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Assessing Production and Marketing Efficiency of Organic Horticultural Commodities: A Stochastic Frontier Analysis

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Abstract: Inefficiency is a problem in the production process, including in the organic farming sector. Over a long term period, this problem can disrupt the productivity of agricultural crops. This research aims to analyze the production and marketing efficiency of organic cabbage farming in the Kopeng agropolitan area, Indonesia. We utilized a Cobb–Douglas production efficiency analysis with the Stochastic Frontier Analysis (SFA) approach. The variables in this study include organic cabbage production, land area, seedlings, organic fertilizers, organic pesticides, and labor. We conducted in-depth interviews with 60 organic cabbage farmers in Kopeng, Indonesia, from January to August 2023. The research results showed that organic cabbage cultivation was economically inefficient in production, technical, and marketing. The use of organic fertilizers, the ability to diversify products on limited land, and the use of pesticides, have not been utilized optimally yet. The results of the marketing efficiency analysis showed that it was efficient. Organic plants were believed to have their market share and to have a higher selling value than non-organic ones. The implication was that the government needed to provide training in producing organic fertilizers and pesticides to reduce production costs so that organic farming could be technically and financially efficient. This research enriched the discussion regarding the need to analyze production and marketing efficiency to find strategies to increase organic cabbage productivity.

Keywords: technical efficiency; Cobb–Douglas production function; farmer; cabbage farming; land area; fertilizers; labor

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1. Introduction

The agricultural sector has an important role in improving the economy. In addition to contributing to the formation of gross domestic products, the agricultural sector also contributes to the provision of employment, foreign exchange contributors, and suppliers of food availability (Awan et al. 2021; Bahn et al. 2021; Lestari et al. 2022; Pawlak and Kołodziejczak 2020; Rukasha et al. 2021). The important role of the agricultural sector certainly makes its production continue to boost productivity (Barrett 2021; Jayne et al. 2021; Sánchez et al. 2022). As a result, the agricultural sector exploits natural resources to reach increased production (Chopra et al. 2022; Khadda 2021).

The agricultural sector is one of the sectors that are directly related to nature and the environment. The exploitation of natural resources in this sector certainly has a negative impact on environmental quality (Caglar et al. 2024; Chien et al. 2023; Tinh et al. 2023; Udeagha and Ngepah 2023). In order to achieve optimal production, this sector continues to be exploited without regard to the sustainability of natural resources (Karamian et al. 2023;

Tinh et al. 2023). In the process of agricultural cultivation, emissions are released, both carbon dioxide emissions (Co2) and methane gas emissions (CH4), which are gases contributing to environmental pollution. Excessive use of fertilizers and pesticides also adversely affects water and soil pollution. Therefore, there is a need for agricultural reform from conventional agriculture to organic farming (Durham and Mizik 2021; Ferdous et al. 2021; Heinrichs et al. 2021; Khadda 2021).

Implementing organic farming is not easy because it faces various challenges. Organic agriculture requires extra energy, time, and cost (Khurana and Kumar 2020; Nematollahi et al. 2021; Thakur et al. 2022; Verburg et al. 2022). Cultivated commodities must be free from chemical fertilizers and pesticides, which are very vulnerable to pest and disease attacks. The need for production input must also be adjusted to the appropriate dose so that organic farming can run efficiently (Singh et al. 2021).

