

Determination of Agro-Industry Area Based on Cassava Commodity in Bondowoso Regency

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Abstract. Bondowoso Regency has various potential commodities in agricultural sector, and one of them is cassava. It was seen from the high productivity and the amount of cassava production in Bondowoso Regency. The high productivity of cassava in Bondowoso, was supported by natural condition of Bondowoso regency with 27,67 percent suitable field for cultivation of cassava. The main purpose of this study is to determine the agroindustry area in Bondowoso Regency based on superior commodity of cassava. The first step was taken to determine the potential agroindustry of potential commodity is by using LQ method. Secondly, to determine the superior commodity based on cassava in agroindustry area is by using MCDM method. The result of the study showed that Wringin district is a potential area for the development of agroindustry based on cassava with superior commodity like Tape and it's processed products. **Keywords :** Agroindustry Area, Cassava, Bondowoso Regency, Tape, Superior Commodity

1. Introduction

Regional development is basically carried out by optimizing the natural resources through the development of local economic, based on basic economic activities in one area. Bondowoso Regency has the main potential in the agricultural sector which contributes quite large in the PDRB as well as for the labor absorption. Considered the number of livelihood-based population, the majority of the population works in the agriculture – based on home industry sector [2].

One sector that provided the largest contribution was the agricultural sector, which was 48.40% [2]. The data showed that the potential for agriculture was quite large which can be used as industrial raw materials. However, based on RPJMD of Bondowoso District 2013-2018, this potential had not been utilized optimally in industrial sector activities. This because the minimum optimization of small and medium industry in using the raw materials of best regional agricultural potential and the use of appropriate technology in industrial development. In addition, the development of agricultural sector in Bondowoso Regency had not been able yet to create more value for developing Bondowoso Regency.

Bondowoso Regency still has a relatively high level of unemployment, which is an issue in human resources development. This indicates that the development of agricultural sector as the basic sector has not been able to give more valuable contributions. Therefore, agricultural development must be followed by the development of complementary sectors and industrial sectors based on agricultural



products (agro-industry), so that the additional sources aside from agricultural land could be obtained [8].

The government of Bondowoso Regency need to make policy priorities to keep the regional development run well. The determination of these policy priorities can be created by recognizing the superior commodity through the increased value of agricultural products. Each region had different superiorities to be optimally used. The prospect of increasing demand for value in agricultural products is an incentive to increase attention of agro-industries development in the context of economic growth and strategies to reduce poverty.

The purpose of this study was to discuss the application of the LQ method and the TOPSIS MCDM method, in identifying the potential of cassava – based in Bondowoso district. In addition, it is expected that the results of this study can be used as the basic for developing the potential of cassava in the Bondowoso area

2. Literature Review

Location Quotient (LQ) method to identify the best commodities was accommodated from Miller & Wright (1991), Isserman (1997), and Ron Hood [4]. According to Hood (1998), LQ is a simple and easy economic analysis tool with all its advantages and limitations. LQ method is one of base economic models, as the first step to understand the activity sector that supports the economic growth. LQ is used to measure the relative concentration or level of specialization of economic activities by using comparative approach through. This method presents a relative comparison of a sector ability in the area under investigation with the same ability in a wider area. The unit is used as a measurement to produce the LQ coefficient is the amount of labor, production, or other units that can be used as criteria.

Multiple Criteria Decision Making (MCDM) is a method of decision making to determine the best alternative of a number of alternatives based on certain criteria. Usually, the forms of the criteria, are measurements, rules or standards that are used in decision making. Based on its objectives, MCDM can be divided into 2 models i.e Multi Attribute Decision Making (MADM) and Multi Objective Decision Making (MODM). MADM is method that used to solve problems in a discrete space. Therefore, the assesment or selection of several alternatives in a limited number can be done by using MADM. While, MODM is a problem solving method in continuous space, such as problems in mathematical programming. Generally, it can be concluded that MADM is the right method to select the best alternative of a number alternatives, and MODM is used to designs the best alternatives [5]. The model used in this decision support system is Multi Attribute Decision Making - Technique for Order Preferred Similarity to Ideal Solution (MADM-TOPSIS). It is used for problem solving in ranking.

