Competitive advantages of biopharmaceutical commodities in Bali province

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Competitive advantages of biopharmaceutical commodities in Bali province

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Abstract. In the midst of a shift in people's lifestyles that leads to an increasingly intensive use of herbal medicines, it has a positive impact on the existence of biopharmaceutical commodities that are increasingly economically valuable. This study aims to analyze (1) the leading biopharmaceutical commodities and (2) the competitive advantages of the biopharmaceutical commodities of the Province of Bali. The research was conducted in eight districts in the province of Bali. The number of respondents was determined using a purposive method, with a total of 160 respondents. Primary data collection was carried out through direct interviews with farmers using a questionnaire, while secondary data was collected from BPS-Statistics Indonesia. The location quotient (LQ) analysis is used to identify the top biopharmaceutical commodities, and the policy analysis matrix (PAM) method is used to study competitive advantage. The results showed that the leading biopharmaceutical commodity for Bali Province was turmeric, while ginger, galingale, galangal, and curcuma were not among the leading biopharmaceutical commodities. The results of the analysis using the PAM approach with the Private Cost Ratio indicator show that turmeric, ginger, galangal, galingale, and curcuma have competitive advantages.

1. Introduction

Nowadays, there is a shift in people's preferences for consuming drugs, from chemical drugs to herbal medicines, in line with increasing public awareness of the importance of living a healthy life. According to [1] some people choose to live a lifestyle back to nature, which is marked by the tendency for the behavior to consume herbal medicines to be more widespread, which are perceived to have relatively no side effects and more competitive prices compared to chemical drugs.

Biopharmaceutical commodities are known as multipurpose commodities because, apart from being useful as medicines for the prevention and cure of various diseases, they can also be used as cosmetic ingredients and seasonings. As medicine, several parts of this commodity can be used, such as leaves, stems, fruit, tubers, or roots, and there are also parts that can be consumed directly [2].

Along with the return to nature movement and amid increasing public awareness of using herbal ingredients in everyday life, the need for biopharmaceutical commodities as raw materials for traditional medicines is also increasing. Changes in people's lifestyles to more herbal-centric have had an impact on strengthening the bargaining position of biopharmaceutical commodities. Modern technology is now being used by the herbal medicine industry to transform biopharmaceutical inputs into a variety of herbal products. On the other hand, the use of herbal products has also greatly increased outside of rural and urban groups [3]. This has spurred a significant increase in demand for herbal medicines and improved the outlook for the biopharmaceutical commodity industry.

The increase in demand for biopharmaceutical commodities was also driven by the development of the culinary industry as part of the development of tourism, where this industry really needs biopharmaceutical commodities to be used as seasonings. The spices turmeric, ginger, galangal, galingale, and curcuma are needed as flavor enhancers to spoil the tongues of tourists. The culinary industry is a very profitable source of demand for biopharmaceutical commodities.

Bali Province, as a world tourist destination, has several types of biopharmaceutical commodities, which grow and develop with various variations. The biopharmaceutical commodities cultivated by farmers in the province of Bali include turmeric, ginger, galangal, galingale, and curcuma. Farmers are already familiar with various biopharmaceutical commodities because they have been passed down from generation to generation.

However, it is unfortunate that until now the Bali Province biopharmaceutical commodities have not been clearly identified, which commodities are the basis sector, and which biopharmaceutical commodities have competitive advantages. As a result, the economic potential of these commodities cannot be optimally actualized. Within this framework, a study was conducted that aimed to analyze (1) the leading biopharmaceutical commodities of the Province of Bali and (2) the competitive advantage of the biopharmaceutical commodities of the Province of Bali.

2. Research methods

The study was conducted in eight districts in Bali, including Badung, Gianyar, Klungkung, Karangasem, Bangli, Tabanan, Jembrana, and Buleleng regencies. The population in this research is farmers who cultivate biopharmaceutical commodities. The number of respondents was determined using a purposive method, with a total of 160 respondents. Data was collected in using two approaches: (1) primary data collection was carried out through direct interviews with farmers using a questionnaire, and (2) secondary data was collected from BPS - Statistics of Indonesia. The data collected through questionnaires method was organized by a tabulating process. Both raw data sets were analyzed using statistical analysis. The data sources from BPS were analyzed using location quotient (LQ) analysis to determine the leading biopharmaceutical commodities. Mathematically, LQ is formulated as follows:

$$LQ = \left(\frac{Y_{ij}}{Y_j}\right) \Big/ \left(\frac{Y_i}{Y}\right) \quad (1)$$

