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The Empowerment of Red Onion Farmers in Increasing Multiplier Effect of Income

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Abstract

The problem in this study is that many red onion farmers in Brebes Regency are still not prosperous because the red onion farming that is being carried out is still inefficient, so they cannot provide optimal results. This study aims to analyze the efficiency level of red onion farming in the Brebes Regency and formulate strategic priorities for improving the welfare of red onion farmers in the Brebes Regency. The analytical method in this study is a mixed method between quantitative descriptive, namely the Cobb - Douglas production function with a stochastic frontier approach. The second analysis technique used is Analytical Hierarchy Process (AHP). The result shows that the average value of the technical efficiency of red onion farming is 0.718. Reducing the use of production factors in red onion farming can be done by reducing the use of production factors of NPK fertilizers and pesticides. The calculation result of the price efficiency of the production factor used is still more than 1, which is 46.60. The result obtained from the calculation of economic efficiency for red onion farming in the Brebes Subdistrict is 33.45. The calculation result of the economic efficiency is more than 1, meaning that red onion farming in Brebes Subdistrict is not yet economically efficient. The most prioritized criterion in empowering red onion farmers in Brebes Regency is government policy, with a weight value of 33.3%. The most prioritized alternative in the Shallot Farmer Empowerment Strategy in Brebes Regency is the policy support for determining the cost of goods sold with a weight value of 17.4%.

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INTRODUCTION

Red onion is a commodity that Indonesian households widely consume as a spice for daily cooking. Given the high consumption needs, the production of red onion in Indonesia has increased yearly. The Central Statistics Agency (BPS) noted that red onion production in Indonesia reached 1.82 million tons in 2020 (Central Statistics Agency, 2021). The number increased by 14.88% year-on-year. Red onion production showed a fluctuating trend over the past year. In January 2020, red onion production was recorded at 152.93 thousand tons. The number increased by 9.1% to 166.85 thousand tons in February 2020 and decreased by 22.95% to 128.55 thousand tons in April 2020. Red onion production rose 15.15% in May to 148.03 thousand tons but dropped by 14.3% to 126.92 thousand tons a month later. Afterward, red onion production jumped to 198.89 thousand tons in August 2020. However, production fell again for three months from September-November 2020. The number increased again in December 2020, along with data on Indonesia's red onion production according to the largest producing province.

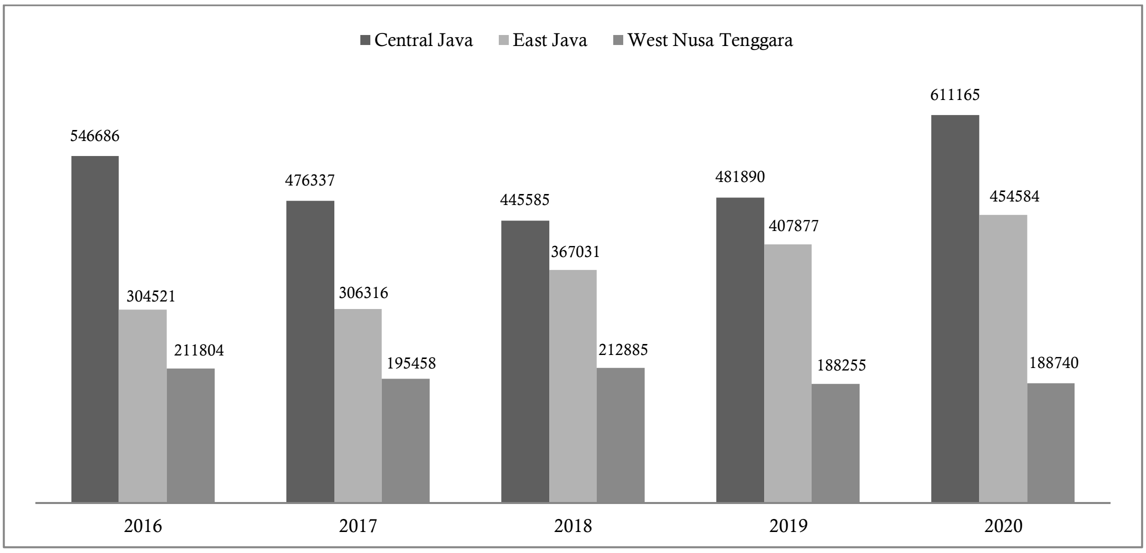

Figure 1. Red Onion Production by Province with the largest production in Indonesia 2016-2020 (Tons).
Source: Central Bureau Statistics, 2021

Based on the data from the Central Statistics Agency (2021) in Figure 1 above, Central Java Province is the highest producer of red onion in Indonesia, which is 611.17 thousand tons in 2020. This amount contributes 33.86 percent to national red onion production.

The population of the Brebes Regency was 1,809,096 in 2019, with 908,786 male residents and 900,310 female persons. Even if the quantity and percentage have fallen, Brebes Regency residents still work primarily in agriculture. The workers employed in the agricultural sector made up 31.66 percent of the overall employment as of August 2019. Compared to August 2018, when this condition consumed 33.63 percent of the workforce, this condition declined. The number of employees in the service and trade industries also fell.