One of the areas that has begun to implement organic agriculture is the Kopeng Agropolitan area located in Semarang, Indonesia. Agropolitan areas are defined by Law of the Republic of Indonesia No. 26 of 2007 as any area with one or more activity centers in rural areas that function as a system of agricultural production and management of particular natural resources, as shown by the functional linkages and spatial hierarchies of agribusiness systems and settlement system units. Agribusiness is a concept or business that starts with production, processing products, marketing, and other agriculture-related activities. Kopeng is an agropolitan area for agricultural products in Central Java Province, Indonesia. The potential of the agricultural sector in this area is so large that many people work as farmers (Lestari et al. 2022; Prajanti et al. 2023). However, massive and conventional agricultural cultivation decreases agricultural production due to reduced soil nutrients. This condition makes some farmers change their cultivation patterns from conventional to organic. One of the organic commodities that are widely cultivated are cabbage commodities. Cabbage plants have a relatively high market share for export. Currently, cabbage is a vegetable commodity ranked fifth in Indonesia in terms of export value and volume. The export destination countries of Indonesia are Taiwan and Singapore, with respective export values of USD 5.97 million and USD 1.83 million. The center provinces of cabbage are in Central Java and West Java, with average production over the last five years (2015–2019) of 328,759 tonnes and 285,806 tonnes. Cabbage is suitable to grow in Kopeng because it is a highland area with a suitable climate and nutrient content. Cabbage cultivation applies to an organic farming system, namely an agricultural system that uses natural materials.

Organic farming requires precise calculations to run efficiently. So far, organic farmers in the Kopeng Agropolitan Area have not fully possessed the skills in organic farming and are still experiencing various obstacles. The inputs of production that are not easy to obtain are one of the problems faced. In addition, the marketing process of organic cabbage is also not like cabbage in general because the market for organic cabbage is not for all people, but only for specific consumers. Organic cabbage farmers are still constrained by organic farming certification because the procedure is not easy, and the cost is not cheap (Hebbar et al. 2023; Mohanty et al. n.d.; Thakur et al. 2022).

The demand for substantial financial and manufacturing inputs will significantly impact the production of organic cabbage. An insufficient combination of quantities and production factors will affect the amount of production and costs incurred. This situation requires farmers to use their production factors to manage their farms efficiently. If farmers do not use production factors efficiently, there is unexploited potential to increase farm income and create a surplus (Wongnaa et al. 2019). Furthermore, low production and high costs will eventually result in farmers' low incomes. Therefore, it is necessary to analyze the efficiency of production and marketing of organic cabbage farming to know whether this business is efficient.

The research refers to the efficiency proposed by Farrell (1957). Efficiency measurement involves measuring the distance of an observed data point to the frontier. Production efficiency is called economic efficiency or productive efficiency. Farrell (1957) developed literature to carry out empirical estimates for technical, allocative, and economic efficiency.

Allocative efficiency uses minimum cost criteria to produce a certain amount of output on an isoquant. Technical efficiency is expressed by how far a unit of economic activity operates from the function of frontier production at a certain technological level. The frontier production function is a production function that describes the maximum output which can be achieved from each level of input use (Coelli et al. 2005).

We use the Stochastic Frontier Analysis approach to calculate efficiency. The Stochastic Frontier is a parametric-based model that measures efficiency and risk management, including in the agricultural sector. This model has advantages over regression methods or Data Envelopment Analysis because it can be used to assess risk, optimize input resources, help researchers in creating measurable goals, and identify optimal plant combinations for risk diversification. This approach was used by several previous studies (Eni et al. 2023; Ji et al. 2023; Yu et al. 2023). To calculate the efficiency value, we use the Cobb–Douglas theory of the production function. According to Douglas (1928), the Cobb–Douglas production function is a function or equation involving two or more independent variables and a dependent variable. The Cobb–Douglas production function has several properties which are very useful for empirical research, and the production function can be initiated by making logarithms so that it is easy to analyze using linear regression analysis (Douglas 1928; Ishikawa 2021; Wang et al. 2021).

Some previous studies that examined the efficiency of farming still produced different findings. The efficiency of agricultural production can be influenced by cultivation management (Idoje et al. 2021; Karunathilake et al. 2023), labor (Idoje et al. 2021; Karunathilake et al. 2023), seed quality (Zulfiqar 2021), and also the use of fertilizers (Ogutu et al. 2014; Van Campenhout et al. 2021). Other studies mention that organic and conventional farming have different levels of efficiency (Durham and Mizik 2021; Huffaker et al. 2016; Khurana and Kumar 2020; Le Campion et al. 2020). The difference in the results of previous studies provides a gap for further research in farming efficiency, especially organic farming. This study aims to analyze the efficiency of production and marketing of organic cabbage farming in the Kopeng Agropolitan area.

