Spatial Patterns of Expertise Suitability in the Ruminant Sub-Sector of Subang Regency, West Java Province

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Abstract. One of the causes of the high open unemployment rate for vocational school graduates is the incompatibility of the competency skills held with the potential of the available area. Subang Regency is one area that has considerable potential in the agricultural sector. The study aims to analyze the spatial pattern of expertise in vocational schools based on ruminant commodities in Subang Regency to support agricultural vocational schools according to their superior capacity. This research was conducted using a combined LQ (Location Quotient) analysis to identify the base area and combine physical and non-physical geographic components applying the spatial approach to identify the area's carrying capacity. The research concluded that Jalancagak, Dawuan, and Cipundeuy Sub-Districts are the most suitable sub-districts for addressed competency as Ruminant Agribusiness expertise because there are villages with a variety of basic commodities, physical and non-physical aspects of geography that are categorized as high so that the competence of Ruminant Agribusiness expertise carried out according to its carrying capacity. This research also found the expertise suitability competencies based on the village level, as upgrading scale, so that the carrying capacity that supports SMK is known precisely.

1. Introduction

Vocational High School, later called Sekolah Menengah Kejuruan or SMK in Bahasa, is a formal education vital in improving human resources. According to Government Regulation of the Republic of Indonesia, Number 17 of 2010 concerning Management and Implementation of Education, article 76 paragraph (2) stated that one of the vocational secondary education functions is to foster students with the expertise of science and technology and vocational expertise of the professions under the needs of the community [1]. Competency-based education is expected to prepare students better to meet the labor market, stimulate students to develop competencies, increase motivation, and reduce dropout rates [2]. The number of SMK in Indonesia, in general, has grown every year, based on the 2019/2020 school year. The number of schools and vocational students in Indonesia experienced the highest increase, with the number of registered schools being 14,301 and the number of students 5,249,149 [3]. However, the Open Unemployment Rate (later called Tingkat Pengangguran Terbuka or TPT in Bahasa) according
to the highest education completed in 2018-2020 shows that SMK graduates have the highest TPT rate compared to that of other education levels [4]. There is no doubt that SMK is the way to improve the education of human resources quality that needs to be evaluated. One of the causes of the high (TPT) open unemployment rate for SMK graduates is the incompatibility of the areas of expertise carried out in SMK between local potential and regional needs so that apart from not being able to contribute to regional economic growth, the absorption of SMK graduates in the regions is relatively low, the presence of SMK is expected to meet the needs of the Business World/Industrial World or produce graduates who can work independently, at least for business fields in their area [5]. Preparing students to optimally cultivate their regional potential by providing knowledge, skills, and work attitudes related to their regional potential following technological developments and industrial needs is one way to develop regional potential-based Vocational High Schools [6].

The previous study of the region's potential has been carried out, one of which is to analyze the suitability of the expertise program at SMK. Research by [7], used the variable number of workers in one sector at district levels by using Location Quotient (LQ) analysis in analyzing the needs of SMK expertise programs. The other research, conducted a descriptive study using a documentary approach and the LQ method to identify local potential in Cilacap Regency and describe the level of alignment for indicating the spectrum of expertise in each corridor and creating a spectrum of SMK expertise that in line with local capacities [8]. However, so far, none of the study has reviewed the suitability of SMK expertise from a spatial dimension.

One of the areas in Indonesia that has potential in the agricultural sector is Subang Regency, located in West Java Province. Apart from being a national rice barn, this area was also selected as one of Indonesia's priority livestock development locations, especially beef cattle, by the Ministry of Agriculture of the Republic of Indonesia in 2018 [9]. However, based on the Ministry of Education and Culture data in 2021, Subang Regency only has one SMK that organizes Ruminant Agribusiness skills competence, namely SMK Peternakan Juara Subang, which is located in Tenjolaya Village, Kasomalang sub-districts. Based on the problems described previously, it is appropriate if the Subang Regency area is supported by a SMK that organizes the competence of Ruminant Agribusiness expertise.

The purpose of this study was to identify the spatial pattern of the expertise suitability area of Vocational High Schools that organizes Ruminant Agribusiness Skills Competencies based on the carrying capacity of the region. The carrying capacity is obtained from the collaboration of the ruminant commodity base area and geography's physical and non-physical aspects. Economic geography can be superior in an area by studying the economic (human) aspects as well as the geographical aspects (physical in the form of slopes, elevations, climates, and so on) [10].

2. Method

2.1. Data collection and analysis

The data used included the population from the ruminant sub-sector sourced from Subang Regency 2020 [11]. The population data for each commodity from the ruminant livestock sub-sector at the sub-district level consists of dairy cattle (*Freisian holstein*), beef cattle (*Bos taurus*), buffalo (*Bubalus bubalis*), horses (*Equus caballus*), goats (*Capra aegagrus hircus*), and sheep (*Ovis aries*).

