Agriculture development of Lampung Province based on agropolitan zonation

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Abstract. Lampung Province is one of provinces in Indonesia which has a huge agriculture potential. Lampung’s sectoral contribution to gross domestic product (GDP) is predominantly from agriculture sector which makes up to 30% of the total Lampung GDP in 2017. The high agricultural contribution supports Lampung to surpass national economic growth in 2011–2017. Lampung is one of Indonesia’s major producer of a wide variety of agricultural products and commodities which include palm oil, cassava, rice, and chili pepper. However, the agriculture potential is not managed properly, thus agriculture sector shows a declining trend on Lampung regional GDP. This research aims to determine zonation of agropolitan area to promote agriculture development in Lampung Province. We use quantitative method by retrieving secondary data of GDP, agriculture commodities, and road map derived from Statistics of Lampung Province and Open Street Map (OSM) respectively. Analysis of the GDP data using Location Quotient (LQ) and Krugman Specialization Index (SI), and analysis of agropolitan zonation using geographic information system (GIS). The result indicates that agriculture development using agropolitan zonation is strongly affected by the percentage of agriculture shares on GDP and the distribution of road network across Lampung Province.

1. Introduction
Economic development in Lampung Province is based on agriculture sector. Agriculture sector makes up to 35.92% [1]. Lampung is one of Indonesia’s major producer of a wide variety of agricultural products and commodities which include coffee, corn, cattle, sugarcane, palm oil, cassava, rice, and chili pepper [2]. Thus the government puts an effort to accelerate agriculture development for food resilience and society welfare.

Agriculture sector shares the biggest contribution to GDP in Lampung. Nonetheless, the agriculture sector shows decreasing trend over time (2013 – 2016). In 2013 agriculture shares 33.16% of GDP, but lowering down to 31.68% in 2016. Low prospects in agriculture need to be promoted by appropriate regional development regarding the agriculture potential. Agriculture development in Lampung becomes a remarkable process regarding agriculture is predominantly supporting the regional economy.

Agriculture sector in Lampung has a huge potential to develop since Lampung has a well-developed road network. Lampung connects Java Island with Sumatra Island due to its location alongside the Sunda Strait (Figure 1). The road network plays a role in supporting national strategic zone in eastern coast of Lampung. It also increases the rate of economic growth, especially in agriculture sector, by providing accessible route to distribute agriculture commodities.
Agriculture plays a significant role on supporting regional economy, such as agriculture output. The role is also associated with other sector, such as production and labor [3]. The significant role of agriculture is shown as agriculture also becomes a driver of the development of rural areas [4]. As an main growth of rural areas, agriculture has a contribution to economy and society [5] [6]. Based on economic perspective, agriculture proves the efficiency to sustain during monetary crisis [7].

Friedmann and Douglas implemented Myrdal’s core-periphery on agropolitan development concept. Agropolitan is a bottom-up development approach and aim to accelerate income equality [8]. Agropolitan is characterized by (i) small geographic scale; (ii) independent and autonomous community-based policy; (iii) rural economic diversity, emphasizing on micro industry; (iv) rural-urban linkages on industry and local economic resources; and (v) using local technology and resources. The agropolitan strategy aims to increase the diversity of economic activity; to expand regional market; catalyst capital recirculation; and encourage learning process. Agropolitan area is supported by decent facilities, infrastructure to promote agribusiness as the agropolitan-based growth engine. Fundamental facilities for agropolitan area including infrastuctures to support production and marketing, such as electricity and road network, transportation, and industrial area.

According to Regional Law of Lampung No 1 Year 2010 regarding spatial planning, verse 83 cites that strategic potential of emerging agropolitan areas are Lampung Tengah District, Tanggamus District, Lampung Barat District, Lampung Selatan District, Pringsewu District, Lampung Utara District, Lampung Timur District, Pesawaran District, Mesuji District, Way Kanan District, Tulang Bawang Barat District, and Tulang Bawang District. Agropolitan development is part of 2005 – 2025 long term development planning of Lampung Province.

2. Methods
The Location Quotient (LQ) used in this study to quantify GDP of agriculture sector and determine the value of agriculture significancy towards regional economy in every district. The GDP data is derived from constant price, which indicates economic growth to measure the performance of the economy over time or in comparison with other countries/in comparison with previous periods.
2.1. The Location Quotient (LQ)

The LQ analysis is a method to quantify the concentration of a particular economic sector in a region as compared to the bigger scale area [9]. In this study, the LQ is used to determine which districts have significant potential in agriculture sector. GDP data used in the LQ analysis to quantify how concentrated agriculture sector is in every district in Lampung Province.