The TOPSIS method is a technique for ordering preferences based on similarity to an ideal solutions. An ideal solution (also called an ideal positive solution) is a solution to maximize the benefit and minimize the cost, while ideal negative solution (which is called anti-ideal solution) is used to maximizes the cost and minimizes the benefit. The best alternative is an alternatives which has the closest value to the ideal positive solution and the furthest from the ideal negative solution [9].

3. Research Method

3.1 Conceptual Framework

Regional development planning must ideally be supported by accurate data. In order to fulfill the accurate data, it is necessary to identify the potential of an area as an initial basis for further planning. The development of a strong agro-industry area must be in line with the vision and mission, and regional development policies. The strategy of developing best agroindustrycommodity is one of the efforts to accelerate the creation of comprehensive and simultaneous community welfare.

The initial step in formulating a best commodity development strategy was to identify the potential areato develop cassava-based agroidustry in Bondowoso Regency, then analyzing the best products to

be developed. This approach was carried out by considering all aspects of supply (comparative advantage) and aspects of demand (competitive advantage) of regions that provided additional value and have a prospective for the development of best agroindustry of cassava-based. Identification of areas that have the potential to develop cassava-based agro-industry is done using the LQ method, while the MCDM method is used to determine the best commodities. The cluster approach was carried out to decide the policy of developing cassava-based superior agroindustry as an effort to increase additional value and regional competitiveness. The flowchart of the conceptual framework of this research is outlined in the form of a flow chart in Figure 3.1.

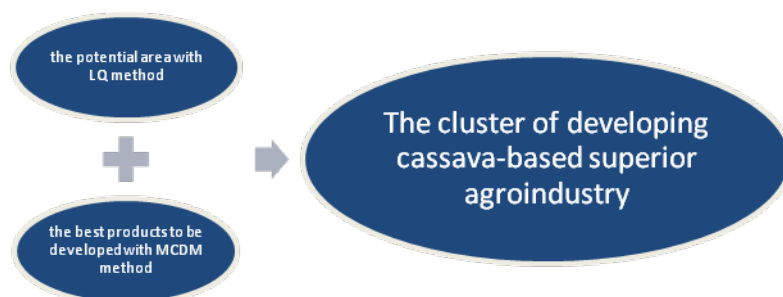


Figure 3.1 The flowchart of the conceptual framework

3.2 Place and Time of Research

This research activity was done in Bondowoso Regency, East Java. The research time was held from June to August 2018.

3.3 Data Collection Method

Data collected consist of primary and secondary data. Primary data were obtained by conducting field observations, interviews and distributing questionnaires to respondents. The technique used in taking respondents in this research was purposive sampling method by determining or deliberately choosing the example to be studied. Respondents in this research consisted of experts related to the agro-industry sector both from the internal government and from external parties as many as 15 respondents which included 3 people of Agriculture Department, 4 people of Industry and Trade Department, 5 practitioners, and 3 academicians. Secondary data was gained from library searching and department documents/ related institutions. Secondary data involved the statistical data from the Central Bureau of Statistics of Bondowoso Regency and other sources of literature relevant to the research topic.

3.4 Data Analysis Methods

The collected data was analyzed according to the research objectives to be achieved. The tools to help analyze and process the data were MS-Excel and Expert Choice 2000 programs.

To find out the development prospects of an area which was based on the comparative of the best potential, identifying the best commodity of basic and non-basic sectors using the LQ method was used. This approach was a comparison between the functions of relative production / range of commodity area at the regional level with the function of relative production / range of commodity area at a larger level. This can be formulated as follows:

$$LQ_{ij} = \frac{X_{ij}/X_i}{X_{.j}/X_{..}}$$

Where:

LQ_{ij} : Quosien index of commodity location i in Bondowoso District

X_{ij} : Total area size / commodity production i in the District to Bondowoso Regency

$X_{i.}$: Total area size / total production of all commodities throughout Bondowoso Regency

$X_{.j}$: Total area size / total commodity production j in East Java Province

$X_{..}$: Total area size / total commodity production in East Java Province

Assessment criteria in determining the basis and non-basis degree sizes depended when the LQ value is greater than one ($LQ > 1$), the commodity belonged to basis commodity. Whereas if the value is equal to or smaller than one ($LQ < 1$) means the commodity is included in non-basis commodity [10].