2. Methodology

The main aim of this research is to calculate the efficiency level of farming as one of the leading horticultural commodities, namely cabbage commodities. We also analyze the marketing chain of these superior commodities. The population in this study are all farmers in the Kopeng Agropolitan Area, Central Java Province, Indonesia (see Figure 1). The samples in this study were taken using purposive sampling. The purposive sampling method is a technique of determining samples based on certain considerations. The consideration is cabbage farmers in the Kopeng Agropolitan area who grow cabbage using organic cultivation techniques. We conducted in-depth interviews with 60 organic cabbage farmers in Kopeng from January to August 2023.

The variables in this study consist of dependent and independent variables. The dependent variable in this study is organic cabbage production in tonnes. At the same time, the independent variables in this study include organic fertilizers, land area, seeds, organic pesticides, and labor.

We used Cobb–Douglas production efficiency analysis with a Stochastic Frontier Analysis approach. The analysis model uses the Cobb–Douglas production function as follows (Labini 1995; Murthy 2002):

$$Y = aX_1^{b1}.X_2^{b2}.X_3^{b3}.\ldots.X_n^{bn}e^u \quad (1)$$

whereas Y: production; X_1: factor of production, where i = 1, 2, 3. . . . n; a: intersep; b_i: regression coefficient of an estimator of the i variable; u: error; and e: natural logarithm.

Equation (1) is converted into linear form by transforming into logarithmic form. The aim is to determine the optimal inputs and technical efficiency which are achieved in organic cabbage farming in the Kopeng Agropolitan area. After being transformed into a natural logarithmic form, the equation is as follows:

$$Log\ Y = a + b_1 LnLA_1 + b_2\ LnSd_2 + b_3 LnOF_3 + b_4\ LnOP_4 + b_5\ LnLb_5 + e \quad (2)$$

where Y: logarithm of organic cabbage production; $LnLA$: natural logarithm of land area; $LnSd$: natural logarithm of seeds; $LnOF$: natural logarithm of organic fertilizer; $LnOP$: natural logarithm of organic pesticides; $LnLb$: natural logarithm of labor; b_1–b_5: value of coefficient; and e: error term.

Figure 1. The Kopeng Agropolitan Area in Central Java, Indonesia. Source: https://www.google.com/maps, accessed on 5 April 2024.

Technical efficiency is the initial efficiency analysis in this study. The formula used to calculate technical efficiency is as follows:

$$TE = \exp\left(-E\left[\frac{u_i}{\varepsilon_i}\right]\right) \quad (3)$$

With the knowledge that:

$$E\left[\frac{u_i}{\varepsilon_i}\right] = \left(\frac{\sigma_u \sigma_v}{\sigma}\right)\left\{\left[\frac{f(\varepsilon_i \lambda \sigma^{-1})}{1 - F(\varepsilon_i \lambda \sigma^{-1}) - (\varepsilon_i \lambda \sigma^{-1})}\right]\right\} \quad (4)$$

whereas ε = sum of v_i and u_i; σ = equation for $(\sigma_{v2} + \sigma_{u2})^{1/2}$; and λ = ratio of σ_u to σ_v.

F and f are standard normal density, and the evaluation distribution function over $(\varepsilon_i \lambda \sigma^{-1})$. Technical Efficiency ($TE$) scores range between 0 and 1, or $0 \leq TE \leq 1$. If the TE value is close to 1, then there is a greater technical efficiency achieved. The closer the efficiency value to 0, the more technically inefficient.

