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# The competitiveness of medicinal plants in Central Java Indonesia

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**Abstract.** Indonesia hold a potential opportunity to be a pharmaceutical production country. In the other side, Indonesia facing agriculture product and market competition internationally and domestically. Improving competitiveness of specific products are aimed to hit the export market and also to be able to compete with import products in domestic market. Considering Indonesian market opportunity, therefore we perform this study aiming to examine the competitiveness of medicinal plants in Central Java area. The basic method applied in this study was descriptive and data sources are primary and secondary data. Data were analyzed using Revealed Comparative Advantage (RCA) and Trade Specialization Index (TSI) approaches. According to the study, we reveal that medicinal plant commodities in Central Java province have average score 8.52, indicating a strong comparative advantage in global markets, while the commodities appear to have average score of 0.97 at 0 to 1 range, representing a strong competitiveness. Those results are attributed to natural and environmental condition, as well as high demand of global market. This competitiveness will encourage traditional/modern medicinal industries in global market.

## 1. Introduction

Indonesia is one of potential pharmaceutical manufacturing countries. It is home of 30.000 out of 40.000 medicinal plants in the world and has been developed to be one of the most extensive places of natural beauty care regimen in the world [1]. Various types of medicinal plants have been produced as raw materials of both modern and traditional medicine (herb). The large demand of medicinal plants results in tremendous trade from local to international scales [2]. The development of medicinal plant production is filled with bright prospects due to some factors such as flora, soil and climate conditions, the development of modern and traditional medicine industries, and the increasing of consumption and rising prices in medicinal commodities [3]. Out of 283 species of medicinal plants recommended by the Indonesia National Agency for Drug and Food Control, only 13 species were found have been intensively cultivated by the Indonesian people that are ginger (*jahe*), galangal (*lengkuas*), lesser galangal (*kencur*), turmeric (*kunyit*), bitter ginger (*lemuyang*), Javanese turmeric (*temulawak*), pink and blue ginger (*temu ireng*), Black Face General (*keji beling*), sweet grass (*dringo*), cardamom (*kapulaga*), fingerroot (*temukunci*), cheese fruit (*mengkudu*), and king of bitters (*sambiloto*). Table 1 showing production data of intensively-cultivated medicinal plants in Indonesia [4].



**Table 1.** The production of medicinal plants in Indonesia (2011-2015)

No	Commodity	Production Year (ton)			Growth		from 2014 to 2015 (%)
		2011	2012	2013	2014	2015	
1	Ginger	94.743	114.538	155.286	226.115	313.064	38.45
2	Galangal	57.701	58.186	69.730	62.521	55.150	-11.79
3	Lesser galangal	34.017	42.626	41.343	37.716	35.972	-4.62
4	Turmeric	84.803	96.979	120,726	112.088	113.101	0.90
5	Javanese turmeric	24.106	44.085	35.665	25.128	27.840	10.79
6	Cardamom	47.231.297	42.973.264	54.171.417	72.760.295	93.121.006	27.98
Total		47.526.667	43.329.678	54.594.167	73.223.863	93.666.133	61.71

The data indicate that of six commodities, galangal is the only commodity which showed a decline production from 2011 to 2015. The production declining was resulted, probably, from a decrease in width of planting area, as well as in demand, and change in trend of demand of both domestic and foreign medicinal plant industry. Central Java is one of the largest centers of medicinal plant production which contributes to substantial proportion of medicinal plant production in Indonesia. Table 2 specifies the aforementioned fact.

**Table 2.** Medicinal plant production in Central Java (2015)

No	City/ Regency	Production (kg)					
		Ginger	Lesser galangal	Turmeric	Galangal	Javanese turmeric	Cardamom
1	Purworejo regency	2.508.370	350.229	400.160	116.987	3.024.783	768.540
2	Wonogiri regency	7.579.773	1.373.130	16.647.991	4.007.142	3.215.300	4.871
3	Karanganyar regency	2.214.017	122.570	1.089.981	1.141.087	787.790	53.000
4	Rembang regency	4.764.615	1.099.646	3.527.909	1.422.399	234.537	10
5	Semarang regency	8.163.670	75.549	2.777.461	457.896	534.349	2.332.981
6	Others	15.071.295	5.743.756	4.130.244	6.910.194	2.245.894	18.259.338
Total		40.301.740	8.764.880	28.573.746	13.055.705	10.043.653	20.418.840

Source : Central Bureau of Statistics and General Directorate of Horticulture, 2016 [5].

