Identifying sustainable agricultural commodities in Wajo regency

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Abstract. This research was conducted to identify leading commodities in the three agricultural subsectors, which are plantations, fruits, and horticulture, cultivated by the local people within Wajo Regency. The research method used is Location Quotient (LQ) with criteria for the harvested area, numbers of trees, production quantity, and production value. Secondary data are used in the study and obtained from Wajo in Figures years of 2010 – 2014, Indonesia Statistics years of 2010-2014, South Sulawesi Agriculture Statistics, Regional Development in Figures years of 2010-2014, Agriculture Produce Prices, 2010-2014, Annual Statistic of Indonesian Fruits and Vegetables, and survei. The research shows that, of fourteen plantation commodities, there are four leading commodities generating a competitive advantage, namely cloves, cacao, coconut, and cotton. For fruit plants, of there are eighteen types of fruits cultivated by the local people, of which only four are leading commodities that are sapodilla, durian, banana, and pineapple. With respect to horticultural crops, of thirteen commodities, six of them generate competitive advantage, namely elongated beans, cayenne peppers, eggplants, watermelons, spinach, and cucumbers.

1. Introduction
The study is inspired by the differences in resources, potency, and uniqueness possessed by each region when developed could increase productivity and competitiveness, which is, in turn, to affect the local growth and the welfare of farmers. To the date, however, the local government of Wajo did not have accurate information about potential commodities that have a competitive relative to other regions within the South Sulawesi Province so that the government did not have a structured effort to develop commodities that are potential and could provide a sustainable competitive advantage. The absence of information on leading commodities could also lead to waste of extension activities and services conducted by the local and national government, waste of budget, and even a decline in investment interest from the private sector [1]. This also makes that commodities that were developed over time cannot compete with the same commodities cultivated by other regions even though technological innovation applied, but it could not effectively increase productivity up to a competitive level due to the fact that agriculture commodity depends upon climate condition [2] the impact of land conflict on agriculture [3] and less role of banking institution [4].

In a region, there are a number of commodities produced, but not all of these commodities can be developed in a sustainable manner which can be caused, including the number of levels of productivity and the amount of production that is low compared to other regions. The unavailability of...
evaluations in terms of production and productivity at the provincial level makes the various policies produced less effective.

It is also important that clear information of potential commodities, in terms of geographical areas [5], types of commodities [6], or efficient in terms of technological and socio-economical aspects [7], can further stimulate public interest and attract private sectors to take part in investment in driving higher regional growth [8]. In other words, the identification of strategic commodities and leading sectors can direct both local government and investors to accurately assess various investment opportunity information cross-sectoral. In addition, local government policies to improve the community can be more targeted and consistent.

Differently, with no information on potential commodities, the choice commodities to cultivate by the people and local government may depend upon the decision of global trade, price trades, and the household who control food and income [9]. This condition does not consider suitability with natural resources so that it could be very likely not competitive in the future when the commodities are cultivated by other regions that have the nature of advantage [10].

Furthermore, the availability of potential commodities' information could encourage the creation of cooperation [10,11] between regions because of the need by other regions, either similar commodities or those commodities that have connections within a value chain. This will certainly encourage the growth of cross-border value chain policies and expand economies of scale. It is therefore that the study examines an overview of potential commodities that should develop to leverage the competitiveness of the region by focusing on the development of sustainable commodities.

2. Method

Location Quotient is an index used to compare the commodity at Wajo Regency with other regencies in South Sulawesi Province. This method has been popular to analyze concentration of commodities to designate commodity basis or leading commodities [12–14]. The formula used is

\[ LQ = \frac{P_i / P_t}{P_i / P_t} \]  

Where, LQ is Location Quotient.

\( P_t \) = Production (harvested areas/production quantity/production value/numbers of trees) of commodity i at the district level.

\( P_t \) = Production (harvested areas/production quantity/production value/numbers of trees) of all commodity j at the district level.

\( P_i \) = Production (harvested areas/production quantity/production value/numbers of trees) of commodity I at Wajo.

\( P_t \) = Production (harvested areas/production quantity/production value/numbers of trees) of commodity crops j at Wajo.