On the other hand, the number of workers in the industrial sector has increased, so the percentage has also increased (Central Statistics Agency, 2021). Red onions are an essential inseparable part of the household's daily life. The function is as a seasoning for cooking. Besides, those red onions contain beneficial nutrients, which are frequently used as a traditional medicine because red onion is a non-substituted spice. (Ministry of Agriculture, 2016; Setiawan & Wilujeng, 2016; Muhaimin & Abdul, 2017).

The harvest area and production of red onions in Brebes Regency from 2018 to 2020 have increased, and in 2020 the harvest area reached 38,951 ha from 29,151 ha in 2019, with an increase in production from 3,029,328 tons in 2019 to 3,835,111 tons in 2020. Red onion production in Brebes Regency in 2012-2020. In 2012, the highest red onion production owned by Larangan Subdistrict was 549,541 Kw; in 2013, it was 588,002 Kw; then, it reached 1,004,865 Kw in 2014. In 2015, the production of red onion in Larangan District was 850,730 Kw, it reached 876,924 Kw in 2016, and there was a decrease in red onion production in Brebes Regency in 2017, for Larangan Subdistrict only produced 490,419 Kw and the highest production in 2017 was Wanasari Subdistrict of 587,900 kw. In 2018, the total production of red onion in Brebes Regency was 3,037,730 Kw, with the highest number produced from the Larangan Subdistrict of 688,450 Kw, while the lowest number was in 2018, only 11,800 Kw. In 2019, Larangan Subdistrict still contributed the highest production of 771,860 Kw. In 2020, Wanasari District had the highest production level of 1.006,512 Kw. The considerable potential of red onion is an excellent condition to positively impact the realization of the welfare of the red onion farming community in the Brebes Sub-district, Brebes Regency. However, it seems that it is still far from expectations when many farmers live in less prosperous conditions.

The productivity of red onion in Brebes Regency decreased during 2012–2020. Tsurayya & Kartika, (2015) stated that the decline in the productivity of red onion is due to a lack of awareness to control plant pests. Meanwhile, Aldila et al., (2015) stated that the low competitiveness of Indonesian red onion is caused by the high cost of farming, especially for seeds, labor, and pesticides. The high production costs incurred, which reached 90% of total revenue, caused the selling price of red onion also to tend to be high.

The competitiveness level of farming businesses can be measured based on technical, economic, and allocative efficiency. The ability to combine the use of technical inputs at a minimum cost level will affect the efficiency of entrepreneurs or farmers (Nurhapsa et al., 2017). Technically, if the production process is carried out inefficiently, it will fail to realize maximum productivity. Whereas if the amount of input required to produce the good is not optimal, as shown by the marginal revenue product that is not proportionate to the marginal input cost used, the manufacturing process is considered highly inefficient. Inefficient input use will affect the level of farm productivity, which will also affect the level of commodity competitiveness (Tinaprilla et al., 2017). However, there are still many onion farmers who are not prosperous because red onion farming, which they do, has not provided maximum profit. So there is a need for empowerment for red onion farmers.

Research on the empowerment of red onion production and government policies regarding the implementation of local government programs that participate in the welfare of the community, especially red onion farmers in the Brebes Subdistrict. Jeckoniah et al., (2014) stated that efforts to improve welfare that focus on the accumulation of income and assets have the potential to empower women. Therefore, governments, non-governmental organizations, and development programs that support women's empowerment should improve their approaches to ensure that the poorest also have the opportunity to participate in the red onion value chain and other development interventions.

Rosyadi & Purnomo, (2014) stated that the research location for red onion farming does not provide significant benefits to the farmer's household economy. The higher selling prices at the retail and wholesale levels do not significantly impact agricultural profits in the study area. Red onion farming carried out by the research area farmers are inefficient. The red onion marketing network in the research area is relatively long, consisting of 4 marketing channels.

Research on farming efficiency has been carried out by many previous researchers but still produces varied findings. The results of previous studies explained that red onion farming is still challenging to achieve a level of efficiency, especially technical efficiency (Charhouni et al., 2018; Ndirangu, 2021; Tegegne et al., 2014).

Other studies explain that the efficiency of red onion farming can be achieved if the input allocation is appropriate (Baree, 2012; Huy & Nguyen, 2019; Yan et al., 2018; Ahmad & Wibowo, 2021; Noer et al., 2020). Studies on the empowerment, production efficiency, and profitability of red onion, especially the farmers, show different results, namely the study's results have not been able to prosper the farmers (Sumarno et al., 2020; Maryanto et al, 2018; Sulistyorini, 2020). With the empowerment of red onion as described above, the Subdistrict Government of Brebes Regency is expected to change the fate or welfare of its people, which in this case are red onion farmers to be better. The urgency of this research is that efforts are needed to improve the welfare of red onion farmers by empowering them through the optimization of farming efficiency so that it can become the novelty of this research.