The formula of LQ is shown in the equation below:

\[ \text{LQ} = \frac{s_i}{s_t} \frac{s_t}{S_t} \]  \hspace{1cm} (1)

The value of each Location Quotient is given by the formula above using the share (si) district’s agriculture GDP, district’s total GDP (st), the province’s agriculture GDP (Si), and the total province GDP (St).

Interpretation of LQ results:

- If LQ > 1, this indicates a high concentration of the agriculture sector in a given district, compared to the average share of each district.
- If LQ = 1, the agriculture sector has a share of the total in accordance with its share of the base.
- If LQ < 1, the agriculture sector has less of a share of the total than is generally found in the Lampung Province.

2.2. Krugman Specialization Index

Krugman Specialization Index (SI) is used to measure concentration and specialization [10]. The index compares one economic activity in a certain region with the overall economy. Its values range from 0 that identifies the region has no specialization of economic activity, to 2 that characterizes high concentration of economic activity. The formula of Krugman Specialization Index is shown in the equation below:

\[ \text{SI} = 1 - |(E_{ij} : E_j) - (E_{ik} : E_k)| \]  \hspace{1cm} (2)

Where:
- \( E_{ij} \): GDP of sector i in region j
- \( E_{ik} \): GDP of sector i in region k
- \( E_j \): total GDP in region j
- \( E_k \): total GDP in region k

3. Results and Discussion

3.1. The Location Quotient

It is shown in Table 1 the LQ value of every district. The results show that there are three districts which have consistency of high LQ value. By applying LQ equation on the agriculture sector, we can see which districts have agriculture as their basic. Districts which have highest LQ values are as follows: Lampung Tengah, Lampung Timur, and Lampung Selatan. The three districts rank top three over 2013 – 2016 with LQ value over 5.00.

| District/City      | 2013 LQ | Classification | 2014 LQ | Classification | 2015 LQ | Classification | 2016 LQ | Classification |
|--------------------|---------|----------------|---------|----------------|---------|----------------|---------|----------------|
| Lampung Barat      | 1.64    | BASIC          | 1.63    | BASIC          | 1.64    | BASIC          | 1.66    | BASIC          |
| Tanggamus          | 3.05    | BASIC          | 3.05    | BASIC          | 3.06    | BASIC          | 3.06    | BASIC          |
| Lampung Selatan    | 5.75    | BASIC          | 5.70    | BASIC          | 5.68    | BASIC          | 5.68    | BASIC          |
| Lampung Timur      | 6.80    | BASIC          | 6.80    | BASIC          | 6.80    | BASIC          | 6.84    | BASIC          |

Table 1. Location Quotient of agriculture in Lampung Province 2013 – 2016.
Lampung Tengah District has the highest LQ value amongst the others. It also has an increasing trend during 2013 – 2016. In the second place is Lampung Timur District which also has an increasing trend over the years. Lampung Selatan District, in the other hand, has significant high value with a lowering trend. The three districts stand out as the most prospective of agriculture sector due to their higher LQ values in the midst of other districts in Lampung Province.

3.2. Krugman Specialization Index
The SI results as shown in Table 2 indicate the distribution of districts which have high specialization in agriculture sector. The top three districts with highest SI value are Lampung Tengah, Lampung Timur, and Lampung Selatan, respectively. There is huge gap between the three districts and others, thus indicates that agriculture sector plays significant role in building the regional economy in the three districts. The SI value in the three districts is over than 1.5 which concludes that agriculture is the primary supporter of regional GDP and the main economic engine.

