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The Effect of Spatial Distribution Pattern of Cassava Plantation on Tapioca Production in Pati Regency

Eva Banowati[1], Puput Nopiani[1,] Hawik Henry Pratikto[3]

[1]Faculty of Social Sciences, Universitas Negeri Semarang,
Semarang, Indonesia
[2]Technology and Vocational Education Faculty, IKIP Veteran
Semarang, Indonesia
Corresponding email: evabanowatigeografi@mail.unnes.ac.id

Abstract—**Cassava in Pati regency becomes a raw material in tapioca industry. In theory, the economic base of tapioca industry is capable of creating high added value, absorbing relatively large workforce, having high backward linkage or forward linkage, and having a high growth rate. This study aims to determine the effect of spatial distribution pattern of cassava plantations on tapioca production. The research population is areas (cassava field) and tapioca industry. The research used Cluster Area sampling technique of cassava and Simple Random Sampling in tapioca industry. This research used descriptive quantitative data analysis techniques, and spatial analysis. In calculating the result of spatial distribution pattern analysis, it is known that the area spread index (Moran Index) influences the production and smooth supply, transportation in terms of cost, distance, and travel time. The results of calculation to identify the index of spatial distribution pattern got the positive value of 0,0038, it means the distribution pattern of clustered cassava land facilitates the transportation of cassava crop transportation as a tapioca industry supply.**

Keywords—*Spatial Distribution; Tapioca Production; Tapioca Industry Supply*

I. INTRODUCTION

Cassava has a fairly low planting and maintenance cost while the yield or production is very influential on the market, and the demand of cassava is quite high. In some areas that are difficult to obtain rice, cassava is used as complementary food, so that people use it as staple food (Purwono and Purnamawati, 2009). Ironically, national cassava production has continued to decline since 2015, although the average productivity of land has increased by 30 tons of cassava per ha/year accompanied by the decline of sweet potatoes and tapioca prices. This condition indicates the reduction of cassava land area directly affecting food security. Indonesia is vulnerable to food, even imports increase by 594,000 tons. Imports are needed because of the imbalance between the availability of cassava and tapioca to the needs of the food processing industry. BPS reported (2015) that imports in January - August reached 4,193.59 tons due to a low production.

Administrative coverage of Pati Regency has a variety of landforms that are influenced by physiographic conditions stretching from the edge of the sea (Java Sea) to produce marine landforms and to volcanic landforms. Based on the results of EPT in 2002, the area of Pati Regency is 150 368 Ha consisting of 59 332 Ha of paddy fields, 66 086 Ha of non-rice fields and 24 950 Ha of non-agricultural land. The types of soil in Pati Regency are Latosol, Red Yellow, Mediteran, and the acidity level (pH) above 6 is crumb, loose, and rich in organic materials which are suitable for agriculture. Rainfall and falling rain distribution form climate types C2, D2, and E1-E4 supporting cassava farming activities (Department of Agricultural Pati Regency, 2016).

The process of tapioca production is so simple from the side of the process or the time that used. In the theory of Economy basis, tapioca industry could create the highest increased value, absorb high quantity of employees, have a high relation of inter- sector thus backward linkage although forward linkage, and have a high speed of growth (Muta'ali, 2015).

The strategic potential of the tapioca production in Pati Regency requires to be carried out a strategic study to control and to supervise the development of the industrial sector. One of them can be pursued through a geography review by mapping spatial / spatial and regional distribution. According to Yunus (2010), industrial spatial distribution is a spatial aspect in the form of industrial distribution and the development in the form of points,

lines or areas on the earth's surfaces which are shown in the form of maps.

Industrial geography is a part of economic geography that studies industrial location and location factors, such as the availability of raw materials and energy resources in an area. The energy resources referred to include hydropower or electric power as a driving force for factory machinery, labor providers, water providers, markets and transport facilities (Daldjoeni, 1992).

The process of industrialization geographically is a selective process. Industrial development will create spatial distribution patterns that vary in each region, not least the spatial distribution pattern of the tapioca production in Pati Regency. The pattern of industrial spatial distribution provides an overview of the characteristics of an industry, especially the aspects of homogeneity in an industrial location selection (Hayter, 1997). The choice of location for industry is important because by placing the industrial location in the right location, there will be various kinds of savings, so that profits will be increase.