This study aims to: 1) analyze the efficiency level of red onion farming in the Brebes Regency and 2) formulate strategic priorities for improving the welfare of red onion farmers in the Brebes Regency.

RESEARCH METHODS

This research uses mixed research methods, which is in conducting this study, the researchers use a combination of quantitative and qualitative methods. This research was conducted in Brebes Subdistrict, Brebes Regency, because this area is the fourth largest red onion production center in Brebes Regency after Larangan, Wanasari, and Bulakamba Subdistricts. In addition, Brebes Subdistrict is focused on being a research location since Brebes Subdistrict has a land area of 5.558 Ha. in 2020 for the type of red onion in Brebes Regency and has significant productivity in 2020, which is 53.2661 Kw. in 2020 with average of 95.84 Kw/Ha. The population in this study were all red onion farmers in Brebes Regency, totaling 10,221 farmers. The sampling method used in this research is random quota sampling. The number of samples in this study was 100 farmers.

The analytical technique used to analyze the data in this study is a mixed method between quantitative descriptive, namely the Cobb - Douglas production function with a stochastic frontier approach, to identify the factors that influence the production of red onion and analyze the efficiency level of red onion production. In addition, this study uses a qualitative descriptive analysis method to identify the empowerment of red onion farmers with the Miles and Huberman method using the validity of data triangulation of source data.

With the application of the frontier production function, the Cobb- Douglas function is used to analyze the factors that can affect the output or in this case is the farming production. In farming research using the Cobb - Douglas production function, it can be written in a mathematical model as follows:

$$\text{Ln } Y = \beta 0 + \beta 1 \text{ Ln}X1 + \beta 2 \text{ Ln}X2 + \beta 3 \text{ Ln}X3 + \beta 4 \text{ Ln}X4 + \beta 5 \text{ Ln}X5 + \beta 6 \text{ Ln}X6 + u \quad \text{....(1)}$$

Where a is Intersep, Ln Y is the Natural log of the resulting production; Ln X1 is the Natural log of land area; Ln X2 is the Natural log of seeds; Ln X3 is the Natural log of organic fertilizer; Ln X4 is Natural log of chemical fertilizer; Ln X5 is Natural log of pesticide; Ln X6 is Natural log of labor. β1 – β6 is the Regression coefficient; n is the number of production factors, and u is the Intruder error.

There are three efficiency tests, namely technical efficiency (ET), price or allocative efficiency (EH), and economic efficiency (EE), which occur when technical efficiency and price efficiency are achieved. This efficiency test is carried out to see a combination of certain production factors or inputs to get maximum results or output.

Technical efficiency is a quantity that indicates the ratio between actual production and maximum production. Technical efficiency can be calculated using the formula (Soekartawi, 2003).

$$ET = Y_i / Y_i^* \quad \text{..(2)}$$

Where ET is the level of technical efficiency (production), Y_i is the amount of production (output) i, Y_i^* is the estimated amount of production in the observation i—obtained through the Cobb-Douglas frontier production function.

The measurement of the level of technical efficiency of red onion in this study is the output result of the Frontier software version 4.1c. Technical efficiency decision-making is ET = 1, and farming is technically efficient if the average technical efficiency is equal to one. ET ≠ 1, if the average technical efficiency is not equal to one, farming is technically inefficient.

According to Shinta (2011), price efficiency helps measure the success level of farmers in carrying out their farming, and the aim is to achieve maximum profit. Price efficiency can be achieved if farmers can make the value of each production factor's marginal product (NPM) equal to the input price (Px). Mathematically, according to Soekartawi (2003), it can be written as follows:

$$\frac{bi\,.Y\,.Py}{Xi\,.Pxi} = 1 \text{ or } \frac{NPMx}{Px} = 1 \quad (3)$$

Where Px is price factor x, X is Total production factor X, bi is Production elasticity, Y is Total output, and Py is Output price. In practice, the average values of y, Py, X, and Px are calculated so that it can be written as follows:

$$\frac{bi\,.\bar{y}\,.\overline{Py}}{\overline{Xi}\,.\overline{Pxi}} = 1 \quad (4)$$

After getting the results of the Marginal Product Value (NPM) of each input or production factor, the next step is to calculate the average price efficiency as follows:

$$EH = \frac{NPM1+NPM2+NPM3}{3} \quad (5)$$

According to Soekartawi (2003), in reality, NPMx is not always the same as Px, but things that often happen are NPMx/Px > 1, which means that the use of factor x is not yet efficient. The addition of factor x is necessary to achieve efficiency. NPMx/Px 1 denotes inefficiency; factor x must be decreased to obtain efficiency. Economic efficiency is multiplying all technical efficiency with price efficiency (allocative) of all production factors or inputs. The economic efficiency of farming can be written as follows (Soekartawi, 2003):

$$EE = ET \times EH \quad (6)$$

Where EE is Economic Efficiency, ET is Technical Efficiency, and EH is Price Efficiency.There are three possibilities regarding the concept of efficiency according to Soekartawi (2003), namely: If the value of economic efficiency is greater than 1 (one), which means that maximum economic efficiency has not been achieved, so it is necessary to increase the use of production factors in order to achieve efficient conditions. Suppose the value of economic efficiency is less than 1 (one). This means that the efforts made are inefficient, so it is necessary to reduce the use of production factors. If the value of economic efficiency is equal to 1 (one). This means that efficient conditions have been achieved and have obtained maximum profits

The second analysis method is the Analytical Hierarchy Process (AHP). The Analytical Hierarchy Process (AHP) in this study is used to determine strategies by comparing several alternative options and developing priority programs to solve complex problems in a hierarchical form.