LQ > 1 indicates that there is a relative concentration in one region compared to the whole region. This means that commodity i in a region is a base sector or in that region has a comparative advantage. LQ = 1 is a non-base sector, meaning that commodity i in one region does not have a comparative advantage. The production of commodities produced is only sufficient to meet their own needs in the region. LQ < 1. is a non-base sector, meaning that commodity i in a region does not have a comparative advantage, commodity production i in that region cannot meet its own needs and must obtain supplies from outside the region.
3. Findings
3.1. Plantation Crops

The findings indicate that there were fourteen plantation commodities cultivated by the people within Wajo Regency. Four of them can be categorized as leading commodities indicating by their average LQ scores more than one. Those four commodities are coconut, clove, cocoa, and cotton. Interestingly, when measured by the production value, the score of LQ is less than 1 for coconut and cocoa. This was due to the low LQ score booked in 2011 affecting the total average score of those two commodities.

To candlenut, despite having an LQ score of more than 1, this commodity was cultivated by people only until 2011. It is therefore that the commodity was dropped out as a leading commodity. The findings result that there were two leading commodities indicated by their highest scores of LQ, which are clove and cotton. With respect to cloves, the commodity is only found in certain areas due to the fact that this commodity can only be planted in certain areas, that are found in two sub-districts within Wajo regency, and only one sub-district indicating as a leading commodity relative to other sub-districts.

Table 1. The Trend of Location Quotient Score in Plantation Plants Within Wajo Regency (Harvest Area, Production Quantity and Production Value).

| No | Commodity   | Lq Score By Years | Average Lq Score |
|----|-------------|-------------------|------------------|
|    |             | 2010  | 2011  | 2012  | 2013  | 2014  |                   |
| 1  | Coconut     | Harvest Area Production Area | 1.21  | 1.18  | 1.23  | 1.17  | 1.32  | 1.22  |
|    |             | Production Quantity | 1.90  | 0.81  | 1.41  | 1.21  | 1.06  | 1.19  |
|    |             | Production Value    | 1.89  | 0.76  | 1.11  | 0.84  | 0.74  | 0.98  |
|    |             | Harvest Area Production Quantity | 1.79  | 1.36  | 0.76  | 0.85  | 0.73  |       |
| 2  | Hybrid Coconut | Harvest Area Production Area | 0.92  | 0.23  | 0.31  | 0.24  | 0.19  | 0.30  |
|    |             | Production Quantity | 0.92  | 0.21  | 0.24  | 0.16  | 0.14  | 0.25  |
|    |             | Production Value    | 0.04  | 0.03  | 0.03  | 0.03  | 0.04  | 0.03  |
| 3  | Robusta Coffee | Harvest Area Production Area | 0.01  | 0.02  | 0.00  | 0.03  | 0.03  | 0.02  |
|    |             | Production Quantity | 0.01  | 0.02  | 0.00  | 0.02  | 0.02  | 0.02  |
|    |             | Production Value    | 1.81  | 1.68  | 1.64  | 1.45  | 1.63  | 1.64  |
| 4  | Clove       | Harvest Area Production Area | 0.81  | 19.88 | 3.02  | 1.59  | 1.40  | 5.49  |
|    |             | Production Quantity | 0.80  | 18.79 | 2.36  | 1.10  | 0.98  | 4.51  |
|    |             | Production Value    | 1.06  | 1.15  | 1.08  | 1.09  | 1.24  | 1.12  |
| 5  | Cocoa       | Harvest Area Production Area | 1.13  | 0.43  | 1.33  | 1.62  | 1.60  | 1.11  |
|    |             | Production Quantity | 1.12  | 0.41  | 1.04  | 1.12  | 1.12  | 0.91  |
|    |             | Production Value    | 1.20  | 1.16  | 1.22  | 1.17  | 1.31  | 1.21  |
| 6  | Cashew      | Harvest Area Production Area | 1.02  | 0.42  | 0.91  | 0.96  | 0.85  | 0.77  |
|    |             | Production Quantity | 1.02  | 0.39  | 0.71  | 0.67  | 0.59  | 0.64  |
|                      | Harvest Area | Production Quantity | Production Value | Harvest Area | Production Quantity | Production Value | Harvest Area | Production Quantity | Production Value |
|----------------------|--------------|---------------------|------------------|--------------|---------------------|------------------|--------------|---------------------|------------------|
| Pepper               | 0.47         | 0.47                | 0.49             | 0.44         | 0.45                | 0.46             | 0.23         | 0.32                | 0.48             | 0.38             | 0.32             | 0.18             | 0.28             |
| Nutmeg               | 0.20         | 0.45                | 0.88             | 1.05         | 0.87                | 0.87             | 0.85         | 0.76                | 0.00             | 0.00             | 0.00             | 0.00             | 0.00             | 1.98             |
| Candlenut            | 0.00         | 0.00                | 0.00             | 0.00         | 0.00                | 0.00             | 0.00         | 0.00                | 0.00             | 0.00             | 0.00             | 0.00             | 0.00             | 1.10             |
| Kapok                | 0.00         | 0.00                | 0.00             | 0.00         | 0.00                | 0.00             | 0.00         | 0.00                | 0.00             | 0.00             | 0.00             | 0.00             | 0.00             | 0.77             |
| Vanilla              | 0.88         | 1.03                | 1.72             | 0.30         | 0.22                | 0.81             | 0.00         | 0.08                | 0.20             | 0.27             | 0.21             | 0.15             | 0.00             | 0.00             |
| Cane                 | 0.00         | 0.07                | 0.11             | 0.20         | 0.88                | 0.30             | 0.00         | 0.06                | 0.09             | 0.14             | 0.62             | 0.25             | 0.00             | 0.00             |
| Folk Tobacco         | 0.00         | 0.50                | 0.28             | 0.07         | 0.18                | 0.28             | 0.00         | 0.32                | 0.20             | 0.10             | 0.24             | 0.16             | 0.00             | 0.00             |
| Tobacco              | 0.00         | 0.47                | 0.22             | 0.05         | 0.13                | 0.23             | 2.11         | 2.43                | 1.52             | 1.41             | 0.00             | 1.47             | 0.00             | 0.00             |
| Tobacco              | 2.49         | 19.96               | 2.21             | 3.04         | 0.00                | 7.51             | 3.72         | 28.31               | 2.60             | 3.15             | 0.00             | 9.25             |

