Analysis of The Regional Development Level in Aceh Province

Agus Ramadhan¹, Atang Sutandi¹, Andrea Emma Pravitasari¹,²

¹Regional Development Planning Division, Department of Soil Science and Land Resource, Faculty of Agriculture, IPB University, Jl. Meranti, IPB Darmaga Campus, Bogor, West Java, Indonesia, 16680
²Center for Regional Systems, Analysis, Planning and Development (P4W/CRESTPENT), IPB University, Jl. Raya Pajajaran, Bogor, Indonesia, 16144

*Corresponding author: agusramadhan1994@gmail.com

Abstract. Regional development level assessment is a way of measuring the level of welfare of an administrative region. This research aims to identify the level of regional economic growth, the level of regional development and clustered region based on the characteristics of the region. The analyses used in this research are Klassen typology, scalogram, entropy diversity index (EDI) and clustering. The results of this study indicate that the region's economic growth rate in the province of Aceh during the year 2010-2016 amounted to 2.30%. The level of regional development in Aceh province is divided into 3 hierarchies. From 2011-2014, there are 3 regions that have developed to become more developed areas including the following: Banda Aceh City, Langsa City, and Sabang City referred to as Hierarchy I. There is also a negative development trend occurred in Aceh Singkil Regency as it has transformed from Hierarchy II to Hierarchy III. The Province of Aceh has the same level of economic activity in each regency which is dominated by the agricultural sector. Aceh Utara Regency is the region that has the most evenly distributed economic activity, while Sabang City is the region that has the most unequal distribution. Based on the regional characteristics, the cluster analysis in Aceh Province has identified 3 groups including the following: Group I (3 regencies), Group II (11 regencies), and Group III (9 regencies).

Keywords: regional development level, klassen typology, clustering, entropy diversity index, scalogram

1. Introduction
Economic development is a series of businesses in an economy to develop economic activity. The purpose of economic development is to improve and develop the infrastructure, the company, the level of education and technology. Efforts to increase the rate of economic growth and the growth of dominant sectors lead to trickle-down effects so that the welfare of the people will automatically increase. The implications of this development are expected to increase employment opportunities, increased income levels and higher public prosperity [1].

Various economic activities encourage each region to develop its economic potential. One indicator to show the level of prosperity of a region can be seen from the Gross Regional Domestic Product (GRDP) at the current price or constant price. The development of a region cannot be separated from the development of other surrounding regions that can be seen from the Gross Regional Domestic Product (GRDP) and population growth so that it can see the regional economic growth rate, the
structure of the economy, and the shift in regional economic activity. The GRDP of Aceh Province in 2016 has amounted to Rp 116,386,730.6 trillion, an increase of Rp 3.73 trillion from 2015 with the agricultural sector as the largest contributing sector [2]. The increasing GRDP is not in line with the increasing poverty rate, which caused the region to fall behind. Most of the rural poor are farmers [3, 4]. Several factors can cause a region to lag in economic development such as low attractiveness, limited resources, and low infrastructure facilities. These factors cause a low level of economic activity.

The regional development policies covering rural and urban areas in Aceh Province so far have not been able to provide significant changes to the improvement of community welfare. The poverty level of Aceh Province ranks first on the island of Sumatra with the percentage of the poor population of 16.73% and the increase of poor people to 872.61 thousand (16.89%) in 2017 [2]. On the other hand, the Aceh Province Human Development Index (HDI) number 2014-2016 has increased from 68.81 to 70.00. High HDI is expected to reduce the unemployment rate. Meanwhile, the open unemployment rate (TPT) in Aceh Province in 2016 is 7.57%, that 13.22 % from general high school. The number of companies in Aceh Province was 4,207 companies with 104,181 workers. The economic development of a region can be seen from the results of several economic indicators, one of which is the unemployment rate [5].