Price efficiency represents the second efficiency analysis. Price efficiency will be achieved if the ratio of the marginal product value of each input to the price is equal to 1. So, the formula used is as follows:

$$NPM_x = P_x, \text{ or}$$

$$\frac{NPMx}{Px} = 1 \quad (5)$$

Or in other forms, such as the following:

$$\frac{b.Y.Py}{X} = Px \quad (6)$$

or

$$\frac{b.Y.Py}{X.Px} = 1 \tag{7}$$

whereas b is elasticity of production; Y is the average organic cabbage production; Py is the average production price Y; X is the average factor of production X; and Px is the average factor price of production X.

The conditions used are as follows:

If $\frac{NPMx}{Px} > 1$, then the use of production factor x is not efficient, and the factor of production x needs to be included in order to achieve efficiency. If $\frac{NPMx}{Px} < 1$, the use of factor x of production is inefficient, and to achieve efficiency, the factor x of production must be reduced.

Economic efficiency is the third efficiency analysis. An economically efficient production process uses inputs and costs as little as is feasible to create a given quantity of output, or uses inputs and costs specifically designed to achieve the highest possible output. When technological and pricing efficiency are attained, economic efficiency can follow. We calculate the economic efficiency in the following ways:

$$EE = TE \times PE \tag{8}$$

whereas EE = economic efficiency; TE = technical efficiency; and PE = price efficiency.

Before analyzing marketing efficiency, we calculate the marketing margin using the following method:

$$M = PP - SP \tag{9}$$

where M is marketing margin; PP = purchase price; and SP = sales price.

Then, to calculate marketing efficiency, the following formula is used (Miftah et al. 2023; Onyemauwa 2010):

$$ME\ \frac{MEx}{RP} \times 100\% \tag{10}$$

where ME = marketing efficiency; MEx = marketing expenses; and RP = retail price.

The categories of efficiency calculation results are as follows: $ME < 50\%$ = efficient and $ME > 50\%$ = inefficient.

3. Empirical Results and Discussion

The respondents in this research were 60 farmers of the organic cabbage commodity in the Kopeng agropolitan area. The ages of respondents in this study ranged from 24 to 60 years old. However, most of the farmers are elderly, within the age range of 45–60 years, as many as 60%. The educational level of the respondents was 15% who had not completed elementary school, 40% who had completed elementary school, 35% who had completed junior high school, 9% who had completed high school, and the final 1% had diplomas or bachelor's degrees. However, there is no need to doubt the experience of organic cabbage farmers in the Kopeng agropolitan area, because most have more than 30 years of experience.

The average area of land owned by farmers is 0.70 ha, consisting of owned, rented, and cultivated land. In recent years, farmers in agropolitan areas have realized how important it is to preserve agricultural land, considering the high dependence on chemical fertilizers. Another problem is the difficulty of obtaining subsidized chemical fertilizers, and the selling prices of organic commodities tend to be higher. The cost of chemical fertilizers also continues to increase. Using fertilizer in agricultural commodities fertilizes on the soil so that the harvest is more abundant (Le Campion et al. 2020; Thakur et al. 2022). However, it turns out that agriculture's dependence on chemical fertilizers has a negative impact on farmers themselves. Apart from decreasing soil fertility quality, the input costs that they have to pay also increase. With this awareness, many farmers switch from inorganic to organic farming. Their awareness motivated them to switch to organic farming.

The average cabbage farming uses labor from the farmer's family, which aims to save input costs. The marketing process of cabbage agricultural products actually varies. Some are sold to middlemen, and some are sold directly to the market (Cortes et al. 2023; Nandi et al. 2017; Vorley et al. 2009). Especially for organic cabbage, the average farmer hands over their harvest to local organic traders who already have partners with several supermarkets. This is because organic cabbage farmers have been unable to sell their crops independently, because they do not have organic commodity certification.

3.1. Production Efficiency Analysis with Stochastic Frontier Analysis Approach

Efficiency calculations in this study depict the actual field conditions. Because the efficiency calculation uses a natural logarithm as the model, the findings yield a coefficient of elasticities. The results of efficiency estimation in this study are as follows.

Table 1 shows the results of the initial inputs used and transformed into natural logarithms in the form of percentages. The following explains the elasticity coefficient for each input used in organic cabbage farming in the Kopeng agropolitan area.