Multi criteria decision making from a problem that had n alternatives and m criteria. Each alternative was evaluated according to m criteria. All values / ranks assigned to alternatives with respect to the decision matrix denoted by the criteria weighting vector and fulfilling [1].

4. Results And Discussion

4.1 Analysis of Determination of Cassava-Based Agroindustry Potential Areas

In applying LQ method for the productivity of cassava plants, each unit was used for harvest area (ha) and the amount of productivity. LQ results which based on harvest area aspect could meet the best criteria of the offer, since the harvest area was the result of the corresponding growth of plants with agroecological conditions which implicitly included elements (variables) of climate, physiography and soil type.

Table1 Static LQ districts in Bondowoso Regency

No.	Distric	Static LQ
1	Wringin	3,56
2	Curahdami	2,12
3	Taman Krocok	2,02
4	Tegalampel	1,44
5	Prajejan	1,42
6	Botolinggo	1,33
7	Cermee	1,26
8	Binakal	0,87
9	Klabang	0,81
10	Jambesari DS	0,78
11	Sumber wringin	0,40
12	Tamanan	0,32
13	Grujugan	0,20
14	Pujer	0,09
15	Bondowoso	0,08
16	Sempol	0,07
17	Pakem	0,04
18	Sukosari	0,04
19	Maesan	0,03
20	Telogosari	0,00
21	Tapen	0,00
22	Wonosari	0,00
23	Tenggarang	0,00

In the application of LQ towards the acquisition of areas that could be developed into cassava-based agroindustry areas based on aspects of harvested area, it was defined that LQ was the ratio

between the relative share (share) of harvested area of cassava commodity at the regional level to the total area of harvested area of the sub-sector with a relatively broad share the harvest area of cassava at the national level against the total area of the national budget subsector. Through the above approach, it could be observed of which districts could be developed to become a cassava-based agroindustry area in Bondowoso Regency (Table 1).

From Table 1 it can be seen that there are 7 districts in Bondowoso Regency could be developed into cassava-based agroindustry areas. These seven districts were Wringin district, Curahdami district, Krocok Park District, Tegal Ampel District, Pradjekan district, Botolinggo District, and Cermee District. Those district was chosen because the value of LQ was above 1, according to [3] LQ analysis is used to determine the commodities of the food crops sub-sector which has comparative advantages, with LQ criteria > 1 . Furthermore, the kind of superior commodity analysis in order to be developed in the cassava-based agroindustry region was decided using the MCDM method.

4.2 Analysis of Determination of Cassava-based superiority Commodity in Bondowoso Regency

Determination the weight of decision's factors of agro-industry area was done by TOPSIS MCDM analyzing tool using Microsoft Excel. In this case there were several assessments that would be done by considering the values against the criteria. Alternatives in this case are cassava-based agroindustry in Bondowoso regency, namely: tapioca, MOCAF, chips, and tape and its processed.

There were several criteria used as design materials, namely market potential (C1), raw material (C2), additional value (C3), labor (C4), technology (C5), social culture (C6), and environmental impact (C7). Furthermore, these criteria would be used as factors to determine the superior products. The weight was a criterion that ought to exist in determining the decision to decide the superior product. The weighting values of each criterion are shown in table 3. Here was the decision making process with MCDM-TOPSIS:

- a. Giving the value of each alternative (A_i) on each criterion (C_j) that had been determined, where the value was obtained based on the value of crisp, $i = 1, 2, \dots, m$ and $j = 1, 2, \dots, n$.

Table 2. Value of Each Alternative

Alternative	C1	C2	C3	C4	C5	C6	C7
Tape	94	60	96	96	82	96	96
Keripik	102	54	70	102	88	104	104
Tapioka	94	58	70	98	78	102	82
Mocaf	86	56	62	78	78	102	78

- b. Giving the weight value (W) on table 3.