II. METHOD

This research is categorized as survey research. According to Fraenkel and Wallen, 1990 survey research is research that collected information from a sample by asking through questionnaires or interviews so that later described various aspects of the population. Siregar (2013) argued that population is used to describe a group of objects that is target research. The research population is an area (cassava field) and tapioca industry. Then, sample is data retrieval procedure in which only several parts of the population are taken and used to determine the nature and the desired characteristics of the population (Siregar, 2013). The research used Cluster Area sampling technique of cassava and Simple Random Sampling in tapioca industry. This research used descriptive quantitative data analysis techniques, and spatial analysis. Cluster Area sampling technique, determining the minimum sample number using the *Badan Inormasi Geospasial* (BIG) guidelines. Data were taken by the accuracy of the image interpretation test technique. Data analyzed using Join Area Analysis (Moran) to measure spatial patterns. The interpretation of SPOT 6 satellite imagery in November 2014 shows that the majority of cassava lands are located in the northern part of the upper slopes to the lower one of Volkan Muria (83.7%) covering the Tlogowungu, Margoyoso, Cluwak, Gembong, Margorejo and Tayu Districts.

III. DISCUSSION

Spatial Analysis

Widoyo (2001) argued that geography is a science that uses a holistic approach through the study of spatial,

territorial, ecological, and systemic, and historical to describe and to analyze the structure of interrelation patterns, functions, and processes, interaction, interdependence, and reciprocal relationships of a series of symptoms , appearance, or occurrence of human life (population), activities or cultivation with the condition of the environment on the earth's surface. Thus, the study can explain and identify the location or spread, the similarities and differences in the region in terms of potential, problems, other geographic information and it can also predict new information on the future geographic symptoms which are then utilized for human welfare.

Spatial analysis is a typical approach in geography because it is a study of the diversity of the face of the earth by examining each of its spatial aspects. Aspects of the earth's space include location factors, natural conditions, and socio-cultural conditions of the community. In reviewing these aspects, a geographer is very concerned about the factors of location, distribution, interrelations and their interactions. One example of spatial approaches is a piece of land that is expensive because the land is fertile and is located on the side of the road. In this example, the first is to assess land based on agricultural productivity, while the second assesses the land based on the value of its space, which is a strategic location.

The Definition of Spatial Distribution Patterns

Distribution in this case is the location position located in an area or place in certain circumstances. Classification of the distribution can basically be divided into three types, including: 1) Clustered 2) Random and 3) Regular (Yunus, 2010).

The spatial understanding of geographic views is a rigid definition, which is all matters concerning the location or place (Rustiadi, et al. 2009). The term of the space can be interpreted as a particular part of the earth's surface which is able to accommodate various forms of human activities in meeting their life's needs. Industrial spatial distribution is a spatial aspect in the form of distribution and industrial development in the form of points, lines or areas on the surface of the earth that are shown in the form of maps (Yunus, 2010).

The Distribution of Cassava Fields in Pati Regency

The interpretation of SPOT 6 satellite imagery in November 2014 shows that cassava land is located in the northern region, namely the physiology of the upper slopes to the lower slopes of Volkan Muria (83.7%) covering the Tlogowungu, Margoyoso, Cluwak, Gembong, Margorejo and Tayu Districts as well as 16.3% in the southern part of the northern *paddleeng* of Kendeng Mountains covering the areas of Sukolilo, Kayen and Tambakromo Districts.
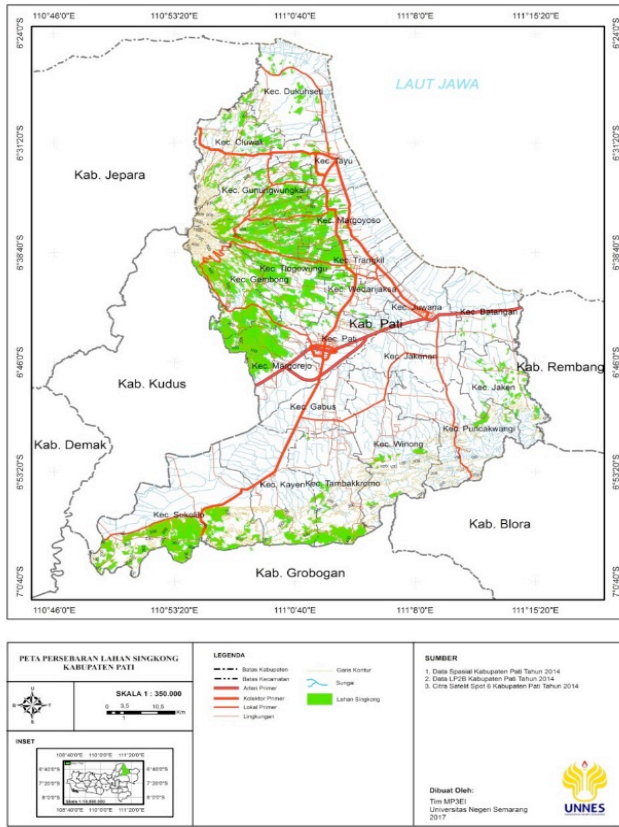
Figure 1. The Distribution of Cassava Field in Pati Regency (Source: Banowati, et al, 2017)