Table 2 shows that the medicinal plant production in Central Java contributes varies between 15-50% of Indonesian total production. The main areas of medicinal plant production are Semarang regency, Semarang city, Boyolali, Sukoharjo, Karanganyar and Wonogiri. Meanwhile, the central areas of the development of medicinal plants in farmers' lands under the guidance of the government and the business are in Kudus, Kendal, Temanggung, Wonosobo, Magelang, Purworejo, Banyumas, Cilacap, and Sragen.

The medicinal plant products are intended not only to fulfill the needs of domestic industries, but also to be traded in international markets. Indonesia does not only export the products, but it also imports medicinal plant materials. Table 3 gives an overview of exports and imports of medicinal plants.

**Table 3.** Value (US\$) and volume (kg) of Indonesia's medicinal plant exports-imports (2011-2015)

Export Commodity								
Year	Cardamom/ HS 090830		Ginger / HS 091010		Turmeric/ HS 091030		Others / HS 091091	
	Value	Volume	Value	Volume	Value	Volume	Value	Volume
2011	17.213.756	7.150.538	1.209.189	1.175.524	4.502.349	2.672.115	1.534.115	245.282
2012	16.977.378	8.151.228	1.357.846	1.013.717	2.125.352	1.212.312	2.272.618	488.117
2013	10.729.475	6.737.734	14.909.488	22.471.685	2.100.919	1.946.541	1.622.003	731.877
2014	10.145.154	7.766.404	49.126.585	61.191.401	4.515.333	3.808.159	1.287.306	769.996
2015	7.785.335	6.248.064	18.230.204	25.935.366	10.499.058	8.670.791	2.468.081	1.186.806
Import Commodity								
Year	Cardamom/ HS 090830		Ginger / HS 091010		Turmeric/ HS 091030		Others / HS 091091	
	Value	Volume	Value	Volume	Value	Volume	Value	Volume
2011	184.736	32.645	16.571.827	22.381.338	332.457	269.541	407.662	58.827
2012	17.134	29.355	16.703.921	22.885.392	390.248	119.373	255.124	60.718
2013	36.351	18.180	5.927.010	6.307.746	475.280	249.491	91.716	16.259
2014	85.067	22.695	2.464.877	2.763.949	323.984	245.413	235.096	73.166
2015	10.656	4.669	5.976.593	6.857.943	299.930	152.966	178.831	91.055

Source : United Nations Commodity Trade, 2017[6].

In the above table shows the value and volume of four export commodities are greater than those of import commodities. However, if we compare in each item's value, we will find that import value is higher than the export one. This indicating that the competitiveness of Indonesia's medicinal plants is higher compared to other countries. Not all intensively-cultivated medicinal plant commodities is traded in international markets. The export / import value of medicinal plant commodities products in Central Java province can be seen in the Table 4.

**Table 4.** Value (US \$) and volume (kg) of medicinal plant exports of Java province during the periods of 2011-2015

Export Commodity								
Year	Cardamom/ HS 090830		Ginger / HS 091010		Turmeric/ HS 091030		Others/ HS 091091	
	Value	Volume	Value	Volume	Value	Volume	Value	Volume
2011	4,454,631	1,561,126	173,787	65,152	276,312	177,565	563,696	208,975
2012	7,728,354	2,892,426	233,722	76,168	178,000	40,431	570,402	86,526
2013	3,676,129	2,358,899	1,347,201	1,994,415	95,773	50,000	497,782	180,075
2014	3,996,925	3,523,851	3,562,613	3,388,355	398,296	261,773	733,913	375,164
2015	4,386,925	3,458,805	2,353,129	2,992,882	433,461	397,211	1,004,484	206,853
Import commodity								
Year	Cardamom/ HS 090830		Ginger / HS 091010		Turmeric/ HS 091030		Others / HS 091091	
	Value	Volume	Value	Volume	Value	Volume	Value	Volume
2011	0	0	28,202	33,957	0	0	92,311	249,490
2012	0	0	41,200	35,000	0	0	257,932	389,819
2013	28,350	14,175	0	0	0	0	62,475	168,852
2014	0	0	0	0	0	0	57,394	154,848
2015	0	0	0	0	0	0	28,990	78,350

Source : Department of Industry and Commerce of Central Java, 2016 [7].

Only three commodities including cardamom (in 2013), turmeric (only until 2012), and others were imported during the periods of 2011-2015. In the globalization era, Indonesia encounters product market and agricultural commodity competition. The competitiveness improvement is intended not

only to hit the export market, but also able to compete with import products in domestic markets. The continuity of agricultural production, particularly production of *simplisia* (crude drugs), is essential to absorb employment, to reduce the number of poor population, to increase state revenue, as well as to improve the economic wellbeing of millions of farmers [8]. The purpose of this study is to examine the competitiveness of medical plant of *simplisia* for supporting traditional medicine industries in Central Java.