Aceh Province has experienced imbalanced development and economic growth across the region, which needs the local government's attention to improve the condition. The rise of regional autonomy policy to deal with the unequal development should provide opportunities and challenges for the local governments to manage their resources efficiently and effectively. However, after the last 10 years, there has been a high rate of poverty in Aceh Province, which contradicts the goal of regional autonomy to provide the local governments with the broad authority to improve the services and welfare of the people in a democratic, fair, equitable, and sustainable way. The regional autonomy policy can be effectively optimized if the local government manages to promote its regional potential, natural resources, human resources, and other financial opportunities. In line with this background, the objectives of this research are: (1) to identify the economic growth of Aceh Province, (2) to identify the level of regional development, and (3) to classify regencies/cities in Aceh Province based on the similar characteristics and the level of regional development.

2. Research Methods
The research was conducted in Aceh Province, which consists of 18 regencies, 5 cities, and 289 districts and 6,474 villages or villages with an area of 5,677,081 ha. The implementation of the research starts from preparation, data collection in the field, data processing and analysis and the preparation of the thesis is planned for 8 months, starting from September 2017 to April 2018. The location of the study can be seen in Figure 1.

![Figure 1. Location of the study.](image-url)
2.1. Data Types and Data Sources
The data used in this research is secondary data obtained from related institutions. Secondary data consists of Admission Map, Aceh Province land cover map of 2010 to 2016. Village potential data (PODES) in 2011 and 2014 and gross regional domestic product at constant prices (GDP ADHK), human development index, percentage of poor people in 2010 to 2016 taken from the Aceh Province Central Statistics Agency (BPS). The softwares used in the study were Microsoft Word, Microsoft Excel, ArcMap 10.2 and Statistica.

2.2. Data Analysis Procedure

2.2.1. Regional Economic Growth Analysis. Klassen Typology analysis is used to know the description of the pattern and structure of the economic growth of each region [13] [6]. The data used in Klassen Typology analysis is GDP based on constant prices from 2010 to 2016. The analysis determines the average of economic growth as the vertical axis and the average per capita income as the horizontal axis, the observed area can be divided into four classifications, namely: high income but low growth, high growth and high income, low growth and low income, high growth but income. For more details can be seen in Table 1.

| Sectoral Contributions | Sectoral Growth | Sectoral Growth |
|------------------------|-----------------|-----------------|
| gi >= s                | high income but low growth | high growth and high income |
| si < s                 | low growth and low income | high growth but income |

information:

- gi = growth of regional sector analysis
- g = growth of the reference regional sector
- si = contribution to the sector analysis area
- s = contribution of the reference area sector

2.2.2. Regional Development Level Analysis. There are two methods to determine the level of regional development, namely Scalogram Analysis and Entropy Diversity.

2.2.2.1. Scalogram Analysis. One way to measure the level of development of a region appropriately and easily is to use a scalogram method [7]. In principle, an area developing economically characterized by the level of community accessibility in the utilization of economic resources that can be described both physically and non-physically. This study uses the potential data of the villages (PODES) in 2011 and 2014 with parameters measured covering the areas of economic means (distance to nearest market, number of markets, number of cooperatives), health facilities (number of nearby state and private hospitals, number of puskesmas, number of poslindes, pharmacies), number of education facilities (number of primary schools, number of junior high schools, number of high schools, number of universities, number of study centers), facilities of worship house (number of mosques, surau number) to the total population of each district in Aceh Province. The group is mathematically presented in Table 2.

| No | Class  | Interval Value         | Hierarchy level |
|----|--------|------------------------|-----------------|
| 1  | Hierarchy I | X > (average + (St Dev IPW)) | High            |
| 2  | Hierarchy II | average < x < (St Dev IPW) | Medium          |
| 3  | Hierarchy III | X < average             | Low             |

Table 1. Determination of Sectoral Contributions.
Table 2. Hierarchy of Regional Development.
2.2.2.2. Entropy Diversity Index. Entropy analysis is used to calculate the level of diversity of activity components. The value of the entropy diversity index reflects the level of development of the economic structure in an area/region. Entropy diversity index value (EDI) is obtained by dividing entropy value (S) with maximum entropy value (Smax), as in the following equation:

$$\text{Entropy Diversity Index (EDI)} = \frac{S}{S_{\text{max}}}$$  \hspace{1cm} (1)

2.2.3. Cluster Analysis in Aceh Province based on Regional Characteristics
Cluster analysis is a method of grouping data (objects) based only on information found in the data to describe the object and the relationships between them [8, 9]. The cluster analysis used in this research is the K-Means algorithm method with data processing using Statistica software. Cluster analysis makes object grouping based on the distance between object pairs [10].