Source: (1) Calculated from Wajo in Figures Years of 2010 – 2015
(2) Calculated from Indonesia Statistic Years of 2010 – 2014
(3) Calculated from South Sulawesi Agriculture Statistics Years of 2012 – 2014
(4) Calculated from Regional Development in Figures Years of 2010 – 2014
(5) Calculated from Agriculture Producer Prices Years of 2014

3.2. Fruit plants
The people of Wajo generally cultivate various types of fruits, but there are 18 types of fruit plants that are mostly cultivated in this region. Those fruit plants include advocate, mango, rambutan, duku/lanzones, pomelo, tangerine, durian, guava, water guava, sapodilla, papaya, banana, pineapple,
sallaca, jackfruit, breadfruit, and starfruit. Of these, four commodities were categorized as leading commodities due to their average LQ scores, which are sapodilla, banana, durian, pineapple.

To pineapple, although its LQ score measured by numbers of tree numbers booked a low score (less than 1), this commodity is still considered to be potential because production quantity of pineapple and its market value are relatively higher and promising indicated by its LQ score showing more than 1 in 2014. It is also supported by the highest average LQ score than of other fruits when measured by the production quantity and harvest area.

Table 2. The trend of location quotient in fruit plants within wajo regency (numbers of trees, production quantity and production value).