The first step is to determine the goals based on the existing problems. This research aims to formulate the empowerment of red onion farmers in the Brebes Regency.

The second step is to determine the criteria. The criteria are obtained from observations and discussions with key persons or people who are considered to honestly know and understand the problems of red onion farmers in the Brebes Regency.

The third step is to determine alternatives. Determining alternatives is the same as determining the criteria above. The alternatives are obtained from the key person. Besides that, these alternatives can also be obtained from similar previous studies and have similar problems. This case discusses the empowerment steps to improve the welfare of red onion farmers in the Brebes Regency.

The fourth step is distributing questionnaires to several respondents or key persons the researchers have selected. The fifth step is compiling a matrix of the average results obtained from some key persons. After that, the results are processed using expert choice version 11.0.

The sixth step is to analyze data processing results from expert choice version 11.0 to find the results of inconsistency and priority values. The last step is to determine the priority scale of the criteria and alternatives to achieve hierarchical variables to improve the welfare of red onion farmers in the Brebes Regency.

RESULTS AND DISCUSSION

In the analysis of the stochastic frontier production function, the regression coefficient is the coefficient of elasticity because the model is in the form of a natural logarithm (Ln) (Satiti, 2013). Estimating the stochastic frontier production function can be seen from the elasticity coefficient generated from the efficiency calculation Fadlli & Bowo (2018); Fadli & Magfirah (2022). The estimation result of the stochastic frontier production function can be seen in table 1 as follows.

Table 1. The Estimation Result of Stochastic Frontier Production Function

No.	Variables	Coefficient	t-ratio
1.	Constant	3.872	2.074
2.	LX_1	0.245	2.546
3.	LX_2	0.108	1.375
4.	LX_3	0.453	5.230
5.	LX_4	0.127	-0.247
6.	LX_5	0.118	0.641
7.	LX_6	0.215	-0.276
Average Technical Efficiency Value		0.718	
N		100	

Source: Data Processed, 2022

Based on table 1 obtained the research estimation result as follows:

$$LnPr = 3.872 + 0.245LnLh + 0.108LnBt + 0.453LnPO + 0.127LnPNPK + 0.118LnPs + 0.215LnTk + \varepsilon \quad .... (8)$$

Where LnPr is Red onion production, LnLh is Land Area, LnBt is Seeds, LnPO is Organic Fertilizer, LnPNPK is NPK Fertilizer, LnPs is Pesticide, LnTk is Labor and ε is Error term.

Based on estimation result above, it can be seen that the production input that has been estimated has previously been transformed into the form of a natural logarithm (Ln). Thus, the unit used in this study is in the form of a percent (%).

The coefficient value for the input of land area is 0.245, which means that if the input of land area is added/increased by 1%, the red onion production will increase by 0.245% by assuming that other variables are fixed (*ceteris paribus*).

The coefficient value for seed input is 0.108, which means that if the seed input is added/increased by 1%, the red onion production will increase by 0.108% by assuming that other variables are fixed (*ceteris paribus*).

The coefficient value for the input of organic fertilizer is 0.453, which means that if the input of organic fertilizer is added/increased by 1%, the red onion production will increase by 0.453% with the assumption that other variables have fixed values (ceteris paribus).

The coefficient value for the input of NPK fertilizer is 0.127, which means that if the input of NPK fertilizer is added/increased by 1%, the red onion production will increase by 0.127% with the assumption that other variables have fixed values (ceteris paribus).

The coefficient value for pesticide input is 0.118, which means that if the pesticide input is added/increased by 1%, the red onion production will increase by 0.118% with the assumption that other variables have fixed values (ceteris paribus).

The coefficient value for labor input is 0.215, which means that if the labor input is added/increased by 1%, the red onion production will increase by 0.215% with the assumption that other variables have fixed values (ceteris paribus).

The calculation result of the technical efficiency processed using Frontier Version 4.1 software obtained the average value of the technical efficiency of red onion farming of 0.718. This means that the number is less than one, which means that the use of production factors in red onion farming is not technically efficient, so reducing the use of production factors is necessary. Reducing the use of production factors in red onion farming can be done by reducing the use of production factors of NPK fertilizers and pesticides.