Table 1. Production efficiency estimation of cabbage farming.

No.	Variables	Coefficient	t-Ratio
1.	Constanta	3.871	3.074
2.	$LnLA_1$	0.439	2.661
3.	$LnSd_2$	0.318	2.236
4.	$LnOF_3$	0.542	5.140
5.	$LnOP_4$	0.025	0.243
6.	$LnLb_5$	0.203	0.638
7.	The Average Technical Efficiency Score	0.690	

Sources: data processed.

The elasticity coefficient for land area input is 0.439, meaning that when farmers increase the input area of land by 1%, farmers will receive an increase in production yield by 0.439%, assuming ceteris paribus. The efficiency in running a farming business can be influenced by several factors, namely land area, seeds, labor, fertilizers, pesticides, and others. Organic cabbage farming also requires a combination of several production factors to achieve high productivity. The land area has a positive and significant effect on increasing agricultural production of cabbage in Kopeng. The organic farmers in Kopeng rent land to cultivate organic cabbage. The location of their land will influence the number of plants that can be planted. Narrow land forces farmers to make efficient use of their land, and conversely, with larger land, farmers can cultivate more cabbage. The area of agricultural land will influence the scale of business, ultimately influencing whether or not a farming business is efficient. Land area is one of the most important factors in organic cabbage farming. The availability of land in farming will affect the production of the farm. However, to increase land area is not easy (Lu et al. 2022; Santpoort 2020). Not all organic cabbage farmers have their own land, and the land they own is partly rented.

The coefficient of elasticity for seedling input is 0.318. This means that when the farmer adds 1% of the seed input, the farmer will receive an increase in production yield by 0.318%, assuming ceteris paribus. The seed production factor is also one of the important factors in organic cabbage farming. Seeds affect production with a coefficient value of 0.318. The quality of seedlings will affect quality of of the harvest from organic cabbage. Therefore, the selection of seedlings must be of really good quality (Le Campion et al. 2020; Ogutu et al. 2014). Organic farming practices emphasize that the use of organic seeds is free from synthetic chemicals. Producing organic seeds ensures that cabbage plants are cultivated from the beginning with organic principles, maintaining the integrity of organic certification. Organic cabbage farmers often prioritize seed varieties according to whether they are suitable for organic growth conditions, including resistance to pests and diseases common in organic systems. Farmers can choose and adapt varieties to their growth conditions by producing their seeds, resulting in more prosperous and resilient harvests (Bennett et al. 2021; Boutagayout et al. 2023). The production of organic cabbage seeds is carried out in-house in the Kopeng agropolitan area. Providing quality seeds is important for farmers to increase their productivity. By providing your own seeds, production costs can be minimized.

Organic fertilizer in organic cabbage farming affects production with a coefficient value of 0.542. This means that when farmers add the input of organic fertilizer by 1%, farmers will receive an increase in production yield by 0.542%, assuming ceteris paribus. In organic cabbage farming, fertilizer is one of the factors that play an important role in maintaining plant fertility. The fertilizer that is used is certainly not chemical fertilizer, but organic fertilizer, of which the average is manure (Hossain et al. 2021; Jiang et al. 2022). The use of fertilizer must certainly be in accordance with the dose in order to provide optimal results. Fertilizers should be applied in the right amount or concentration to meet the nutritional needs of plants without causing negative effects such as nutrient imbalances, soil degradation, or environmental pollution. Using fertilizers at the correct dosage ensures that plants receive adequate nutrients for healthy growth and development, leading to optimal yields. Self-processed organic fertilizer positively and significantly influences cabbage production in the Kopeng agropolitan area. Currently, around a thousand hectares of land are processed with organic fertilizer. Three farmer groups in Kopeng have started making and using pure organic fertilizer. The regional government provided agricultural equipment and other supporting facilities worth more than IDR 1 billion, which were handed to the farmer group.