This study used maps of the administrative boundaries of Subang Regency and also land use map, slope, and elevation map sourced from Geospatial Information Agency. District capitals and road network sourced from Development Planning Agency at Sub-National Level (Bappeda) of Subang Regency year 2017. Junior High School and SMK data from the Ministry of Education and Culture year 2020. Agro-industry data source based on the Regional Office of Cooperatives, MSMEs, Trade and Industry year 2020.

2.2. Analysis

This study was conducted using a combined LQ (Location Quotient) analysis to identify the base area of the ruminant sub-sector and combine physical and non-physical geographic components applying the
spatial approach to identify the area's carrying capacity. LQ is commonly used early in identifying the sectors driving growth [12]. The LQ method is applied to identified regional profiles by comparing the sector's role in a region and at a higher regional level with the same variables [13]. The following equation obtains the LQ index value:

\[ LQ = \frac{s_j^i}{S_j^n} \]

Information:
LQ : Location Quotient Index of commodity i at the district level Subang Regency
\( s_j^i \) : total population of commodity i in district j
\( s_j^n \) : total population of commodities in district j
\( S_j^i \) : total population of commodity i in Subang Regency
\( S_j^n \) : total population of commodities in Subang Regency

The criteria of the LQ index, if:
LQ > 1, then the commodity is the base commodity and meets the region's needs and can also be distributed to other regencies.
LQ = 1, then these commodities are non-basic commodities, regarding production is only sufficient to meet the regencies' needs and cannot be distributed to other regencies.
LQ < 1, then the commodity is a non-basic commodity, which cannot meet the regencies' needs, thus requiring supplies from other regencies.

The field of science that studies various phenomena on the earth's surface from a spatial viewpoint is Geography [14]. Geography integrates disciplines that study the object of study of people, places, and the environment in the physical and human dimensions [15]. Indicators used to determine the suitability of physical geographical aspects include slope, elevation, and land use data [16]. While the data used to determine the suitability of non-physical aspects of geography have: accessibility, agro-industry reach, and the number of junior high school students. Several stages are carried out to achieve these goals, first determining the classification of each indicator. Second, each indicator goes through a zonal statistics process to see the spatial distribution in each village administration area. Third, combining indicators for each aspect with scoring and weighting using the overlay (union) tool in ArcGis. The overlay in the GIS tool has the essential operation of superimposing two vector layer planes to create a new layer that reflects the original layer plane distribution. [17].

3. Results and discussion

3.1. Base region classification
This study uses LQ (Local Quotient) analysis in identifying the bases areas of the ruminant sub-sector. The base area of the ruminant livestock sub-sector is classified based on the number of base commodities per district using the Natural Breaks classification in ArcGis, from this process produces three categories, including High Category (has 4-5 base commodities), Moderate (has 2-3 base commodities) and Low (has one base commodity). Table 1 shows the regional classification of the ruminant sub-sector based on the district. The regional base classification of the ruminant sub-sector saw in Figure 1.
Table 1. Regional classification of ruminant sub-sector base.

| High              | Moderate          | Low               |
|-------------------|-------------------|-------------------|
| Cipeundeuy        | Cisalak           | Sukasari          | Kalijati          | Pamanukan         |
| Dawuan            | Tanjungsiang      | Legonkulon        | Pabuaran          | Tambakdahan       |
| Jalancagak        | Ciater            | Pusakanagara      | Patokbeusi        | Binong            |
|                   | Kasomalang        | Pusakajaya        | Purwadadi         | Pagaden Barat     |
| Sagalherang       | Compreng          |                  | Ciasem            | Cibogo            |
| Serangpanjang     | Pagaden           |                  |                  |                   |
| Cijame            | Cipunagara        |                  |                  |                   |
| Subang            |                   |                  |                   |                   |
|                   |                   |                  |                   |                   |

Figure 1. The basic regional classification of the ruminant sub-sector.

3.2. Classification of physical geographic aspects

Indicators used to determine the suitability of physical geographical aspects include slope, elevation, and land use data. The values and weights of the physical geographic aspects are shown in Table 2.

Table 2. Values and weights aspects of physical geography.

| No | Indicator | Weight | High   | Moderate | Low   |
|----|-----------|--------|--------|----------|-------|
|    |           |        | Score 3| Score 2  | Score 1|
| 1  | Slope     | 40     | 120    | 80       | 40    |
| 2  | Height    | 30     | 90     | 60       | 30    |
| 3  | Land Use  | 30     | 90     | 60       | 30    |
|    | Total     | 100    |        |          |       |
In assigning a weight value to the Physical Geographic Aspect variable, the slope indicator is given greater weight than other indicators with considerations based on the technical criteria for the agricultural designation area in the Regulation of the Minister of Public Works Number 41/PRT/M/2007 concerning Guidelines for Technical Criteria for Cultivation Areas [18]. From these regulations, one would argue that the more significant the slope angle requires, the more severe conservation measures would increase erosion.