3. Results and Discussion

3.1. Analysis of Regional Economic Growth in Aceh Province
The result of Klassen Typology analysis in 2010-2016 shows that the economic growth rate in Aceh Province is 2.31%. The highest economic growth rate in Simeulue Regency is 6.10% while the lowest economic growth rate is in Lhokseumawe City at -5.32%. Simeulue district has a high rate of economic growth due to the added value generated from marine sub-sector activities, while in Lhokseumwe City experienced very low economic growth due to the completion of some company activities engaged in the oil and gas sector so that the economic growth rate decreased. A growth center affecting economic activity will diminish as it moves further away from growth centers [11].

The regions included in quadrant I (high growth and high income) are Banda Aceh City, Sabang City, West Aceh Regency, Nagan Raya Regency, and Central Aceh Regency. This shows that the five regions have a high economic growth rate with an average of around 4.07% and GRDP per Capita above the average of Aceh Province with an average of around 30.70 million. Economic growth and per capita income and large ADHK GRDP will have an impact on population migration from surrounding areas [11]. Migration is caused by higher wages and better employment prospects in urban areas [12]. Revenues and jobs lure people to the center of growth due to the Better public facilities in the growth centers. Whereas the regions in quadrant II (high income but low growth) are the City of Lhokseumawe and Aceh Utara Regency. Both regions have a per capita GRDP rate that is higher than the average province of Aceh with an average of around 37.60 million but has a low level of economic growth below the average of Aceh Province with an average of around 1.8%. Aceh Utara Regency and Lhokseumawe City have a wealth of nature so much (e.g. oil and gas) that making the GDP in both areas is high.

The area located in quadrant III (low growth and low income) only one region, namely Aceh Timur Regency with GRDP per capita below the average of Aceh Province of 19.382 million and economic growth rate below the average of Aceh Province of -0.25%. It identifies that Aceh Timur Regency with GRDP contribution is still dominated by the agricultural sub-sector has not been able to maintain a strong economic base as a supporter of other sectors in the economic growth of the agricultural and mineral resource (e.g. Gas and Oil) sector. The reduced contribution of agriculture in the 2010-2016 period indicates that the sector has not received optimal attention, especially from the government as the policyholder.

Quadrant IV (high growth but low income) is the most occupied quadrant by regencies/cities in Aceh Province. The regions in the quadrant IV have an economic growth rate above the average of Aceh Province but the level of GRDP per capita is below Aceh Province. The regencies/cities with quadrant IV are Aceh Tamiang Regency, Aceh Tenggara Regency, Gayo Lues Regency, Bener Meriah Regency, Bireun Regency, Pidie Jaya Regency, Pidie Regency, Aceh Besar Regency, Aceh Jaya Regency, Aceh Barat Daya Regency, Aceh Selatan Regency, Aceh Singkil Regency, Simeulue Regency, Langsa City, and Subulussalam City. The Klassen typology map can be seen in Figure 2.
3.2. Regional Development Level Analysis in Aceh Province

The results of the analysis showed that the Province of Aceh has experienced an increase in the economic sector developments in the period of 2010-2016. In 2010, the average entropy value of the province of Aceh was 0.0350 while in 2016 the value was 0.0363. The total value of the entropy diversity index in the Province of Aceh also experienced an increase from 2010 of 0.8061 to 0.8352 in 2016. This reflects that the economic sector in Aceh Province has experienced a growth in the diversity of types of activities.

Based on entropy value, Aceh Province has an average total entropy value of 4,811. The value of the entropy has not reached the maximum value, it should have 17 sectors of the economy then the Province can reach the entropy value \( \ln (17) = 5.968 \). Nevertheless, the value is close to the maximum entropy value. It can be stated that the rate of dissemination of activity throughout the region is relatively evenly distributed.