In organic cabbage farming, pesticides have a positive but not significant influence on organic cabbage production. Pesticides are also an important factor in agriculture because they are used to eradicate pests. The use of pesticides must also be in accordance with existing doses so that it will not damage plants. Pesticides used in organic cabbage farming are organic pesticides (Chala 2022). The demand for pesticides in Kopeng is significant because not all agricultural land is managed organically.

The coefficient of elasticity for labor input is 0.203. This means that when farmers increase labor input by 1%, farmers will see an increase in yield from their output by 0.103%, assuming ceteris paribus. No less of an important factor in the production of organic cabbage is labor. In this case, labor influences production with a coefficient value of 0.203. Labor in farming plays a role in the cultivation process, from tillage, planting, care to harvesting (Karunathilake et al. 2023; Yang and Li 2023). Farm labor is required to prepare soil in initial stage. This activity includes plowing, weeding, soil structure management, and initial fertilization. Farm workers are responsible for preparing the soil for seed or seedling planting. They will proceed with planting seedlings or seeds, ensuring proper spacing and depth for each crop type. Throughout the plant growth period, farm laborers must perform various maintenance tasks. The harvesting stage demands hard work from farm laborers to harvest mature crops promptly. They must be skilled in identifying the ideal harvest time and employing efficient harvesting techniques to ensure high-quality yields (Lestari et al. 2022).

3.2. Technical Efficiency of Organic Cabbage Farming

The results of technical efficiency calculation show that organic cabbage farming in the Kopeng agropolitan area is technically inefficient with an efficiency value of $0.690 < 1$. A technical efficiency value of less than 1 indicates excessive use of inputs and needs to be reduced to achieve efficiency (Ashrit 2023; Ji et al. 2023). The factor of production that needs to be reduced is the excessive use of labor. Although most farmers use labor from their own families, they must also estimate the costs spent for the time and energy used. The excessive production factors will actually have the opposite impact on agricultural production because of the enactment of the law of diminishing return (DeBoe 2020). When the use of a production factor is optimal, adding these inputs can reduce production. Organic cabbage farmers must be able to estimate the use of production inputs appropriately in order to achieve technical efficiency.

3.3. Price Efficiency of Organic Cabbage Farming

Price efficiency shows the relationship between the marginal product value of input and the marginal product value of output (Mohajan 2021).

The production factors for organic cabbage farming used in the Kopeng agropolitan area show that the overall results of the production factors used as variables do not reach the efficiency price (Table 2). This is shown by the calculation results of production factors with the value of price efficiency of more than 1. The result of calculating the efficiency of the price of production factors of land area obtained a result of 1.32. This means that the production factors of land area are not efficient based on the price aspect. The calculation of price efficiency obtained a result of more than 1. To be able to produce cost-efficiently, cabbage farmers must increase the use of land area.

Table 2. Results of Calculation of Price Efficiency of Organic Cabbage Farming.

No.	Production Factors	Price Efficiency	Information
1.	Land	1.32	inefficient
2.	Plant seeds	2.45	inefficient
3.	Organic Fertilizer	4.34	inefficient
4.	Organic Pesticides	1.54	inefficient
5.	Workforce	5.67	inefficient
	Price Efficiency	35.32	

The calculation of the factors of price efficiency of labor production obtained a result of 2.45. This data shows that the use of seed production factors in organic cabbage farming is not in the form of efficient price. Therefore, to achieve price efficiency, seeds must be added. In running an organic cabbage farm, price efficiency for labor is calculated based on the number of seeds planted by farmers.

Calculating the efficiency of the price factor of organic fertilizer production obtained a result of 4.34. This means that the use of organic fertilizer production factors is not efficient based on the price aspect. The price efficiency calculation result is derived from more than one production factor. To produce cost-efficient production, cabbage farmers must increase the use of organic fertilizers. The calculation of the efficiency price of organic pesticide production factors obtained a result of 1.54. This figure shows that organic pesticide production factors in organic cabbage farming does not reach a price-efficient price. Therefore, it is necessary to add organic pesticides to achieve price efficiency.