| District/City          | 2013   | 2014   | 2015   | 2016   |
|-----------------------|--------|--------|--------|--------|
| Lampung Tengah        | 0.59   | 0.57   | 0.58   | 0.62   |
| Lampung Utara         | 4.19   | 4.17   | 4.17   | 4.07   |
| Way Kanan             | 2.23   | 2.23   | 2.22   | 2.22   |
| Tulang Bawang         | 1.32   | 1.31   | 1.30   | 1.28   |
| Pesawaran             | 0.99   | 1.00   | 1.00   | 1.01   |
| Pringsewu             | 0.41   | 0.40   | 0.40   | 0.40   |
| Mesuji                | 0.72   | 0.77   | 0.80   | 0.82   |
| Tulang Bawang Barat   | 0.58   | 0.57   | 0.57   | 0.56   |
| Pesisir Barat         | 0.32   | 0.32   | 0.32   | 0.32   |
| Kota Bandar Lampung   | 0.35   | 0.36   | 0.35   | 0.34   |
| Kota Metro            | 0.05   | 0.05   | 0.05   | 0.05   |

| District/City          | 2013   | 2014   | 2015   | 2016   |
|-----------------------|--------|--------|--------|--------|
| Lampung Barat         | 0.21   | 0.22   | 0.23   | 0.25   |
| Tanggamus             | 0.68   | 0.71   | 0.75   | 0.77   |
| Lampung Selatan       | 1.58   | 1.63   | 1.69   | 1.76   |
| Lampung Timur         | 1.92   | 2.01   | 2.10   | 2.19   |
| Lampung Tengah        | 3.18   | 3.32   | 3.47   | 3.61   |
| Lampung Utara         | 1.06   | 1.10   | 1.15   | 1.16   |
| Way Kanan             | 0.41   | 0.43   | 0.44   | 0.46   |
| Tulang Bawang         | 0.11   | 0.11   | 0.11   | 0.11   |
The agropolitan zonation is determined by synchronizing the results of LQ, IS, and road network in Lampung Province. According to the LQ and SI results, agropolitan zonation is located on Lampung Tengah, Lampung Timur and Lampung Selatan. The three districts fulfill the criteria of agropolitan since they have high concentration and specialization on agriculture sector. The zonation is also supported by the distribution of road. The road network is well-distributed across the three districts. Main road access such as artery and collector road build a path across Lampung Tengah, Lampung Timur, and Lampung Selatan.

Road network provides accessibility for the agropolitan zonation. The three districts are located close to the cities, Kota Metro and Kota Bandar Lampung. Considering the well build accessibility of the districts, which is resembled by the distribution of artery and collector road across the districts, agropolitan is prospective development for the districts. Artery and collector road are mainly connecting inter region within two or more provinces. The accessibility also puts an ease to the exchange of agricultural products.

Lampung Selatan District, Lampung Timur District, and Lampung Selatan District are potential agropolitan candidates due to the availability of road networks. The availability of road networks across Lampung Tengah, Lampung Timur, and Lampung Selatan is the main pillar of regional connectivity and agricultural market. The three districts have all of kind of roads, arety, collector, and local roads which lead to spatial linkages. Lampung Tengah District is connected to Metro City through local road, meanwhile artery road connects Lampung Tengah to other districts. Districts connected to Metro City are Lampung Tengah and Lampung Timur due to the availability of road networks and the near distance between the regions, thus agriculture market for Lampung Tengah and Lampung Timur is located on Metro City. Lampung Selatan District is located near Bandar Lampung City, furthermore the spatial linkage of Lampung Selatan is stronger with Bandar Lampung City.
3.4. Spatial linkages and agropolitan
The spatial linkages of agropolitan include relationship between urban centres and rural areas. The rural-urban linkages are characterized by interdependence and the linkages of agriculture, manufacture, and service. Road network, especially in Lampung Tengah, Lampung Timur and Lampung Selatan enable rural – urban linkages. Interdependence between agropolitan areas in Lampung Province is strongly connected by road network, which is evidenced by the flows of agricultural products from districts to city centres in Bandar Lampung City. Agriculture products that flow from districts to cities constitute the majority of product flows from rural areas to urban centres. Therefore agriculture sector strengthens the product linkages between urban and rural activities in Lampung Province.

4. Conclusion
Agriculture sector shares the biggest contribution to GDP in Lampung. Thus development policy regarding agriculture needs to be considered as one of the development goals. Agropolitan provides an accommodation to assist agriculture sector to become a lead on regional economy. Lampung has three biggest contributing agricultural districts, resembled by the high LQ and IS values. The districts (Lampung Tengah, Lampung Timur, Lampung Selatan) meet the requirements to be agropolitan area since they have specialized and basic sector on agriculture. Agropolitan zonation in the districts is strongly supported by the availability of road network to boost inter regional accessibility and trade agriculture products.

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