## 2. Methods

### 2.1. Basic Method of Research

Descriptive analytical method using time series during periods of 2011-2015 was employed in the present study.

### 2.2. Location Determination Method

Research location of Central Java was selected using purposive sampling under some considerations that are one of provinces which produces *simplisia* and its region has a potential to develop, and it contributes to the export of medicinal plant commodities.

### 2.3. Type and Source of Data

The data used in this research was primary and secondary data.

### 2.4. Analysis Method

**2.4.1 Revealed Comparative Advantage (RCA) method** RCA method belongs to one of methods used to find out export commodity competitiveness from a country or industry viewed from a comparative advantage [9]. The RCA method applied in the present research was not the common kind which was intended to compare commodity export of a country and that of other countries in the world, but rather the kind in the smaller scope which compared export medicinal plant commodity export of Central Java and that of medicinal plant commodity export of Indonesia. The value of RCA systematically used in the research was calculated using the following formula:

$$RCA = \frac{X_{ij}/X_t}{w_{ij}/W_t} \dots\dots\dots(1)$$

Where, RCA represents competitiveness of medicinal plant commodity export of Central Java viewed from comparative advantage,  $X_{ij}$  denotes value of medicinal plant commodity export of Central Java province,  $X_t$  is total value of export of Central Java,  $w_{ij}$  is value of medicinal plant commodity export, and  $W_t$  is total value of export of Indonesia. The value of competitiveness resulted from the computation entails two possibilities: either the value of  $RCA > 1$  which indicates that medicinal plant commodity export of Central Java has strong competitiveness or the value of  $RCA < 1$ , which reveals that medicinal plant commodity export of Central Java has weak competitiveness. The index of RCA shows the comparison between the current year value of RCA and the previous year value of RCA.

**2.4.2 Analysis of Trade Specialization Index (TSI)** Trade Specialization Index (TSI) was employed to compute competitive advantage of medicinal plant commodities of Central Java in Indonesia. The analysis of TSI is useful to depict Central Java's position of medicinal plant commodities, whether it tends to be an exporter or importer, as well as to put medicinal plant industry in a competitive position which enables to give an overview of capabilities obtained from performance of maximum advantage in the framework of additional value of technologies or government's policy instruments. The formula used is shown below:

$$TSI = \frac{N_x' - N_m'}{N_x' + N_m'} \dots\dots\dots(2)$$

Where, TSI denotes Trade Specialization Index,  $N_x'$  is value of Central Java's medicinal plant commodity export, and  $N_m'$  is value of Central Java's medicinal plant commodity import. A value of the index ranges between -1 and +1. If it has positive value ranging from 0 to 1, then medicinal plant commodities are considered to have strong competitiveness, or Central Java tends to be an exporter of medicinal plant commodities. on contrary, if it has a negative value ranging below 0 to -1, then medicinal plant commodities are said to be weak, or Central Java tends to be an importer [10].

In addition, TSI can be used to identify a competitive position of a commodity in trade, which is divided into several stages: (1) introduction, a stage in which forerunners of medicinal plant industry in other regions export new products and latecomers of medicinal plant industry in Central Java import their products , and a value of latecomer industry TSI ranges between -1.00 and -0.50, (2) import substitution, a stage in which a value of TSI rises to between -0.51 and 0,00, and Central Java's medicinal plant industry indicates low level of competitiveness due to its less high level of production to achieve its economies of scale; such industry exports products with inadequate quality, whereas in fact, the domestic production is less than the domestic demands (in other words, for such commodities, Central Java's medicinal plant industry imports more than it exports, (3) growth, a stage in which a value of TSI rises to between 0.01 and 0.80, Central Java's medicinal plant industry makes large-scale production and starts rapid scale up of exports in domestic markets, and the supply of the commodities is greater than the demand, and (4) maturity, a stage in which a value of TSI ranges between 0.81 and 1.00, medicinal plant products are in the stage of technology standardization, and Central Java is considered a net exporter.

### 3. Results and Discussion

#### 3.1. Competitiveness of Medicinal Plant Commodity Export of Central Java viewed from Comparative Advantage

Revealed Comparative Advantage (RCA) in the present research is defined if export share of medicinal plant commodities in total commodity export of Central Java is greater than that of medicinal plant commodities in total commodity export of Indonesia. It is, therefore, expected that Central Java province possess comparative advantage in producing efficiency-based specialized medicinal plant commodities over other countries.