The calculation of the efficiency of the price factors of labor production obtained a result of 5.67. This means that the use of labor production factors is not efficient based on the price. The calculation result of price efficiency revealed a result of more than 1. To produce organic cabbage cost-efficiently, organic cabbage farmers must increase the use of labor.

The price efficiency of organic cabbage farming shows that 35.32 > 1, which means it is not price efficient yet. The efficiency value is above 1, meaning that the increase of production inputs in organic cabbage farming is necessary. The addition of production factors is certainly not easy considering the limited capital faced by farmers. Innovation is needed in the provision of production inputs such as fertilizers and pesticides. Farmers can mix organic fertilizers independently; however, the obstacle is the availability in fertilizer-making materials. Government assistance includes facilitation training and access to raw materials for making organic fertilizer. In addition to fertilizers, innovation is also needed in the manufacturing of organic pesticides. It also requires training and mentoring so that farmers do not have to buy organic pesticides.

3.4. The Calculation of Economic Efficiency of Organic Cabbage Farming

Economic efficiency is a condition in which production that uses lower inputs and costs is able to produce a certain amount of output, or by using certain inputs and production costs, which are capable in producing maximum output. Economic efficiency can be achieved when technical efficiency and price efficiency are achieved. The calculation of economic efficiency in this study is as follows:

EE = technical efficiency × price efficiency

$$EE = 0.690 \times 35.32 = 24.37$$

The result of the calculation of economic efficiency in organic cabbage farming is 24.37. The results show that economic efficiency is more than 1, which means that organic cabbage farming in the Kopeng agropolitan area is not economically efficient yet. Increasing the usage of factors of production is required to attain economic efficiency. An efficiency value of more than 1 indicates that it is necessary to increase production inputs to achieve economic efficiency (Boltianska et al. 2020). As explained in previous studies, economic efficiency has not been achieved yet when technical and price efficiency are not achieved.

3.5. The Marketing Channel of Organic Cabbage in the Kopeng Agropolitan Area

Based on the results of research in the field, there are two Marketing Channels for organic cabbage commodities in the Kopeng agropolitan area. First, there is the Marketing Channel shown in Figure 2a. Then, in the marketing process of organic cabbage in Marketing Channel II, farmers sell their crops directly to collectors who specialize in selling organic vegetables, and then collectors sell them to wholesalers. These wholesalers directly sell them to consumers. At the same time, the second organic cabbage Marketing Channel is as seen in Figure 2b.

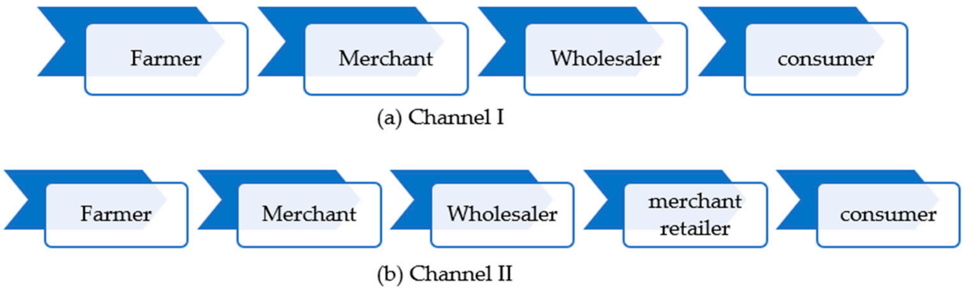

Figure 2. Organic cabbage Marketing Channels in the Kopeng Agropolitan area.

The process of marketing organic cabbage in Marketing Channel II is the harvest of organic cabbage from farmers, which is sold to collecting merchants. Then, the collecting merchants sell organic cabbage to wholesalers. Then, wholesalers sell it to merchant retailers. Then, the retailer sells it directly to consumers.

