growth Centers in Bantul Regency

No	Subdistrict	Hierarchy	Cultivation Area Program
1.	Kasihan	Hierarchy I	• Community Forest Designated Area • Agricultural Designated Area • Aquaculture Area • Industrial area • Tourism Area • Urban Residential Areas
2.	Sewon	Hierarchy I	• Aquaculture Area • Industrial area • Tourism Area • Urban Residential Areas
3.	Banguntapan	Hierarchy I	• Agricultural Designated Area • Aquaculture Area • Industrial area • Tourism Area • Urban Residential Areas
4.	Jetis	Hierarchy I	• Agricultural Designated Area • Aquaculture Area • Community Mining Designated Area • Industrial area • Tourism Area • Urban Residential Areas
5.	Bambanglipuro	Hierarchy I	• Community Forest Designated Area • Aquaculture Area • Community Mining Designated Area • Industrial area • Urban Residential Areas
6.	Kretek	Hierarchy I	• Agricultural Designated Area • Aquaculture Area • Community Mining Designated Area • Industrial area • Tourism Area • Rural Settlement Areas

Source: data processed

The concept of regional hierarchy is actually played by a vertical structure that has a complex structure. This means that the hierarchy is formed as a function of the administrative center that drives the central city or region below it through a downward derivative model (Bekker-nielsen, 2020). The hierarchical network model is able to reveal the economic linkages between provinces into clusters. In this case, the trade structure becomes one-way as in central location theory based on gross regional domestic product and geographical concentration between regions (Kazancik, 2023). Thus, it is known that regional hierarchy plays an important role in regional economic sustainability, especially efficient trade in terms of transportation time and cost. Table 7 shows the hierarchy I for each sub-districts and the cultivation area program in Bantul.

4.2 Gravity Analysis

Gravity analysis plays a very important role in measuring the value of interactions between regional growth centers and the Hinterland. In the analysis carried out, the interaction values for each region have quite significant differences. This is due to the geographical conditions of each region which causes differences in distance, thus affecting people's mobility. Referring to the theory of gravity, people tend to choose an urban area or area that is closest to their area of origin. This condition also becomes a spatial attraction for heading to the city center or regional growth center. The gravity model continues to expand, including its application in cross-regional (in this study cross sub-district) with more varied determining factors (Taha et al., 2002).

Table 8. Interaction Values between Districts in Bantul Regency in 2020.

No	Growth center district (i)	Destination district (j)	Number of residents (Pi)	Population of the destination area (Pj)	Distance (dij/Km) (ij)	Interaction value Aij	Ranking
1.	Kasihan	Sewon	115.050	109.370	4.8	546137955.7	1
		Kretek	115.050	30.320	25.2	5493065.004	16
2.	Sewon	Kasihan	109.370	115.050	4.8	546137955.7	1
		Sanden	109.370	30.960	24	5878637.5	16
3.	Banguntapan	Sewon	124.600	109.370	7.5	242266702.2	1
		Sanden	124.600	30.960	30	4286240	16
4.	Jetis	Imogiri	58.470	62.590	3.8	253437486.1	1
		Sanden	58.470	30.960	18	5587133.333	16
5.	Bambanglipuro	Kretek	40.800	124.600	6.2	403880333	1
		Piyungan	40.800	54.270	29.8	3316554.322	16

Source: data processed

Table 8 shows there are different spatial interaction dynamics between regions taking into account the distance and population of each region. An explanation regarding the value of this interaction can be seen as follows:

- Kasihan district has the highest interaction value (rank 1) of 546137955.7 with Kretek district. On the other hand, Kasihan district has the lowest interaction value (rank 16) of 5493065.004 with Kretek district. The difference in interaction value is thought to be a result of the distance between Kasihan district and Sewon district being considered closer than the distance to Kretek district.
- Sewon district has the highest interaction value (rank 1) of 546137955.7 with Kasihan district. On the other hand, Sewon district has the lowest interaction value (rank 16) of 5878637.5 with Sanden district. The difference in interaction value is allegedly a result of the distance from Sewon district to Kasihan district being considered closer than the distance to Sanden district.
- Banguntapan district has the highest interaction value (rank 1) of 242266702.2 with Sewon district. Meanwhile, Banguntapan district has the lowest interaction value (rank 16) of 4286240 with Sanden district. The difference in interaction value is allegedly a result of the distance from Banguntapan district to Sewon district being considered closer than the distance to Sanden district.
- Jetis district has the highest interaction value (rank 1) of 253437486.1 with Imogiri district. Meanwhile, Jetis district has the lowest interaction value (rank 16) of 5587133,333 with Sanden district. The difference in interaction value is thought to be a result of the distance from Jetis district to Imogiri district being considered closer than the distance to Sanden district.
- Bambanglipuro district has the highest interaction value (rank 1) of 403880333 with Kretek district. Meanwhile, Bambanglipuro district has the lowest interaction value (rank 16) of 3316554.322 with Piyungan district. The difference in interaction value is thought to be a result of the distance from Bambanglipuro district to Kretek district being considered closer than the distance to Piyungan district.