In general, farmers use approximately 61-70 kg of NPK fertilizer. The amount of use of NPK fertilizer is not following the recommendation. The farmers should be able to use 50-60 kg of NPK fertilizer because the use of NPK fertilizer is only done during the second follow-up (30-35 days after planting), and its use is also combined with other fertilizers. In the general use of pesticides, farmers use 5-6 liters of pesticides. This aims so that not many pests attack red onion plants. Usually, farmers spray pesticides 16 times per planting period. The intensity of pesticide spraying, according to the recommendation, is 13 times per planting period. This aims so that there are not too many chemicals attached to the red onion.

This is caused since red onion farmers in Brebes Regency provide too much input, causing a decrease in production. Red onion farmers in Brebes Regency are expected to be able to combine the use of inputs used, namely land area, seeds, organic fertilizers, NPK fertilizers, pesticides, and also labor to achieve efficiency in red onion farming.

Price efficiency shows the relationship between the input marginal product value (NPM) and the output marginal product value (NPM) (Nicholson & Snyder, 2021). In price efficiency, three possibilities occur: If the efficiency value is less than 1, then the use of production factor x is not efficient, and to achieve efficiency, the production factor x must be reduced. If the efficiency value is more than 1, then production factor x is not yet efficient, and to achieve efficiency, the production factor x must be added. If the efficient value is equal to 1, then production factor x is efficient and maximum profit is obtained.

Table 2. The Calculation Result of the Price Efficiency of Red Onion Farming

No.	Production Factors	The Calculation Result of Price Efficiency	Explanation
1.	Land Area	2.76	Not Efficient
2.	Seeds	8.69	Not Efficient
3.	Organic Fertilizer	6.43	Not Efficient
4.	NPK Fertilizer	4.67	Not Efficient
5.	Pesticide	18.33	Not Efficient
6.	Labor	5.72	Not Efficient
	Price Efficiency	46.60	

Source: Data Processed, 2022

Table 2 reveals that the Brebes Subdistrict's employment of red onion farming production factors indicates that price efficiency has not been achieved in terms of the production factors' overall performance. The calculation result of the pricing efficiency of the production factors shows that it is still greater than 1.

The calculation's output for the land area's production factor price efficiency is 2.76. Based on the price aspect, this indicates that the usage of the production component of land area has not been practical. The calculation result of the price efficiency is more than 1. To carry out cost-efficient production, red onion farmers must increase the use of the land area.

From the observation result in the field, to run red onion farming in terms of price efficiency, the land area is calculated based on the rental price of the land. In general, the land owned by red onion farmers in Brebes Subdistrict is leased, which is only approximately 11.000-20.000 m², and the rental fee is around 8 million-15 million per year. The rental fee borne by red onion farmers varies in price levels. The more land you rent, the more expensive the rent.

The price efficiency of the seed production factor was calculated to be 8.69. It thus indicates that adopting price-based seed production variables has not been effective. The price efficiency calculation's output is more than 1. Red onion farmers must utilize more seeds and seedlings to conduct cost-effective production. The observations result in the field, and red onion farmers use seeds ranging from 5-11 quintals for one planting season. The type of seed commonly used by red onion farmers in the Brebes Subdistrict is Bima. The price of seeds ranges from 4 million-7 million per Kw. The limited capital owned by red onion farmers impacts the number of seeds used.

The calculation result of the price efficiency of organic fertilizer production factor obtained the result of 6.43. This figure shows that using organic fertilizer production factors in red onion farming is inefficient. Therefore, it is necessary to add organic fertilizer to achieve price efficiency.

The use of organic fertilizer by red onion farmers is approximately 60-70 kg for the first follow-up (12-17 days after planting). The price of organic fertilizer varies. For subsidized organic fertilizer, it is around Rp. 1000 -Rp. 2,000, while the non-subsidized organic fertilizer is approximately Rp. 5.0000-Rp. 100,000. The fact found in the field is that most red onion farmers in Brebes Subdistrict use subsidized organic fertilizers because the costs incurred are not too large.

The pricing efficiency of the NPK fertilizer production factor was calculated and came up with a result of 4.67. Therefore indicates that, in terms of price, the usage of the NPK fertilizer production factor is inefficient. The price efficiency calculation's output is more than 1. Farmers of red onions must use more NPK fertilizer to produce their crops cost-effectively.

Based on field observations, red onion farmers use NPK fertilizer during the second follow-up (20-36 days after planting). The amount of NPK fertilizer used by red onion farmers ranges from 61-70 kg. NPK fertilizer is more expensive than organic fertilizer, ranging from Rp. 150,000-Rp. 350,000. Almost all red onion farmers reduced their use of NPK fertilizers. It is done to limit the capital needed for the production process.

The pricing effectiveness of the pesticide production factor was calculated to be 18.33. It also indicates that, in terms of cost, pesticide manufacture has not been cost-effective. Price efficiency has a calculation result more significant than 1. Farmers of red onions must use more pesticides to produce their crops cost-effectively. (Berhan, 2015).