3.5.1. Marketing Margin of Organic Cabbage Farming

The marketing margin of organic cabbage is the difference between the selling and purchase prices at the level of farmers, gatherers, and wholesalers. Profit margin is the difference between marketing margin and organic cabbage marketing costs. The results of the calculation of organic cabbage marketing margin are presented in the table below.

The selling price of organic cabbage in Marketing Channel I is cheaper than in Marketing Channel II (see Table 3). This condition causes the margin in Marketing Channel I to be lower than in Marketing Channel II because the margin value for Marketing Channel I is IDR 12,500, while for Marketing Channel II it is IDR 15,000.

3.5.2. The Analysis of Marketing Efficiency of Organic Cabbage Farm

Marketing is one of the keys in the agricultural sector. If marketing is successful, everyone involved will profit. A product's marketing performance can be ascertained by examining its marketing efficiency. To find out whether Marketing Channels I and II for organic cabbage are efficient or not, the Marketing Channels can be calculated to find whether the EP value > 50%; if it is, then the organic cabbage marketing system is considered inefficient, and if the EP value is < or = 50%, the organic cabbage marketing system is considered efficient.

Table 3. Marketing Margin of Organic Cabbage in the Kopeng Agropolitan Area.

Marketing Line	Purchase Price (IDR/kg)	Profit Margin
Channels I		
Collecting merchants	10,000	7000
Wholesalers	17,000	5500
Consumer purchase price	22,500	
Marketing Margins	12,500	
Channels II		
Collecting merchants	10,000	7000
Wholesalers	17,000	5000
Reseller	22,000	3000
Consumer purchase price	25,000	

The marketing process of organic cabbage in Marketing Channels I and II is efficient because it reaches < 50% (see Table 4). The field analysis results above show that the marketing process which is carried out by organic cabbage farmers still depends on collecting traders/middlemen. Marketing Channel I in organic cabbage starts from farmers who sell crops to middlemen. Then middlemen sell to wholesalers, and in the final stage the wholesalers sell to consumers. Meanwhile, Marketing Channel II shows that farmers sell their crops to middlemen. Then middlemen sell to wholesalers, and wholesalers sell them to retailers, who then sell to consumers. Organic cabbage marketing depends on traders because organic farmers in the Kopeng Agropolitan Area do not have organic certificates, so they cannot sell their products independently. This is because the process of managing certificates is not easy and requires quite expensive costs.

Table 4. The Calculation Results of Organic Cabbage Marketing Efficiency.

Commodity	Distribution Channel	Marketing Efficiency
Organic cabbage	Channels I	2.02%
	Channels II	3.91%

The marketing efficiency of organic cabbage farming in Marketing Channels I and II can be said to be efficient because the value is below 50%. Nevertheless, farmers still obtain little profit compared to the risks that must be faced, which are very great. Organic farming is not an easy thing. Organic cabbage cultivation requires extra energy and costs because obtaining organic production inputs is difficult (Jeločnik and Subić 2020). In addition, the use of organic fertilizers and pesticides will certainly have different results from chemical fertilizers and pesticides. Sometimes the use of organic fertilizers and pesticides that do not follow the recommended dose will have a lesser impact than optimal results.

4. Conclusions

Based on the results and discussion above, it can be concluded that organic cabbage farming in the Kopeng Agropolitan area is greatly influenced by several production factors ranging from land area, seeds, organic fertilizer, organic pesticides, and labor. The analysis of economic, technical, and production efficiency shows that the results still need to be more efficient, so that it is necessary to make more optimal use of production inputs. In terms of the marketing side, the results are efficient. Organic cabbage marketing has two marketing channels, and both are efficient, but the benefits received by farmers could be more optimal. Farmers need an appropriate composition of production inputs to achieve efficient organic cabbage farming. A mentoring program for farmers regarding the proper procedures for using inputs is necessary. The government needs to provide training in making organic fertilizers and pesticides in order to reduce production costs. An assistance system is needed for the arranging of organic product certification so that farmers can sell their crops to receive maximum profits.

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