Calculation of the results of the analysis of the spatial distribution pattern of Figure 1 is known area distribution index (Moran index) affects the production and smooth supply, transportation in terms of cost, distance, and travel time.

Table 1. Patterns of Spatial Distribution of Cassava Land (Join Area Analysis)

No.	District	L	L	Area Value		
				(x)	(x − x̄)	(x − x̄)²
1	Tlogowungu	6	36	4283	3417	11675889
2	Gembong	2	4	3276	2410	5808100
3	Cluwak	3	9	2427	1561	2436721
4	Gunungwungkal	5	25	1400	531	285156
5	Margoyoso	4	16	1097	231	53361
6	Margorejo	4	16	1638	772	595984
7	Trangkil	3	9	537	-329	108241
8	Dukuhseti	2	4	110	-756	571536
9	Tayu	4	16	301	-565	319225
10	Sukolilo	1	1	115	-751	564001
11	Jaken	3	9	72	-794	630436
12	Winong	4	16	51	-815	664225
13	Tambakromo	3	9	51	-815	664225
14	Kayen	3	9	63	-803	644809
15	Wedarijaksa	4	16	85	-781	609961
16	Pati	6	36	16	-850	722500
17	Pucakwangi	3	9	53	-813	660969
18	Batangan	3	9	7	-859	737881
	Total Area Join	63	249	15582		27753220
	Rate		866			

Source: BPS, 2016 (Secondary Data Analysis, in Banowati, et al. 2017)

Information:
L = Number of join areas
x = Cassava Land Area for each District

The number of join areas (L value) in Tlogowungu District = 6, meaning that Tlogowungu District is adjacent to 6 other sub-districts. The value of x = 4,283 means that it has 4,283 Ha of cassava land. Value L Pati District = 6

$$I = \frac{n \sum_{(c)} (x_i - \bar{x})(x_j - \bar{x})}{J \sum_{(c)} (x - \bar{x})}$$

$$I = \frac{18 \times 369.407,9544}{63 \times 27.753.220}$$

$$I = \frac{6.649.343,179}{1.748.452.860} \quad I = 0,0038$$

means that transportation of crops is easy, but the cassava area is 16 Ha (x value). Based on the calculation results, it can be seen that the join area is 63. The calculation results to determine the spatial distribution pattern index are used by the formula:

A positive I value of 0.0038 was obtained, meaning that the distribution pattern of cassava land in Pati was clustered, this is facilitated transportation of cassava harvests as tapioca industry supply.

Referring to the theory of determining Weber's industrial location (1929) which became the starting point of modern industrial thinking. Analysis of the determination of industrial location geographically affects the type of business and activities that takes into account several spatial factors (space or place) to find the optimal location and minimal costs of an industry supported by the available raw facilities, especially the weight loss industry type after going through the production process, as well as tapioca industrial products lighter than raw materials (cassava). The factory location must be closer to the source of raw materials so that the low cost (least cost location).