| Commodity                     | Lq Score By Years | Average Lq Score |
|-------------------------------|-------------------|------------------|
|                              | 2010  | 2011  | 2012  | 2013  | 2014  |          |
| Advocate                     | Harvest Area Trees | 0.05  | 0.01  | 0.01  | 0.02  | 0.31  | 0.16  |
|                              | Production Value  | 0.03  | 0.02  | 0.01  | 0.02  | 0.04  | 0.02  |
|                              | Harvest Area Trees | 0.05  | 0.02  | 0.02  | 0.03  | 0.21  | 0.14  |
| Mango                        | Harves Area Trees | 3.74  | 1.97  | 0.58  | 3.17  | 0.90  | 1.85  |
|                              | Production Value  | 0.27  | 1.76  | 0.55  | 0.07  | 3.61  | 0.77  |
| Rambutan                     | Harvest Area Trees | 6.21  | 4.56  | 0.45  | 5.28  | 0.81  | 2.33  |
|                              | Production Value  | 0.24  | 0.17  | 0.38  | 0.03  | 0.90  | 0.19  |
|                              | Harvest Area Trees | 0.60  | 1.51  | 0.92  | 1.70  | 0.04  | 1.02  |
| Duku / Lanzones              | Harvest Area Trees | 0.30  | 0.31  | 0.82  | 0.03  | 0.85  | 0.24  |
|                              | Production Value  | 0.10  | 1.01  | 8.91  | 0.19  | 1.16  | 1.51  |
| Tangerines                   | Harvest Area Trees | 2.68  | 1.88  | 0.80  | 0.83  | 3.40  | 1.76  |
|                              | Production Value  | 0.06  | 1.56  | 19.89 | 0.39  | 0.62  | 1.78  |
| Pomelo                       | Harvest Area Trees | 0.15  | 0.06  | 0.19  | 0.32  | 0.04  | 0.11  |
|                              | Production Value  | 0.96  | 0.52  | 0.27  | 0.94  | 0.17  | 0.56  |
| Durian                       | Harvest Area Trees | 0.05  | 0.16  | 0.48  | 0.31  | 0.03  | 0.10  |
|                              | Production Value  | 1.22  | 0.04  | 0.55  | 0.05  | 0.03  | 0.15  |
|                              | Harvest Area Trees | 0.71  | 0.45  | 0.20  | 0.32  | 0.39  | 0.41  |
|                              | Production Value  | 2.04  | 0.03  | 1.14  | 0.04  | 0.03  | 0.18  |
|                              | Harvest Area Trees | 0.13  | 1.31  | 1.36  | 0.46  | 1.63  | 1.33  |
|                              | Production Value  | 1.57  | 0.97  | 1.97  | 0.82  | 4.11  | 1.71  |
|                              | Harvest Area Trees | 0.20  | 1.90  | 1.28  | 0.72  | 1.71  | 1.58  |
Apart from these four commodities, there are also a number of fruit plants that can be considered to become leading commodities. Those fruits are papaya, breadfruit, and guava. The last two mentioned, breadfruit and guava, booked LQ score greater than one (LQ>1) on average when measured by harvest area and production value, while a low LQ score recorded in numbers of trees only. Differently, papaya showed a score of LQ close to 1 on harvest area, and other measurements, numbers of trees and production value recorded an LQ equal to one and more than one respectively. This findings are in line with the fact that papaya is good when cultivated in the lowland, like in Wajo at most of its sub-district.

**Table 3.** Continued the trend of location quotient in fruit plants within wajo regency (numbers of trees, production quantity and production value).

| Commodity | Lq Score By Years | Average Lq Score |
|-----------|-------------------|------------------|
|           | 2010  | 2011  | 2012  | 2013  | 2014  |         |
| Papaya    |        |        |        |        |        |         |
| Harvest Area | 0.22  | 0.25  | 0.52  | 0.45  | 1.26  | 0.95    |
| Numbers of Trees | 1.05  | 0.41  | 1.05  | 1.60  | 1.04  | 1.00    |
| Production Value | 0.33  | 0.39  | 0.68  | 0.60  | 1.20  | 1.73    |
| Harvest Area | 1.47  | 2.82  | 2.37  | 1.84  | 1.30  | 1.78    |
| Numbers of Trees | 2.30  | 1.40  | 2.07  | 1.94  | 0.36  | 1.71    |
| Production Value | 2.20  | 4.36  | 3.07  | 2.49  | 1.24  | 2.31    |
| Banana    |        |        |        |        |        |         |
| Harvest Area | 19.44 | 0.75  | 0.64  | 0.20  | 3.61  | 4.61    |
| Numbers of Trees | 0.97  | 0.52  | 0.36  | 0.40  | 0.62  | 0.54    |
| Production | 29.07 | 1.16  | 0.83  | 0.27  | 3.44  | 6.35    |
Horticultural plants

With respect to horticultural crops, there are eleven horticulture plants mostly cultivated by the local people. Those are elongated beans, large chilies, cayenne peppers, tomatoes, eggplants, cucumbers, chayote, water spinach, watermelons, mustard greens, and spinach.