Based on field observations, red onion farmers use approximately 5 liters of pesticides. The application of pesticides is adjusted to the number of pests attacking the crop. Pesticide application is adjusted to the number of pests invading. When many pests attack, red onion farmers apply pesticides about once every three days, but if few pests attack, farmers will apply pesticides about once a week. The types and prices of pesticides are very diverse. The pesticides that red onion farmers usually use are Tenano, Ripcord, Oblivion, and Marshal pesticides. This is because the three types of pesticides are more effective at eradicating pests. The price of the three types of pesticides ranges from Rp. 300,000-Rp 600,000.

The calculation result of the price efficiency of labor production factor prices is 5.72. This figure shows that the use of labor production factors in red onion farming is not yet efficient in terms of price. Therefore, increasing the number of workers is necessary to achieve price efficiency. In carrying out red onion farming in terms of efficiency, the price for labor is calculated based on the number of workers employed during the farming process.

The fact found in the field is that the workers employed by red onion farmers are from outside, not from the family. On average, labor is used during land preparation, fertilization, and harvesting. The number of workers used when preparing the land is approximately 35 people, fertilizing is about 17 people, and harvesting is about 12 people. The wages given by red onion farmers depend on the process. Wages at the time of land preparation range from 50 thousand-60 thousand, fertilization is approximately 60 thousand, and harvest is between 70 thousand-100 thousand.

Economic efficiency is a production condition that uses fewer inputs and costs and can produce a certain number of outputs, or by using specific inputs and costs can produce maximum output. Economic efficiency can be achieved if technical and price efficiency is achieved. Economic efficiency can be calculated in the following way (Soekartawi, 2003):

EE is Technical Efficiency (ET) x Price Efficiency (EH). So So, the calculation of economic efficiency is 0.718 x 46.60 = 33.45. The result obtained from the calculation of economic efficiency for red onion farming in the Brebes Subdistrict is 33.45. The calculation result of the economic efficiency is more than 1, meaning that red onion farming in Brebes Subdistrict is not yet economically efficient. To achieve economic efficiency, it is necessary to add to the use of production factors so that the red onion farming business in Brebes Subdistrict achieves economic efficiency.

The analysis of AHP (Analytical Hierarchy Process) in this study is used to formulate strategy priorities for empowering red onion farmers in Brebes Regency. The components used for AHP analysis in this study include several criteria and alternatives based on the literature review results, previous research, and interviews with predetermined and competent vital persons in agriculture. Five key persons are involved in this study: the Department of Agriculture of Brebes Regency, Agricultural Extension of Brebes Regency, Red Onion Farmer Group, Red Onion Farmers, and Agricultural Expert Lecturers. In the following, the results of the analytical hierarchy process are presented using the Expert Choice 11 program:

Based on the calculation of the analytical hierarchy process on all the criteria for the empowerment strategy of red onion farmers in Brebes Regency with the Expert Choice 11 program, the following result is obtained:

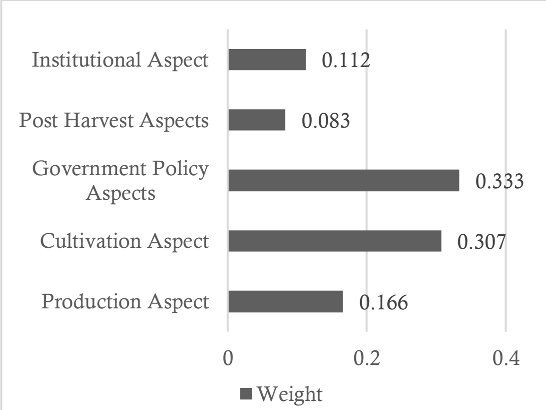

Figure 3. AHP Output of All Criteria for Empowerment of Red Onion farmers in Brebes Regency
Source: Primary data processed, 2022

Based on Figure 3, it can be explained that the most prioritized criterion in the empowerment strategy of Red Onion farmers in the Brebes Regency is government policy, with a weight value of 33.3%. Then, the second priority criterion is cultivation, with a weight value of 30.7%. Meanwhile, the last priority criterion is post-harvest, with a weight value of 8.3%. From the calculation result of the Analytical Hierarchy Process (AHP) with the expert choice 11 program, the inconsistency ratio result is 0.06, which means that the answers given by the key persons are consistent.

Based on the calculation of the analytical hierarchy process on the production criteria with the expert choice 11 programs, the following result is obtained:

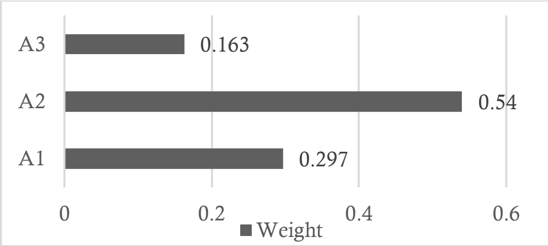

Figure 4. AHP Output of Production Criteria
Source: Primary data processed, 2022

Where A1 is Production factor subsidies, A2 is Private sector investment in the provision of production factors, A3 is the most affordable supply of production factors.