**Table 5.** The growth of RCA value of Central Java's medicinal plants during the periods of 2011-2015

Year	RCA value
2011	9.70
2012	16.31
2013	6.56
2014	4.17
2015	5.87
Total	42.61
Mean score	8.52

Table 5 indicates that mean score of the value of RCA for medicinal plant commodities of Central Java province during periods of 2011-2015 was above 1 (8.52), meaning that during the periods, medicinal plant commodities of Central Java has strong comparative advantage in international markets. The great value of comparative competitiveness of medicinal plant commodity export of Central Java depends very much on the change in exchange rate of Indonesian Rupiah against the U.S. dollars. This occurs since the existing RCA value is influenced by dollar value of exports. Either strengthening or weakening exchange rate of Indonesian Rupiah against the U.S. Dollar exerts a significant influence on competitiveness of medicinal plant commodities of Central Java province.



In addition, land resources availability is one of determinant factors of comparative analysis of the competitiveness seen from the availability of land resources used to produce medicinal plant commodities. Central Java province had width of planting area of medicinal plants of 6,530.39 ha with production of 131,890 tons in 2015 [7]. Table 2 presents regencies/ cities in Central Java province with the most abundant production of medicinal plants, and indicates that Wonogiri regency had the most abundant production in 2015. Table 4 provides an overview of exported production of medicinal plants. Medicinal plant products had been exported to more than 24 countries, but some exports had not been continuously done. Several countries which have continuously been export markets of medicinal plants include Bangladesh, the Netherlands, India, Japan, Germany, Malaysia, Pakistan, the Kingdom of Saudi Arabia, Singapore, Thailand, the United Arab Emirates, and the U.S.A. The biggest export markets are Malaysia, Singapore, Japan, and the Kingdom of Saudi Arabia.

The optimal production of medicinal plants as herbs raw material is determined by such factors as cultivation environment, cultivation techniques, as well as a means of production. The former includes such requirements for growth as climate, growing media, and elevation. Meanwhile, the middle and the latter involve seed varieties used, seed preparation and nursery, land cultivation, planting, care, and harvesting (the Standard Operating Procedure issued by Indonesian Spices and Medicinal Crops Research Institute (*Balai Penelitian Tanaman Rempah dan Obat*) (2004).

Products of herb plants sold by farmers in two categories: fresh products and crude drugs (chopped and dried medicinal plants). The former were produced by farmers in common, while the latter by farmers who also work as product collectors. Medicinal plants as material of herb under SNI No. 01-7084-2005 can be identified by the content of secondary metabolites (active compounds) with medicinal properties and by physical aspects/ properties of the material. Factors determining the content of secondary metabolites include agroclimatic environment, variety, growing media, as well as such physical environments during plant growth as precipitation, intensity of light, moisture, and preharvest-harvest-postharvest treatment. Physical properties of the material cover cleanliness, the growth of fungi, the presence of foreign material, age, as well as the condition of rhizome. In addition to rhizome age, such properties are influenced by harvest treatment and cleaning process. Less hygienic cleaning, or cleaning using dirty water, poor environmental condition and container lead to the growth of fungi and microbes on the material. Traditional medicine industry supplying herb plants requires of dryness levels, physical properties, appearance, color and cleanliness.

**Table 6.** The Production of Medicinal Plants according to Province in 2015

No	Province	The number of production (kg)
1	East Java	144.172.421
2	Central Java	100.739.724
3	West Java	86.369.331
4	South Sulawesi	47.841.950
5	Bengkulu	24.239.060
6	Others	94.337.970

Source : Central Bureau of Statistics, 2016 [11].

Efforts to develop medicinal plants bring about positive benefits for socio-economic aspect of local area in the form of employment absorption in order to reduce unemployment level since the medicinal plant cultivation is done by local farmers living in the surrounding neighborhood. In the aspect of cultivation, farmers do not find any significant difficulties/problems.

Marketing problems are the obstacles mostly faced by farmers in determining product selling price. Farmers occupy price-takers position and product collectors regulate the selling price. Problem dealing with price fluctuation, or the absence of price warranty, is another challenging obstacle. For improving farmers' bargaining power, the Agricultural Department has provided guidance for farming groups to join Association of Medicinal Plant Farmers (*APTO—Asosiasi Petani Tanaman Obat*) which establishes trading partnership program with merchants in Medicinal Plant Industries.