Remarks:
LQ*i* : Location Quotient Index for Biopharmaceutical Commodity *i* in Bali Province
Y*ij* : Total production of biopharmaceutical commodities *i* in Bali Province
Y*j* : Total production of biopharmaceutical commodities in Bali Province
Y*i* : Total production of biopharmaceutical commodities *i* in Indonesia
Y : Total production of biopharmaceutical commodities in Indonesia

If the LQ value > 1, the biopharmaceutical commodity is a basic biopharmaceutical commodity. The production of these biopharmaceutical commodities is not only able to meet the needs of the region but can also be exported outside the region.
If the value of LQ = 1, the biopharmaceutical commodity is a non-base biopharmaceutical commodity. Its production is only sufficient to meet the needs within the region.
If the LQ < 1, the biopharmaceutical commodity is a non-base commodity. Its production cannot meet the needs of its own region, so it needs to be imported from outside the region.

The development of biopharmaceutical commodities is also analyzed using the LQ growth rate formula [4] as follows:

$$\Delta LQ_i = \left(\frac{LQ_i{}^1 - LQ_i{}^0}{LQ_i{}^0}\right) \times 100\% \quad (2)$$

Competitive advantage with private cost ratio (PCR) indicators is analyzed using the a *policy analysis matrix (PAM)* [5,6] approach (table 1).

Table 1. Policy Analysis Matrix.

	Costs			
	Return	Tradable Inputs	Domestic factors	Benefit
Private prices	A	B	C	D
Social prices	E	F	G	H
Divergences	I	J	K	L

$$Private\ Cost\ Ratio\ (PCR) = \frac{C}{(A-B)} \quad (3)$$

Remarks:
PCR = Private cost ratio
A = Return at the private price level
B = Tradable input at private price level
C = Domestic factor at the private price level

3. Results and discussion

3.1. Identification of leading biopharmaceutical commodities in Bali Province

Some farmers who do biopharmaceutical commodity farming said that they are familiar with several biopharmaceutical commodities, such as turmeric, ginger, galangal, galingale, and curcuma. These commodities have been cultivated across generations; previously, they were only cultivated on a subsistence basis. Now, along with the increasing demand for several biopharmaceutical commodities, farmers have changed their cultivation patterns to become more intensive with a commercial orientation. The productivity of several biopharmaceutical commodities in the Province of Bali varies relatively (Table 2), as indicated by genetic factors, land fertility, agro-climate suitability, and the level of farming intensification.

Table 2. Productivity of biopharmaceutical commodities in Bali Province.

Biopharmaceutical commodities	Productivity $KgHa^{-1}$			
	Minimum	Average	Maximum	SD
Turmeric	17,000.00	21,528.90	25,333.33	1,933.21
Ginger	14,000.00	16,847.69	20,500.00	1,784.58
Galingale	13,800.00	16,722.99	20,800.00	1,739.86
Galangal	13,666.67	22,033.75	30,000.00	3,285.92
Curcuma	12,500.00	16,176.25	20,500.00	2,692.50

Galangal has the highest average productivity, followed by turmeric, ginger, and galangal. Galangal is perceived by farmers as being very easy to cultivate; once planted, it can be harvested regularly and many times without requiring a touch of intensive maintenance. Due to turmeric has a relatively high productivity, below that of galangal, farmers perceive it as a commodity that is easy to cultivate and has a profitable selling price. It is not excessive that turmeric is cultivated in a relatively wider area. Compared with the average productivity of national biopharmaceutical commodities, the average productivity of biopharmaceutical commodities in Bali Province is indicated to be lower. The productivity of biopharmaceutical commodities depends on soil fertility, cultivation techniques, and agro-climate suitability.