Based on the calculation result from the Analytical Hierarchy Process (AHP) in Figure 4. shows that the most prioritized alternative on the production criteria is private investment in the supply of production factors with a weight value of 54%. Meanwhile, the last priority alternative on the production criteria is the provision of continuous and affordable production factors with a weight value of 16.3%. From the calculation result of the Analytical Hierarchy Process (AHP) with the expert choice 11 programs, an inconsistency ratio of 0.008 is obtained, meaning that the answers given by the key persons are consistent.

Based on the calculation of the analytical hierarchy process on the cultivation criteria with the expert choice 11 programs, the following result is obtained:

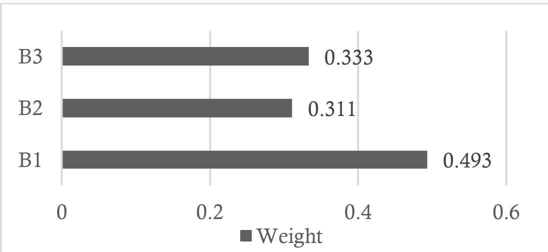

Figure 5. AHP Output Cultivation Criteria
Source: Primary data processed, 2022.

Where B1 is Assistance to farmers, B2 stimulates the use of organic fertilizers and organic pesticides, B3 stimulates the use of superior and labeled seeds

Based on the calculation result from the Analytical Hierarchy Process (AHP) in Figure 4.3 shows that the most prioritized alternative on the cultivation criteria is assistance to farmers, with a weight value of 49.3%. Meanwhile, the last priority alternative is to stimulate the use of superior and labeled seeds with a weight value of 19.6%. From the calculation result of the Analytical Hierarchy Process (AHP) with the expert choice 11 program, the inconsistency ratio result is 0.05, which means that the answers given by the key persons are consistent.

Based on the calculation of the analytical hierarchy process on the government policy criteria with the expert choice 11 programs, the following result is obtained:

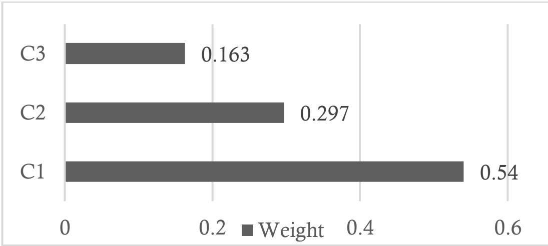

Figure 6. AHP Output of Government Policy Criteria
Source: Primary data processed, 2022.

Where C1 is the cost of goods sold policy support, C2 is Infrastructure development policy, and C3 is Technical assistance (equipment, production factors, and training) to farmers.

Based on the calculation result from the Analytical Hierarchy Process (AHP) in Figure 6. shows that the most prioritized alternative in the government's policy criteria is the policy support for determining the cost of goods sold with a weight value of 54%. Meanwhile, the last priority alternative in the government policy criteria is technical assistance (equipment, production factors, and training) to farmers, with a weight value of 16.3%. From the calculation result of the Analytical Hierarchy Process (AHP) with the expert choice 11 programs, an inconsistency ratio of 0.008 is obtained, meaning that the answers given by the key persons are consistent.

Based on the calculation of the analytical hierarchy process on the post-harvest criteria with the expert choice 11 programs, the following result is obtained:

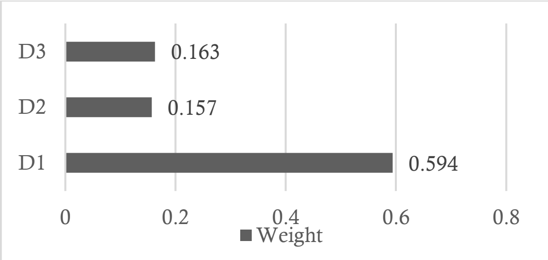

Figure 7. AHP Output of Post-Harvest Criteria
Source: Primary data processed, 2022

Where D1 is a Farmer partnership with prominent entrepreneurs, D2 is Counseling and education on effective post-harvest handling, and D3 is Post-harvest product innovation.

Based on the calculation result of the Analytical Hierarchy Process (AHP) in Figure 7 shows that the most prioritized alternative on post-harvest criteria is the farmer partnership with prominent entrepreneurs, with a weight value of 59.4%. Meanwhile, the last priority alternative on post-harvest criteria is counseling and education on effective post-harvest handling, with a weight value of 15.7%. From the calculation result of the Analytical Hierarchy Process (AHP) with the expert choice 11 program, the inconsistency ratio result is 0.05, which means that the answers given by the key persons are consistent.

Based on the calculation of the analytical hierarchy process on the institutional criteria with the expert choice 11 programs, the following result is obtained:

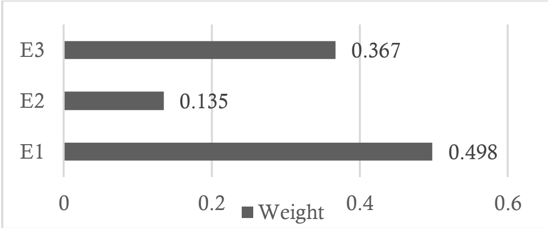

Figure 8. AHP Output of Institutional Criteria
Source: Primary data processed, 2022.