### 3.2. Competitiveness of Medicinal Plant Commodity Export of Central Java viewed from Competitive Advantage

Analysis for measuring competitive advantage of competitiveness of medical plant commodity export of Central Java was done using Trade Specialization Index (TSI) method. The competitive advantage is useful to depict Central Java's position of medicinal plant commodities, whether it tends to be an exporter or importer, as well as to put medicinal plant industry in a competitive position which enables to give an overview of capabilities obtained from performance of maximum advantage in the framework of additional value of technologies or government's policy instruments.

**Table 7.** The growth of TSI value of Central Java's medicinal plant commodities during the periods of 2011-2015

Year	TSI Value
2011	0.96
2012	0.93
2013	0.97
2014	0.99
2015	0.99
Total	4.84
Average	0.97

Table 7 demonstrates the average score of TSI of Central Java's medicinal plant commodities for the period of 2011 to 2015, which is 0.97, indicating that positive value of the index ranges between 0 and 1. Hence, medicinal plant commodities are considered to have strong competitiveness. In other words, Central Java tends to play a role as exporter of medicinal plant commodities. TSI can also be used to identify the position of competitiveness of a commodity in trade. The competitiveness of Central Java's medicinal plant commodities shows TSI average score ranging from 0.81 to 1.00. It is concluded that medicinal plant commodities of Central Java are in stage of maturity.

The usages of traditional medicines are often debatable among surrounding healthcare service providers. With the presence of the Minister of Health Regulation number 003/MENKES/PER/I/2010 on Traditional Medicine Scientific Validity, traditional medicines formulated from medicinal plants today can be consumed along with chemical medicines. As raw materials for traditional medicines in traditional medicine industry (TMI), medicinal plants have to compete with synthetic chemical materials/compounds and active compounds (bioactive materials) which are used by medicine manufactures or pharmaceutical industries. However, some of people's behaviors to consume traditional medicines and modern people's tendencies to seek for alternative medication with the principle of "going back to nature" are prospective opportunities for medicinal plants. The tendencies are attributable to the side effects of synthetic medicines and antibiotics, as well as opinion that natural materials are relatively safer than synthetic materials. According to Corinthian Infopharma Corpora-CIC (2000), the consumptions of traditional medicines appear to have increased 5.4% each year on the average. The opportunities are more widely opened along with the government's policies to develop Indonesian traditional medicines into phytopharmaceutical industry. The increase in medicinal plant global consumption and trade of 20.96% each year on the average is a chance for developing traditional medicine industry which directly increases the demand for medicinal plants to produce traditional medicines.

Central Java is the second biggest producer of medicinal plants in Indonesia [5]. The large-scale production can show that Central Java is able to meet the export demands of medicinal plant commodities with more competitive and relatively lower price compared to those of other countries (importers) in term of the largest export market share. This can be seen in Table 8.



**Table 8.** Price of exported medicinal plants in 2015

Country	Export Price				Average
	Cardamom/ HS 090830	Ginger / HS 091010	Turmeric/ HS 091030	Others/ HS 091091	
Indonesia	1.25	0.70	1.21	2.08	1.31
Malaysia	11.11	1.81	2.25	3.38	4.64
Singapore	7.28	0.66	1.76	4.55	3.56
Saudi Arabia	8.21	1.11	1.87	1.19	3.10
Japan	11.84	8.13	58.37	10.88	22.31

Source: United Nations Commodity Trade, 2017[6].

Export price of medicinal plants is lower for the exported products have not met the specification demanded by importers. This is because the contents of active materials/essential oils in Indonesian products are lower than those of products from other countries like Malaysia, Singapore, Saudi Arabia, and Japan.

On one side, several western countries open their markets to stimulate customs through trade contracts. On the other side, they strengthen supervision on imported medicines, decide or improve requirements of relevant technologies through various actions of medicine use safety and protection, including standards to examine the microorganisms content, antiseptics and standards of product quality, standard techniques and requirements of environmental protection to extract plants containing heavy metals, pesticide residue, and aflatoxin to improve acceptable threshold of technology trade obstacle and green trade barrier [12].

#### 4. Conclusion

On the basis of the RCA analysis results for research data periods of 2011 to 2015, Central Java's commodities of medicinal plant of *simplicia* appear to have the average score of 8.52, indicating a strong comparative advantage in global markets. Meanwhile, referring to TSI analysis results, the commodities appear to have the average score of 0.97 at 0 to 1 range, representing a strong competitiveness. In other words, Central Java has more tendencies to be exporter. Based on the average score, the position of the competitiveness of Central Java's medicinal plants ranges from 0.81 to 1.00, and hence, the commodities are at stage of maturity.

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