Table 9 shows the different spatial interaction dynamics between regions taking into account the distance and population of each region. An explanation regarding the value of this interaction can be seen as follows:

- Banguntapan district has the highest interaction value (rank 1) of 340012540 with Pleret district. On the other hand, Banguntapan district has the lowest interaction value (rank 16) of 5385297.38 with Sanden district. The difference in interaction value is allegedly a result of the distance from Banguntapan district to Pleret district being considered closer than the distance to Sanden district.

- Sewon district has the highest interaction value (rank 1) of 593140907 with Kasihan district. On the other hand, Sewon district has the lowest interaction value (rank 16) of 7565337.6 with Sanden district. The difference in interaction value is allegedly a result of the distance from Sewon district to Kasihan district being considered closer than the distance to Sanden district.
- Jetis district has the highest interaction value (rank 1) of 271269931 with Imogiri district. On the other hand, Jetis district has the lowest interaction value (rank 16) of 5905623.96 with Sanden district. The difference in interaction value is thought to be a result of the distance from Jetis district to Imogiri district being considered closer than the distance to Sanden district.
- Kasihan district has the highest interaction value (rank 1) of 111197034 with Sewon district. On the other hand, Kasihan district has the lowest interaction value (rank 16) of 9834787.5 with Dlingo district. The difference in interaction value is thought to be a result of the distance between Kasihan district and Sewon district being considered closer than the distance to dlingo district.
- Kretek district has the highest interaction value (rank 1) of 60439474.4 with Pundong district. Meanwhile, Kretek district has the lowest interaction value (rank 16) of 1805089.53 with Piyungan district. The difference in interaction value was allegedly a result of the distance from Kretek district to Pundong district being considered closer than the distance to Piyungan district.

Table 8. Interaction Values between Districts in Bantul Regency in 2022.

No	Growth center district (i)	Destination district (j)	Number of residents (Pi)	Population of the destination area (Pj)	Distance (dij/Km) (ij)	Interaction value Aij	Ranking
1.	Banguntapan	Pleret	127.029	51.820	4.4	340012540	1
		Sanden	127.029	31.596	27.3	5385297.38	16
2.	Sewon	Kasihan	111.713	117.287	4.7	593140907	1
		Sanden	111.713	31.596	21.6	7565337.6	16
3.	Jetis	Imogiri	60.559	64.683	3.8	271269931	1
		Sanden	60.559	31.596	18	5905623.96	16
4.	Kasihan	Sewon	60.559	111.713	7.8	111197034	1
		Dlingo	60.559	40.030	15.7	9834787.5	16
5.	Kretek	Pundong	30.917	36.146	4.3	60439474.4	1
		Piyungan	30.917	56.108	31	1805089.53	16

Source: data processed

Efforts to create regional growth centers are not only done through physical capital development, but also need to pay attention to geographic concentration (Rosés & Wolf, 2021). Gravity analysis emphasizes the distance between regions where the closer the region, the more efficient the distribution costs will be. Geographic concentration is necessary in regional economic analysis because it has a considerable influence on markets and trade between regions. Gervais & Jensen (2019) explained that value-added goods and services are maximized in concentrated areas, so areas with high labor, wages, and productivity have great potential for trade. The gravity model in economic trade has an influence on the comparative advantage of a region supported by efficient transportation access (Baniya et al., 2020). Anderson (2010) state the "frictionless gravity lessons," a frictionless world implies that each good has the same price everywhere, and a homogeneous world implies that economic agents everywhere might be predicted to purchase goods in the same proportions when faced with the same prices. Refers to macroeconomics, gravity models are often applied to international trade theory by analyzing the distance aspect between countries. However, recent now show that the gravity model is starting to be associated with spatial aspects of the economy (Nijkamp & Ratajczak, 2021).

5. Conclusion

Increasing regional economic efficiency can be done through accelerated regional growth. Growth acceleration is known to produce two groups of regions, namely the growth center and Hinterland (supporting areas). The results of the scalogram analysis, it is known that in 2020 there will be 5 sub-districts which will be the centers of regional growth in Bantul Regency, including Kasihan Sub-district, Sewon Sub-district, Banguntapan Sub-district, Jetis Sub-district and Bambanglipuro Sub-district. Then, in 2022 there will also be 5 sub-districts which will become centers of growth in Bantul Regency including Banguntapan District, Sewon District, Jetis District, Kasihan District, and Kretek District. Over a period of 2 years, there were several shifts in the sub-district hierarchy which indicated the occurrence of infrastructure development activities in certain areas.

The results of the gravity analysis, it is known that there are differences in interaction values between the growth center sub-districts and the Hinterland. This is caused by differences in distance between sub-districts, which greatly affects community mobility. People who come from the Hinterland sub-district tend to move towards the growth center sub-districts due to factors such as the size of the city such as wages, employment opportunities, facilities, and the size of the buildings resulting in a large attraction. This study is very important for the sustainability of the regional economy in terms of examining and analyzing the main infrastructure that needs to be built in supporting regional growth centers. This research has implications that can be carried out by the government, which is compiling a priority scale for facility development in supporting the socio-economic activities of the community, especially in several sub-districts that become Hinterland. The priority scale of development can be carried out by mapping areas that are adjusted to the targets of the Bantul Regency RPJMD document for 2021-2026. Then, the government can maintain local production factors to increase the regional economy for long run.

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