Based on the analysis of 2010-2016, there are 10 regencies/cities that have the average EDI above the Aceh Province or high economic diversity including the following: Aceh Timur Regency, Aceh Barat District, Aceh Besar Regency, Pidie Regency, Bireuen Regency, Regency Aceh Utara, Aceh Tamiang Regency, Nagan Raya Regency, Banda Aceh City, and Lhokseumawe City. The Aceh Tengah Regency had also developed only in 2015-2016. Besides, there are 13 underdeveloped regencies/cities that have the average EDI below the Aceh Province including the following: Simelue Regency, Aceh Singkil Regency, Aceh Selatan Regency, Aceh Tenggara Regency, Aceh Tengah Regency, Aceh Tengah Regency, Gayo Lues Regency, Aceh Jaya Regency, Bener Meriah Regency, Pidie Jaya Regency, Sabang City, Langsa City, and Subulussalam City. Regency in the United States during the period 1990-2007 has found that economic diversity can strengthen and give a positive impact on regional economic growth [13].

The scalogram analysis in 2011 and 2014 results showed that several regions have experienced a positive trend to develop into developed regions in 2011. There are 15 regencies/cities classified into hierarchy III in 2011, namely Aceh Selatan District, Aceh Timur Regency, Aceh Tengah Regency, Aceh Barat Regency, Aceh Besar Regency, Pidie Regency, Bireuen Regency, Aceh Utara Regency, Aceh Barat Daya Regency, Aceh Tamiang Regency, Nagan Raya Regency, Pidie Jaya Regency, Langsa City, Lhokseumawe City, and Subulussalam City. The hierarchy II class in 2011 consists of 7 regencies/cities including the following: Simelue Regency, Aceh Singkil Regency, Aceh Tenggara Regency, Gayo Lues Regency, Aceh Jaya Regency, Bener Meriah Regency, and Sabang City. There is only one region that is in the hierarchy I, namely Banda Aceh City. The 2011 scalogram is presented in Figure 3.
In 2014, several regions have experienced changes in the level of regional development. The regions in hierarchy III are reduced to 14 regencies/cities, hierarchy II has not changed and remains 7 regencies/cities and their hierarchy is 2 regencies/cities. Regencies/cities that are in hierarchy III are Aceh Singkil Regency, Aceh Selatan Regency, Aceh Timur Regency, Aceh Tengah Regency, Aceh Barat Regency, Aceh Besar Regency, Pidie Regency, Bireun Regency, Aceh Utara Regency, Aceh Barat Daya Regency, Aceh Tamiang Regency, Nagan Raya Regency, Pidie Jaya Regency, and Subulussalam City. Regencies/Cities that are in hierarchy II are Simeulue Regency, Aceh Tenggara Regency, Gayo Lues Regency, Sabang City, Langsa City, and Subulussalam City. The regencies are in the hierarchy I of Banda Aceh and Aceh Jaya. The 2014 scalogram is presented in Figure 4.

From 2011-2014, three regions have transformed and improved their development level, namely Aceh Jaya Regency from Hierarchy II to Hierarchy I, and Langsa City and Sabang City which experienced a change in hierarchy class from Hierarchy III to Hierarchy II. However, there is a region that has negatively transformed from Hierarchy II to Hierarchy III specifically the Aceh Singkil Regency.
3.3. Analysis of the Aceh Province Cluster

The cluster analysis shows that there are three clusters in Aceh Province with different characteristics. Cluster I indicates that the area is an advanced region compared to other regions, as indicated by the high level of Gross Regional Domestic Product Per Capita (GRDP per capita), high regional growth rate, low forest land cover, high built-up area, and high slope area. The areas located in Cluster I are Banda Aceh City, Lhokseumawe City, and Langsa City. The three areas that are in Cluster I are urban areas, where the economy of the area is also very diverse and equipped with various public facilities. On the other hand, cluster I still has 10.16 % of the average poor people.