Based on location quotient (LQ) analysis, biopharmaceutical commodities are identified as the basis sector or leading commodity from the supply side as the farming business of several biopharmaceutical commodities develops. The results of the LQ analysis of biopharmaceutical commodities are presented in Table 3, indicating that only turmeric is categorized as a basic commodity (LQ > 1), so that it can be

categorized as a leading biopharmaceutical commodity in the Province of Bali. Turmeric production is not only able to meet the needs of the Bali region but can also be exported outside the province of Bali. The commodities ginger, galangal, galingale, and curcuma have an LQ value < 1 and the title of non-base commodity, so that from the supply side they cannot be categorized as leading biopharmaceutical commodities in the Province of Bali. The production of ginger, galangal, galingale, and curcuma commodities is not able to meet the demand for the province of Bali. Unlike the case in North Sumatra, ginger and galangal commodities are leading commodities [1,7].

Table 3. LQ analysis for biopharmaceutical commodities.

Biopharmaceutical commodities	LQ values						Remarks
	2017	2018	2019	2020	2021	Average	
Turmeric	1.32	1.94	2.34	1.56	2.09	1.85	B
Ginger	0.81	0.44	0.18	0.82	0.70	0.59	NB
Galingale	0.00	0.46	0.23	0.32	0.21	0.24	NB
Galangal	1.37	0.95	0.49	1.18	0.90	0.97	NB
Curcuma	0.00	0.01	0.03	0.05	0.01	0.02	NB

Remarks: B = basic commodity, NB = non-base commodity

Turmeric consistently has a LQ index > 1 (LQ=1.85) with low variability, indicating that the turmeric commodity is cultivated by farmers in a sustainable manner. Within five years (from 2017 to 2021), turmeric has a positive LQ growth rate of 58.33%. This is inseparable from the consistency of farmers in cultivating turmeric, which is driven by the economic value of the turmeric commodity, which is perceived by farmers as relatively profitable. All the respondent farmers do turmeric farming for commercial purposes, namely to gain profit. The type of turmeric that is currently being intensively cultivated is black turmeric, because the selling price is higher than ordinary turmeric.

Galangal is a biopharmaceutical commodity that is categorized as a non-base commodity but has the potential to become a basic commodity or leading commodity in the Bali region because it has a LQ index close to one (LQ = 0.97). Within five years (from 2017 to 2021), galangal has a negative LQ growth rate of -34.31%. Galangal production in the Bali area has dropped dramatically in 2019, which is likely to degrade galangal as a sector-based commodity so that it is no longer categorized as a leading biopharmaceutical commodity in the Bali region. Fortunately, in 2020, when the COVID-19 pandemic hit, galangal production increased, as indicated by the increasing need for herbal medicines. Most of the respondents knew that there was a habit among most of the elderly in their environment who used galangal for *scrub* which was proven to be efficacious for warming the body. The use of galangal as a *scrub* ingredient has been passed down from generation to generation.

Ginger is also a biopharmaceutical commodity that is relatively widely cultivated, even though, with an LQ index < 1, it is categorized as a non-basic commodity or not a leading commodity. This commodity has experienced an increase in production in 2020, amidst the massive efforts of the community to fight against the ferocious transmission of COVID-19. Throughout 2017 and 2021, ginger experienced a negative LQ growth rate of -13.58%. There are indications that the community has not responded optimally to the development of ginger farming to be used as a source of family income, so its development is still relatively limited. The type of ginger that is relatively widely cultivated by farmers today is red ginger.

Galingale and curcuma are biopharmaceutical commodities that are cultivated in a more limited area, so they have a very low LQ index. This commodity is relatively far from being designated as a basic commodity because it is perceived by farmers as having less economic value, even though it is actually very easy to cultivate. The LQ growth rate of galingale was -54.34%, indicating a decreased ability to meet its own needs, while the LQ growth rate of curcuma was constant.

3.2. Analysis of Bali province biopharmaceutical commodities' competitive advantage

The centers for the development of biopharmaceutical commodities in Bali are in the regencies of Karangasem, Bangli, Badung, Buleleng, Gianyar, and Tabanan. Meanwhile, only a few farmers in Klungkung and Jembrana Regencies cultivate biopharmaceutical commodities. The average of biopharmaceutical farming area varies greatly between commodities and between farmers. Turmeric, galangal, and ginger are cultivated in a wider area, while galingale and curcuma are cultivated in a relatively narrow area.

