

Determination of Leading Commodities and Its Development Area in Sigi District Central Sulawesi

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Abstract. The development of leading commodities in a region must be based on its potential and development opportunities. Various benchmarks can be used as a basis for determining the leading commodities includes Location Quotient (LQ). The study aims to determine the potential leading commodities and its development area in Sigi District. The research was conducted in November 2020-Februari 2021. The data collected were primary and secondary data, which secondary data was in the form of harvested areas time series of agricultural commodities in the 2013-2018 periods. Moreover, primary data was collected through Focus Group Discussion and interview using questionnaire. The leading commodities were analyzed using the LQ while the area development of leading commodities was determined by Technique for Others Preference by Similarity to Ideal Solution (TOPSIS). Criteria for TOPSIS included agroecosystems, water availability, infrastructure, human resource, and support-systems. Based on Location Quotient, the annual commodities of corn, groundnut, green beans, cassava, shallot, Chinese cabbage, tomato and perennial commodities namely clove, nutmeg, coffee, candlenut, cocoa, and vanilla were classified as leading commodities in Sigi District. The potential development area model for shallot is Oloboju Village, Biromaru Sub-District while the potential development area model for corn is Pesaku Village, Dolo Barat Sub-District.

1 Introduction

Agricultural development nowadays is based on potential and superior commodities of a local area. Every region has their respective superior commodities, depending on the available resources. According to [1], leading commodities are commodities which suitable for local agro ecology and also have competitiveness, both in the regional market itself, and also in other areas of the national scope, as well as in the international market.

Agricultural development in one area needs a leading commodities determination as the earliest step [2]. This step should be considered on the efficiency to achieve comparative and competitive advantage as global trade preparation. The efficiency should be placed in

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the both demand and supply side. On the supply side, the most significant factor is the superiority biophysical, technological, and socio-economic conditions in a specific region [3,4].

Determination of a commodity as regional superior commodities must be altered with the forced of its natural resources and human resources. A commodity will be selected as regional leading commodity whether it has high productivity and provide added value which has a positive impact on public welfare[5]. Determination of regional superior commodities must consider also to the contribution to the economic growth and equitable development aspect in those area. Since agriculture is the main source of income, Sigi District Government needs a study to determine the leading commodities as base consideration for making a road map of agricultural development and deciding the priority programs.

2 Methodology

The study aims to determine the potential leading commodities and its development area in Sigi District. The research was conducted in November 2020-Februari 2021. The data were primary and secondary data, which secondary data was in the form of harvested areas time series of agricultural commodities in the 2013-2018 periods. It taken from Sigi Centrak Statistics Agency. Primary data was collected through Focus Group Discussion and interview using questionnaire to 60 respondents.

2.1 Leading Commodities Identification

LQ analysis is used to determine commodities that have a comparative advantage, with LQ criteria > 1 . Operationally, the LQ formulation can be formulated as follows [6]:

$$LQ = \frac{p_i/p_t}{P_i/P_t} \quad (1)$$

With;

p_i = harvested area of commodity i in sub-district level; p_t = total of harvested area of all commodities *in* sub-district level;

P_i = harvested area of commodity i in district level; P_t = total of harvested area of all commodities *in* district level

The commodities were classified in the annual and perennial commodity.

Conditions apply, that if [5]

$LQ > 1$: the commodity becomes base or become a source of growth. Commodities have a comparative advantage; the results can not only meet the needs in the area concerned but also can be exported outside the region.

$LQ = 1$: the commodity belongs to non-base, has no comparative advantage. The production is only enough for meet the needs of their own region and unable to export.

$LQ < 1$: the commodity include to non-base. Production of commodities in an area cannot meet own needs so need supply or import from outside.

2.2 Technique for Others Preference by Similarity to Ideal Solution (TOPSIS)

The Technique for Others Preference by Similarity to Ideal Solution was applied to determine the area development area of the leading commodity.

The Stages of TOPSIS Method [7]:

1. Determine the criteria

The criteria which will be used as references in making decisions are C_i and its nature. The criteria were shown in Table 1.

Table1. Criteria as references for commodity development in Sigi District

No	Criteria	Range of criteria
1	agro ecosystem	very suitable – very inappropriate
2	water availability	very available – very unavailable
3	infrastructure	very good – not very good
4	human resource	very active – very inactive
5	support system	very supportive – very unsupportive

2. Determine the compatibility rating

The rating of alternatives should be suitable with each criterion.

3. Creating a normalized decision matrix

TOPSIS requires a performance rating of each alternative A_i on each of the normalized C_j criteria, namely r_{ij} with formula:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}} \tag{2}$$

4. Multiplying the weight with the value of each attribute

This multiplication to form the Y matrix can be determined based on the normalized weight ranking (y_{ij}) as follows:

$$Y_{ij} = w_i r_{ij} \tag{3}$$

With $i=1, 2 \dots m$ and $j=1, 2 \dots n$

5. Determine the positive ideal solution matrix and the negative ideal solution matrix

6. Determine the distance between the value of each alternative and the positive and negative ideal solution matrix

The distance between alternative A_i and the positive ideal solution is formulated as:

$$D_i^+ = \sqrt{\sum_{j=1}^n (y_i^+ - y_{ij})^2} \tag{4}$$

The distance between alternative A_i and the negative ideal solution is formulated as:

$$D_i^- = \sqrt{\sum_{j=1}^n (y_{ij} - y_i^-)^2} \tag{5}$$

7. Determine the preference value for each alternative. The preference value for each alternative (RC^+) is given as:

$$RC^+ = \frac{D_i^-}{D_i^- + D_i^+} \tag{6}$$

A_i with the highest RC^+ value indicates that the alternative A_i is preferred.