The suitability of the physical geography aspect resulted in three categories, namely high, moderate, and low. The value of the classification interval for the physical geography aspect is obtained from the MEAN value of the zonal statistic as a table using the Natural Break classification type on ArcGIS. Figure 2 displays the suitability classification of physical geographical aspects of the ruminant sub-sector.

The classification of the physical geography aspect of the ruminant sub-sector resulted in a high category of 138 villages, a moderate of 77 villages, and 34 villages low. The areas with the highest category are Cipunagara and Patokbeusi Sub-Districts with ten villages each, while the area with the lowest category is Dawuan Sub-Districts. The high category is dominated by rice fields, flat slopes, and an altitude of 0-200 meters above sea level.

3.3. Classification of Non-Physical Geographic Aspects

The data used to determine the suitability of non-physical aspects of geography include accessibility, agro-industry reach, and the number of junior high school students. Values and weights of non-physical geographical aspects are seen in Table 3.

| No | Indicator                        | Weight | High Score  | Moderate Score | Low Score |
|----|----------------------------------|--------|-------------|----------------|-----------|
| 1  | Accessibility                    | 40     | 120         | 80             | 40        |
|    | Street Value                     |        | 60          | 40             |           |
|    | Distance Value                   |        | 60          | 40             |           |
| 2  | Agro-industry                    | 30     | 90          | 60             | 30        |
| 3  | Junior High School Students      | 30     | 90          | 60             | 30        |
|    | Total                            | 100    |             |                |           |

In assigning weight values to non-physical aspects of geography, the accessibility indicator was given greater weight than other indicators. With accessibility, community mobility and logistics will be smoother, making it easier for investors to come to the area. [19], moreover, one of the indicators used to determine the ease of access to educational services by students [20]. Accessibility consists of road value and distance value. The road value is obtained from the pixel values combination of the raster maps of arterial, collector, and local roads, while the distance value obtained from the combined pixel values of the regional raster maps within a radius of 2 km, 5 km, and 10 km from the district capital. Agro-industry values are obtained from the combined pixel values of regional raster maps within a radius of 2 km, 5 km, and 10 km from the location of the agro-industry. These three indicators use the MEAN operator value from the zonal statistic.

The suitability of non-physical aspects of geography resulted in three categories: high, moderate, and low, as a higher resulting class is a better level of conformity. The value of the non-physical geographical aspect classification interval for each category is obtained from the Total Score of the overlay union results using the Natural Break classification type on ArcGIS. The suitability classification of non-physical geographical aspects of the ruminant sub-sector saw in Figure 3.

The classification of non-physical geographical aspects of the ruminant sub-sector resulted in a high suitability category of 34 villages, a moderate of 127 villages, and low 88 villages. The area with the most villages with the highest suitability category is Dawuan and Jalancagak Sub-Districts, while the area with the most villages with the lowest suitability category is Tambakdahan Sub-Districts.
3.4. Spatial patterns of expertise suitability in the ruminant livestock Sub-sector

Spatial analysis is carried out by assigning values and weights to each regional variable based on ruminant livestock commodities, aspects of physical geography, and non-physical aspects of geography. Then the three aspects are combined with the overlay tool (Union) in ArcGis. At this stage, the classification is done by coding, for the 'base region' variable with the WB code, the 'physical geography' aspect with the GF code, and the 'non-physical geography' aspect with the GNF code, while the code for the 'high' classification level with the code 1, 'medium' with code 2 and 'low' with code 3.

Figure 4 shows that the villages with the best suitability (WB1-GF1-GNF1) to provide expertise related to the ruminant livestock sub-sector are five villages marked with a dark green colour. These villages include Jalancagak and Curugrendeng Villages in Jalancagak Sub-Districts, Rawalele and Manyeti Villages in Dawuan Sub-Districts, Cipeundeuy Village in Cipeundeuy Sub-Districts.

This study uses a combined analysis of LQ and spatial analysis to get more specific results. This research analysis could find the suitability of skill competencies based on the village level, as upgrading scale, so that the carrying capacity that supports SMK is known precisely. The methodology used in such a study can be applied to issues similar to the above study and versatile. A combined method makes the analyses adequately explain the topics concerned.

Figure 2. Classification of physical geographical aspect of ruminant subsector

Figure 3. Classification of non-physical geographical aspects of ruminant subsector

Figure 4. Spatial patterns of expertise suitability of areas in the ruminant livestock subsector.
4. Conclusion
As discussed above, the study concluded that Jalancagak, Dawuan, and Cipeundeuy Sub-Districts are the most suitable districts to carry out the competence of Ruminant Agribusiness expertise because, in that district, there are villages that have a variety of basic commodities, physical and non-physical aspects of geography that are categorized as high, so that the competence of Ruminant Agribusiness expertise can be carried out according to its carrying capacity. For further study, it is recommended to having comparative study with other sectors, so that it would be more visible to suit other sectors and including the variable number of students interested in these skill competencies.

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