With the use of the LQ score measured by harvested area, production, and production value for a period of five years, it was found that there are six types of potential commodities, namely elongated beans, cayenne peppers, eggplants, cucumbers, watermelons, and spinach. Viewed from the LQ trends of the six leading commodities, a number of commodities have recorded low scores in LQ, which are less than one (LQ <1). For example, the elongate bean has recorded an LQ score of less than one for harvest area indicator in the year 2010. This also occurred for spinach, cucumber and watermelon commodities. For spinach, the LQ score was very poor (LQ <1) in 2010 and 2011 and in 2014.

Table 4. The Trend of Location Quotient in Horticultural Plants Within Wajo Regency (Harvest Area, Production Quantity, and Production Value).

| Commodity | Lq Score By Years | Average Lq Score |
|-----------|-------------------|------------------|
|           | 2009  | 2010  | 2011  | 2012  | 2014  |       |
| Elongated | Harvest Area      | 2.16  | 1.16  | 3.02  | 2.66  | 1.60  | 1.92  |
| Vegetable    | Harvest Area | Production Quantity | Production Value |
|--------------|--------------|---------------------|------------------|
| Beans        | 3.08         | 1.46                | 0.83             |
| Big Chilli   | 4.94         | 3.64                | 2.08             |
| Cayenne Pepper | 4.94      | 5.08                | 2.90             |
| Tomato       | 2.62         | 1.24                | 0.71             |
| Eggplant     | 2.13         | 3.72                | 2.01             |
| Cucumber     | 2.01         | 3.53                | 2.02             |
| Chayote      | 0.68         | 0.03                | 0.01             |
| Swamp Cabbage | 0.64       | 3.83                | 0.00             |
| Watermelon   | 0.00         | 0.00                | 0.00             |
| Mustard Greens | 0.52       | 4.04                | 0.23             |
| Spinach      | 0.73         | 6.96                | 3.98             |

Source: (1) Calculated from Wajo in Figures Years of 2010 – 2015
(2) Calculated from Indonesia Statistic Years of 2010 – 2014
(3) Calculated from Annual Statistic of Indonesia Vegetables and Fruits Years of 2010 - 2014
With regards to watermelon, even though the LQ score was only recorded in the last two years (2013 and 2014) due to data availability, this commodity showed a sufficient LQ value to become a leading commodity. The highest LQ score measured by the three indicators was recorded by cayenne and watermelon. On average these two commodities obtained an LQ score of more than two points and even reached 10 points for watermelon. This score is consistent with the trend of the LQ score over a period of five years for cayenne pepper. It is also said the same for watermelon. This indicates that the regency is said to have competitiveness in cayenne and watermelon plants until to province level.

Although the LQ score shown leading commodities to six vegetable plants only, a number of potential vegetable commodities for development and possible to become potential commodities in the future. For example, mustard plants indicated an adequate LQ score for a whole, with the exception in 2014 to record a poor score. In addition to mustard plants, large chilli can also be considered to be a potential commodity since its score reached to more than 1 in 2010 to 2013, with the exception in 2014 only.

4. Conclusion
The local people of Wajo relies more on the agricultural sector as a leading sector, including in plantations, fruits, and horticulture. There are 14 crops mostly cultivated from plantations, 18 from fruit crops, and 13 from horticultural crops. With the use of Location Quotient (LQ), leading commodities in agricultural subsectors of plantations, fruits, and horticulture within the Wajo Regency are identified. Fourteen commodities are found potential and have a sustainable competitive advantage in future. Four of them are contributed from plantation crops which are cloves, cacao, coconut, and cotton. Other four of them are from fruits that are sapodilla, durian, banana, and pineapple. The rest of six crops are from horticulture comprising of elongated beans, cayenne peppers, eggplants, watermelons, spinach, and cucumbers.

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