3 Result and Discussion

3.1 Leading commodities in Sigi District

The LQ commodities were calculated in all commodities which developed in Sigi District. Those were classified in two group namely annual and perennial commodity. Annual commodities which have LQ more than one are have potential as leading commodities.

Table 2. Location Quotient (LQ) annual commodity in Sigi District, 2021

No	Name of commodity	Location Quotient (LQ)
1	corn	1.35
2	groundnuts	1.45
3	green beans	2.54
4	cassava	1.88
5	shallot	1.38
6	Chinese cabbage	2.76
7	tomato	1.39

There are thirteen commodities which have LQ more than one consists of annual and perennial commodities. These commodities are as base commodities which have superior comparative advantage. Its become superior commodities in certain zones because they are produced in an effective and efficient manner. It were supported by natural resources and in accordance with agro ecological zones, so that they have competitiveness, both in quantity and quality. The perennial commodities have big opportunity to be fast-growing commodity such as cocoa and coffee [8]

Table 3. Location Quotient (LQ) perennial commodity in Sigi District, 2021

No	Name of commodity	Location Quotient
1	clove	1.38
2	nutmeg	1.12
3	coffee	1.03
4	candlenut	2.03
5	cocoa	1.50
6	vanilla	1.09

The potency of the commodities accordance with the criteria for the leading commodities in this study, namely: 1) meeting the criteria for LQ value > 1 (having a comparative advantage) [9]. For fruit commodities, there was a research already done and the results showed that the main commodities in Sigi Regency were avocado, jackfruit, pineapple, papaya, *rambutan*, and guava [10].

The main objective of LQ determination is to give recommendation to the government in prioritizing kind of commodity so that the growth of agricultural can be optimal. These recommendation also important to enlarger the commodity development by focusing on superior commodities in each area. It considering mostly on demand aspects such as the resources and the quality. In general, the development of the commodity is to increase the farmer and community's welfare especially the poors [3][11]. Some commodities are potential as leading commodities in Sigi District but the development of the commodities are not balance with its potential [12]. The process of economic development does not happened by itself, but requires various efforts from various parties [13]. Furthermore, the development of the agricultural sector must be followed by focusing attention to the market and post harvest process also by adding the value of commodities to increase incomes [14].

The increasing of income will direct the the market of agricultural products and stimulate the related industries [15].

The sustainability of leading commodities need to be maintained in order to be competitive in a wider market. I needs some necessary activities such as: 1. Increase agricultural production and and product’s quality; 2. Develop entrepreneurial spirit for farmers; 3. Develop of an agribusiness partnership network; 4. Create a conducive investment climate in agribusiness[16].

From those potential leading commodities in Table 2, Sigi Government chooses two of its which also as strategic commodities namely shallot and corn as a development model and choosing those development area. Among of all sub-districts in Sigi, the highest LQ for shallot is Sigi Biromaru Sub-district, while the highest LQ for corn is Dolo Barat Sub-District. Both sub-districts become a model for the commodity development area for corn and shallot. The next step was determination of village name which a development program will take a place.

3.2 The commodity development area determination

The study used the TOPSIS (Technique for Order Preference by Similarity to the Ideal Solution) to select the alternative areas development of commodity which nearest to the most positive alternative and farthest from the most negative option. The TOPSIS method is based on facts or characteristics which were built by the decision maker, the numerical data; and the the solution. The purposes are to evaluate, to prioritize, and to select the subjective inputs by its weights[7].

3.2.1 The determination of shallot development area

The result of TOPSIS for determining shallot development area is shown in Table 4.