Tabel 3. The Weight Value of Criteria

Criteria	Weight
C1	market potential
C2	raw material
C3	add value
C4	labour
C5	technology
C6	socio-cultural
C7	environmental impact

- c. Normalizing the matrix by calculating the normalized performance rating value (r_{ij}) of the alternative A_i on the C_j attribute. The normalization process of attributes to form a normalized

matrix (R) and the multiplication between the weights with the value of each attribute to form a V matrix.

Table 4. VMatrix

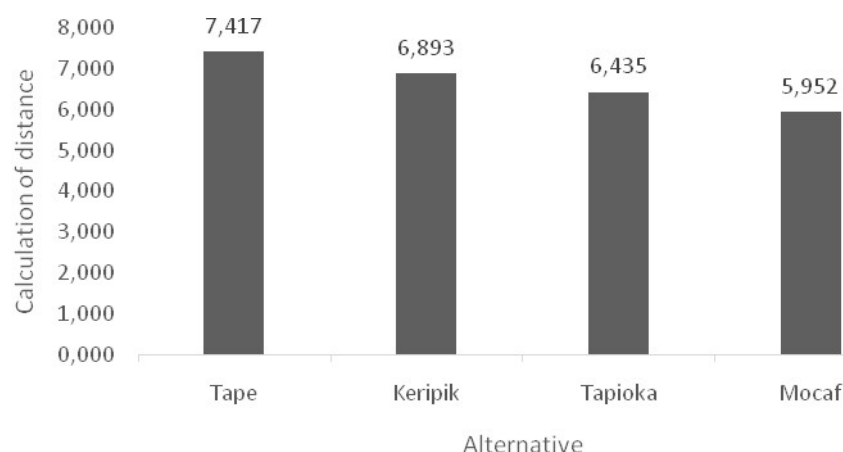
Alternative	C1	C2	C3	C4	C5	C6	C7
Tape	1,353	0,688	1,162	1,162	0,825	1,113	1,113
Keripik	1,356	0,572	0,782	1,140	0,818	1,113	1,113
Tapioka	1,249	0,614	0,782	1,095	0,725	1,092	0,878
Mocaf	1,143	0,593	0,693	0,872	0,725	1,092	0,835

- d. Determining of positive ideal solutions and negative ideal solutions by using the value of matrix V. Positive ideal solutions were obtained by selecting the largest value from each criterion of all alternatives. On the contrary, a positive ideal solution was obtained by selecting the smallest value from each criterion of all alternatives.

Table 5. Ideal Solutions

Alternative	C1	C2	C3	C4	C5	C6	C7
A+	1,353	0,688	1,162	1,162	0,825	1,113	1,113
A-	1,143	0,593	0,693	0,872	0,725	1,092	0,835

- e. Distance Determining considering the ideal solutions and preferences of each alternative. The value of the decision matrix and the ideal solution were used to determine the distance between the values of each alternative with the positive ideal solution and the negative ideal solution. Calculation of distance. The chosen alternative is an alternative that has the shortest distance from the positive ideal solution and the farthest distance from the negative ideal solution.



Picture 4.1 Alternative Ranking Results

Based on the value of the distance calculation for each alternative, the shortest distance from the positive ideal solution was cassava and processed tape, the farthest distance from the negative ideal solution was MOCAF product. So it can be concluded that the best product proposed to Bondowoso Regency government to be given the impetus to advance its agro-industry was tape and its processing.

5. CONCLUSION

Based on calculation results using TOPSIS LQ and MCDM method, it can be concluded that Bondowoso District could develop cassava-based agroindustry by forming a cluster in seven districts that are Wingin District, Curahdami District, Krocok District, Tegal Ampel District, Pradjekan District, Botolinggo District, and Cerme District. While the best products were in the form of tape and its processed.

ACKNOWLEDGEMENTS

This paper is dedicated to kemenristekdikti. This paper is part of the 2018 Higher Education grant applied research.

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