The Distribution of Tapioca Production Location in Margoyoso District
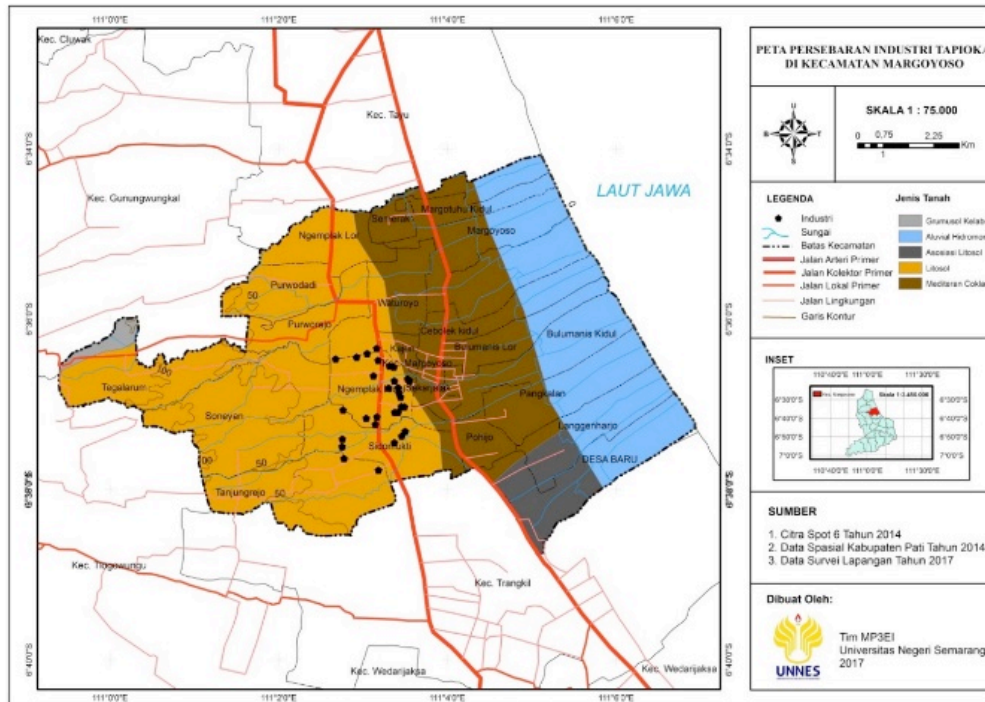

Figure 2. Distribution of Tapioca Production Location in Margoyoso District
(Source : Banowati, et al, 2017)

Pati Regency tapioca production center is located in Margoyoso Subdistrict, in this region there are 269 units (Monograph District, 2016) spread in four villages, namely: Sidomukti, Ngemplak Kidul, Tanjungrejo, and Waturoyo. The mapping of sample distribution of industrial locations using GPS in the form of coordinates can be seen in the following picture.
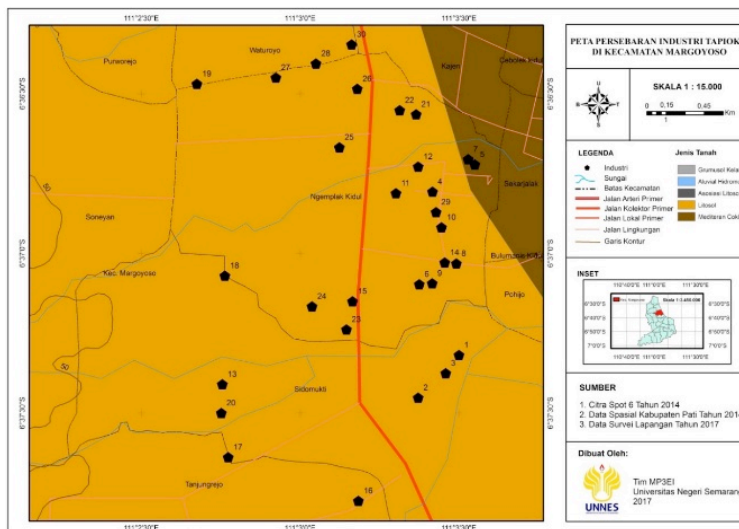

Figure 3. Aglomeration and distribution of samples of Tapioca Industry
(Source : Banowati, et al, 2017)

The pattern of the distribution of tapioca production in Margoyoso Subdistrict is influenced by the existence of raw material sources, accessibility, homophily culture that is the interaction that occurs between individuals who have similarities in views, knowledge that have strong empirical support (Rogers, 1983). The existence of raw material sources is one of the determining factors in the existence of this secondary extractive industry.

Primary data analysis (2017) is known as a random pattern shown by the value of T 0.849 industrial location, and the position of one location with other locations is not interrelated. At any locations of the industry are established in the Margoyoso Subdistrict area (the least cost location) or the prospective because it is easy to get clustered cassava. In line with Aidi's opinion (2000), each industry is truly independent.

Consideration of the proximity of the location with regard to the management of liquid waste that is intentionally channeled into the river, it is conducted to minimize pollution so as not to seep into the wells of the population. The nature of the liquid waste of tapioca contains vegetable matter which decomposes quickly if left inundated in the open. Some rivers that are used as tapioca waste disposal sites including : Bango, Suwatu, Pangkalan, and Pasokan.

IV. CONCLUSION

It can be concluded that simultaneously, the variable of spatial distribution pattern of cassava influences the tapioca production in Pati Regency. The calculation of the analyzed results of the spatial distribution pattern is known as an area distribution index (Moran index) which affects the production and smooth supply, transportation in terms of cost, distance, and travel time.

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