Table 4. TOPSIS Analysis for Shallot Development Area in Sigi District, 2021

Alternatif	C1	C2	C3	C4	C5	D+	D-	RC+	RANK
Bora	0.030	0.027	0.027	0.027	0.060	0.220	0.001	0.003	11
Jono Oge	0.121	0.081	0.027	0.106	0.090	0.129	0.135	0.512	6
Kaluku Bula	0.060	0.054	0.106	0.080	0.090	0.133	0.108	0.448	7
Lolu	0.060	0.054	0.080	0.106	0.090	0.138	0.108	0.438	9
Loru	0.060	0.054	0.080	0.080	0.060	0.150	0.085	0.361	10
Maranatha	0.060	0.054	0.080	0.080	0.060	0.150	0.085	0.361	10
Mpanau	0.060	0.054	0.080	0.080	0.060	0.150	0.085	0.361	10
Ngatabaru	0.060	0.054	0.080	0.080	0.060	0.150	0.085	0.361	10
Oloboju	0.151	0.134	0.133	0.106	0.120	0.003	0.217	0.987	1
Pombewe	0.121	0.107	0.106	0.080	0.090	0.065	0.157	0.707	2
Sidera	0.060	0.134	0.106	0.106	0.090	0.101	0.161	0.614	4
Sidondo 1	0.060	0.081	0.080	0.080	0.090	0.127	0.101	0.443	8
Sidondo 2	0.060	0.081	0.080	0.080	0.090	0.127	0.101	0.443	8
Sidondo 3	0.060	0.081	0.080	0.080	0.090	0.127	0.101	0.443	8
Sidondo 4	0.060	0.081	0.080	0.080	0.090	0.127	0.101	0.443	8
Solove	0.121	0.081	0.080	0.080	0.090	0.093	0.132	0.587	5
Watunonju	0.121	0.134	0.080	0.080	0.090	0.075	0.162	0.682	3

TOPSIS is a compensatory method also. These kinds of method allow the compromise between different criteria, where a bad result in one criterion can be compensated by a good

result in another criterion. An assumption of TOPSIS method is that each criterion has either a monotonically increasing or decreasing preference [17]. The use of TOPSIS method on decision making is it can assist the managerial in obtaining competent candidates [18]. These was similar with the purpose of selecting a village among other alternatives. The Oloboju village get the highest RC+ and the number one in rank which means that this village fit to all criteria or whether one criteria might not fit, other criteria compensated it. The Oloboju village is the most competent candidate area.

3.2.2 The determination of corn development area

Corn as the second commodity is not only as one of national strategic commodity, but also has big potency in Sigi district. The needs of corn for feed industries is increasing by the time as the increasing of human population. Therefore, corn is chosen as one commodity to be development in spite of its potency based on the LQ. The result of TOPSIS for decided in development area of corn is shown in Table 5.

Table 5. TOPSIS Analysis for Corn Development Area in Sigi District, 2021

Alternatif	C1	C2	C3	C4	C5	D+	D-	RC+	RANK
Balamoa	0.066	0.064	0.060	0.060	0.074	0.190	0.055	0.224	12
Balaroa pewunu	0.131	0.095	0.030	0.119	0.111	0.145	0.137	0.484	6
Balumpewa	0.066	0.064	0.121	0.089	0.111	0.148	0.112	0.431	7
Bobo	0.066	0.064	0.091	0.119	0.111	0.154	0.103	0.401	8
Kaleke	0.131	0.127	0.091	0.089	0.074	0.110	0.153	0.582	5
Kaluku tinggu	0.033	0.064	0.091	0.089	0.074	0.191	0.075	0.281	10
Luku	0.066	0.064	0.060	0.089	0.074	0.183	0.062	0.255	11
Mantikole	0.066	0.032	0.091	0.089	0.074	0.189	0.075	0.284	9
Pesaku	0.164	0.159	0.151	0.119	0.148	0.000	0.239	1.000	1
Rarampadende	0.131	0.127	0.121	0.089	0.111	0.072	0.171	0.702	2
Pewunu	0.066	0.159	0.121	0.119	0.111	0.109	0.174	0.615	4
Sibonu	0.131	0.095	0.121	0.119	0.111	0.086	0.164	0.656	3

This method requires ranking and weighting criteria. These are important to determine the best ideal solution [19]. The results of the process of implementing the TOPSIS method can sort the alternatives from the greatest value to the best value. Based on the research conducted, it can be concluded that multiple criteria decision making has been successfully applied in the selection of candidates using the TOPSIS methods [20]. Pesaku village get the highest score of RC+ means that this village is the most competent candidate to be place of corn development area.

The development area need to fulfilled the criteria because its important as capital of the development itself. For example is the condition of road infrastructure which needs to be in good condition so that can be easier to be passed by transportation mode. With the availability of a good road infrastructure, the marketing cost of farms product will be lower and more efficient. Moreover, the production level is mosly determined by the potential and availability of land resources including soil and climate. The role of land resources in increasing productivity could be higher through intensification or expansion and good management [21]. The availability of land area which suitable with commodity's need is one of significant variable. It will reflected to the productivity. Water availability also as important as the climate itself, thus irrigation is one requirement in developing a commodity [22]. Furthermore, human resources also important as the main actors who manage manage the production factors to get optimal productivity [23].

4 Conclusions and Recommendation

4.1 Conclusion

Based on Location Quotient, the annual commodities of corn, groundnut, green beans, cassava, shallot, Chinese cabbage, tomato, while perennial commodities namely clove, nutmeg, coffee, candlenut, cocoa, and vanilla were classified as potential leading commodities in Sigi District. The potential development area model for shallot is Oloboju Village, Biromaru Sub-District while the potential development area model for corn is Pesaku Village, Dolo Barat Sub-District.

4.2 Recommendation

The superiority of the leading commodities based on LQ reflected its superiority from supply side; therefore, it's better to continue by a study in demand side also. The TOPSIS method could be implemented to select the larger area development

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