Table 4. Competitive Advantage for Bali Biopharmaceutical Commodities

Biopharmaceutical commodities	Private Cost Ratio (PCR)			
	Minimum	Average	Maximum	SD
Turmeric	0.2922	0.4377	0.7694	0.0673
Ginger	0.0923	0.3269	0.6428	0.2177
Galingale	0.3362	0.4756	0.7611	0.0776
Galangal	0.0792	0.1017	0.1209	0.0099
Curcuma	0.7144	0.9484	1.7936	0.1777

On average, turmeric, ginger, galangal, galingale, and curcuma have competitive advantages. Galangal has the highest competitive advantage, followed by ginger, turmeric, galingale, and curcuma (table 4). The competitive advantage of biopharmaceutical commodities is supported by their characteristics, which are not easily damaged, so they can be stored for a relatively long time. When prices fall, farmers can still store these biopharmaceutical commodities while waiting for prices to rise. Based on the confessions of several respondents, they often store their commodities in the same place for several months and keep them in good condition. This makes the bargaining position of farmers relatively stronger because they do not need to rush to release their commodities because they are easily damaged. This is very different from vegetables and fruit commodities, which are relatively more easily damaged.

Galangal is the most competitive Bali biopharmaceutical commodity. The coefficient of galangal's private cost ratio (PCR) is 0.1017, which means that saving one unit of foreign exchange at the private price level necessitates a sacrifice of 0.1017 unit of domestic resources. Galangal is indicated to be economical in terms of tradable inputs and domestic factors, with a profitable selling price, making it a competitive commodity. This is inseparable from the benefits of galangal, which are multipurpose, because besides being used as medicinal ingredients and herbs, galangal can also be used as a spice. Most of the respondents were more familiar with the use of galangal as a spice than as a medicinal ingredient because, according to their perceptions, the Balinese spice without galangal tastes bland.

Ginger occupies the second position in the order of the PCR coefficient of 0.3269, which means that to save one unit of foreign exchange at the private price level, it requires the sacrifice of 0.3269 units of domestic resources. According to [8], ginger farming is a profitable business sector. The ginger commodity has been able to penetrate the export market and has very high competitiveness in the UK, Germany, Bangladesh, and Malaysia markets [9]. The achievement of ginger's competitive advantage is supported by its wide-ranging benefits and has been recognized by the public as a commodity for medicinal ingredients, herbal ingredients, thirst-quenching drinks, and also as a cooking spice. The various uses of ginger as a commodity have positioned it as a marketable biopharmaceutical commodity that has a relatively strong competitive advantage. These conditions have inspired some farmers to expand ginger cultivation, driven by sustainable demand.

Turmeric is also widely known as a medicinal plant as well as a spice. Most farmers perceive turmeric as herbal medicine because they are familiar with herbal medicine made from turmeric. Turmeric has a relatively strong competitive advantage with a PCR coefficient of 0.4377. this is correlated with fact that turmeric has been able to penetrate the export market with high competitiveness [10,11]. Based on questionaries, farmers do turmeric farming because it does not require intensive maintenance and has

been perceived to generate profits for them. On the other hand, people's habit of consuming herbal medicine can increase the demand for turmeric. This has implications for competitive turmeric price levels [12]. The condition of galangal commodities is almost the same as that of turmeric, both in terms of benefits and the magnitude of the PCR coefficient.

Curcuma is a Balinese biopharmaceutical commodity with the lowest competitive advantage (PCR = 0.97). This is inseparable from the relatively limited use of curcuma compared to other biopharmaceutical commodities. Some of the curcuma farming that the respondent cultivated was even in the category of not having a competitive advantage (PCR > 1). Such conditions tend to reduce the interest of farmers in doing curcuma farming because it is perceived as unprofitable.

In this study, a competitive advantage indicates that a biopharmaceutical commodity has a demand advantage. The stronger the competitive advantage of a commodity, the more likely it is to have significant demand. In such conditions, these commodities tend to achieve competitive prices, which then have implications for producers' interest in producing in a sustainable manner. It is indicated that a commodity that is leading from the demand side will encourage the emergence of derived supply because producers tend to seek commodities that have strong demand.

4. Conclusion

Turmeric is a biopharmaceutical commodity for the Province of Bali that is categorized as a basic commodity, and from the supply side it can be classified as a leading biopharmaceutical commodity for the Province of Bali. The commodities ginger, galingale, galangal, and curcuma are not categorized as basic commodities. It was discovered that the commodities turmeric, ginger, galingale, galangal, and curcuma have a competitive advantage, with galangal having the highest competitive advantage and curcuma having the lowest.

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