Cluster II consists of 9 regions, namely Aceh Selatan Regency, Aceh Tenggara Regency, Aceh Tengah Regency, Pidie Regency, Aceh Barat Daya Regency, Gayo Lues Regency, Nagan Raya Regency, Aceh Jaya Regency, and Bener Meriah Regency. Most of the regencies are in the Gayo Highlands Region and the Gunung Leuser National Park Area. The area in cluster II is an area that has very large forest cover with a human development index on an average of 67%, GRDP per capita of 21,177 million, a regional development index of 67.22. The slope area in cluster II is dominated by slopes <8% (27%), slope 8-15% (19.35%), slope 16-25% (14.14%) and slope 25-40 (19.14%). The area in cluster II has 17.89% of the average poor people.

Cluster III is an area that has the lowest GRDP per capita, human development index, and regional growth rate among other regions. The area in Cluster III has an average forest cover area of 50% with 2.68% of developed land from each region. The percentage of slope area in cluster 3 was dominated by slopes slope <8% (19%), 8-15% (31.26%), slope 16-25% (27.05%) then and slope 25-45% (12%). The lowest economic level in Cluster III has generated the highest average of the poor population (18.22%). The gross regional domestic product can affect the quality of household consumption, especially if the population income level is very limited [14]. The regions included in Cluster III are Simeulue Regency, Aceh Singkil Regency, Aceh Timur Regency, Aceh Barat Regency, Aceh Besar Regency, Aceh Utara Regency, Bireun Regency, Aceh Tamiang Regency, Pidie Jaya Regency, Sabang City, and Subulussalam City. The area on Cluster III is spatially located on the eastern and western coasts of the Province of Aceh. The map of the Aceh Province cluster can be seen in Figure 5.

![Figure 5. Map of the Aceh Province Cluster.](image-url)
4. Conclusions

1. The level of regional economic growth in Aceh Province has increased, where the highest economic growth rate is in the Simeulue Regency of 6.10% while the lowest economic growth rate is in Lhokseumawe City of – 5.32%.

2. The distribution of economic activity in Aceh Province is relatively equal, where is Aceh Utara regency being the region that has the most equitable economic activity. On the other hand, Sabang City is the region that has the most unequal activity of economic.

3. From 2011-2014, there are 3 regions experiencing progress to become more developed areas, namely Aceh Jaya Regency, Langsa City, and Sabang City. While there is also a region experiencing negative development, especially Aceh Singkil Regency.

4. Most of the regencies/cities in Aceh Province are in Cluster II and Cluster III with relatively similar regional characteristics.

References

[1] Sukirno S. 2007. Makro Ekonomi Modern; Perkembangan Pemikiran dari Klasik hingga Keynesian baru. Jakarta (ID): PT. Raja Grafindo Persada.

[2] [BPS] Badan Pusat Statistik Provinsi Aceh. 2017. Provinsi Aceh Dalam Angka 2017. Banda Aceh (ID): Badan Pusat Statistik Provinsi Aceh.

[3] Macours K, Swinnen JFM. 2008. Rural-Urban Poverty Differences In Transition Countries. *World Development*. 36 (11): 2170-2187.

[4] Abro ZA, Alemu BA, Hanjra MA. 2014. Policies for agricultural productivity growth and poverty reduction in rural Ethiopia. *World Development*. 59: 461-474.

[5] Poyoh A. 2016. Analisis Pertumbuhan Kawasan Pengembangan Ekonomi Terpadu (Kapet) Biak Di Provinsi Papua. *Tata Loka*. 18 (1): 44-56.

[6] Munandar A. 2010. Analisis Ekonomi Dan Potensi Pengembangan Wilayah Kecamatan Gemolong, Kabupaten Sragen. [Thesis]. Surakarta (ID). Universitas Negeri Surakarta.

[7] Silastri N. 2017. Pengaruh Jumlah Penduduk dan Pendapatan Domestik Regional Bruto (PDRB) terhadap kemiskinan di Kabupaten Kuantan Singingi. *JOM Fekon*. 4 (1) 105-117.