Where E1 is the Extension of institutional strengthening of farmer groups, E2 is Incentives for active farmer organizations, and E3 is the Revitalization of Gapoktan and extension institutions.

Based on the calculation result of the Analytical Hierarchy Process (AHP) in Figure 8, the most prioritized alternative on institutional criteria is the Extension of institutional strengthening of farmer groups with a weight value of 49.8%. Meanwhile, the last priority alternative in the institutional criteria is incentives for active farmer institutions with a weight value of 13.5%. From the calculation result of the Analytical Hierarchy Process (AHP) with the expert choice 11 program, the inconsistency ratio result is 0.09, which means that the answers given by the key persons are consistent.

Based on the calculation of the analytical hierarchy process for the overall alternative Strategy for Empowering Red Onion Farmers in Brebes Regency with the Expert Choice 11 program, the following result is obtained:

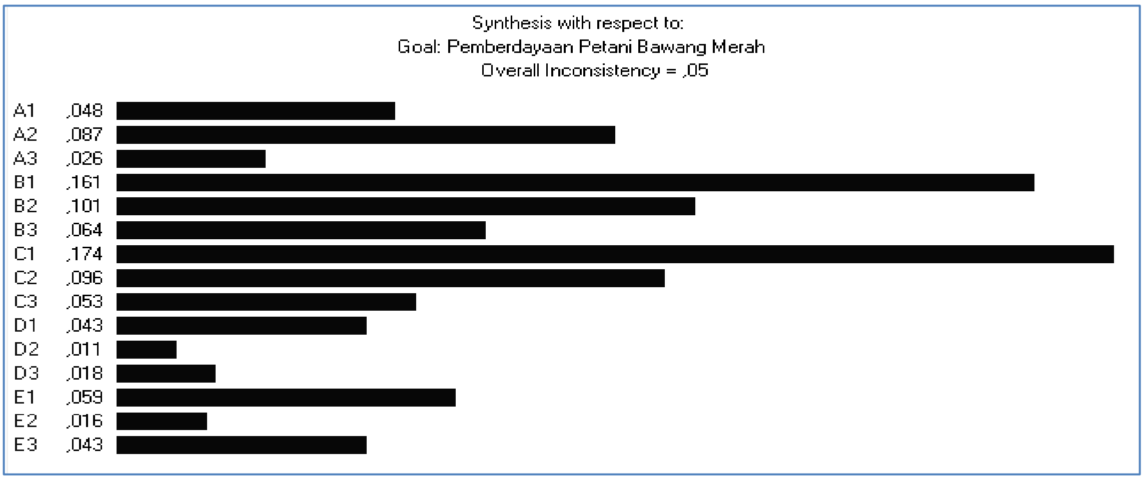

Figure 9. AHP Output of Overall Alternative
Source: Primary data processed, 2022.

Based on the calculation result of the Analytical Hierarchy Process (AHP) in Figure 9, it shows that the most prioritized alternative in the Red Onion Farmer Empowerment Strategy in Brebes Regency is the support for the policy of determining the cost of goods sold with a weight value of 17.4%. They are followed by the alternative of assistance to farmers on the second priority with a weight value of 16.1%. Meanwhile, the last priority alternative is counseling and education regarding effective post-harvest handling, with a weight value of 1.1%. From the calculation results of the Analytical Hierarchy Process (AHP) with the expert choice 11 programs, an inconsistency ratio of 0.05 is obtained, which means that the answers given by the key persons are consistent.

Sensitivity analysis aims to analyze the stability of alternative priorities by varying the simulation on the criteria priority of the strategy. Sensitivity analysis can be performed for both criteria and sub-criteria. Sensitivity analysis concerns whether the final result will always be stable if there is a change in the input, either assessment or priority.

Red Onion Farmer Empowerment Strategy in Brebes Regency is that the most prioritized alternative is the support for the policy of determining the cost of goods sold, as shown in Figure A. Then, after the simulation has been carried out by increasing the input of the production aspect from 16.6% to 29%, the priority policy alternatives are the same, as shown in Figure B. The result indicates that the assessment is stable.

The calculation result of the technical efficiency processed using Frontier Version 1 software in table 1 obtained the average value of the technical efficiency of red onion farming of 0.718. This means that the number is less than 1, which means that the use of production factors in red onion farming is not technically efficient, so reducing production factors is necessary. Reducing the use of production factors in red onion farming can be done by reducing the use of production factors of NPK fertilizers and pesticides.

This situation is in line with the growth theory of diminishing returns, The Law of Diminishing Return, by David Ricardo. The production of red onion will decrease due to too much fertilizer farmers give. Soil fertility has decreased, but fertilizer application damages soil conditions, causing productivity to decrease.

In addition, the proportion of pesticide use for red onion farming should also be reduced. Excessive use of pesticides will cause damage to the red onion agroecosystem due to less uncontrolled use of pesticides. It can also reduce red onion production (Marendra Kiloes, 2017). The result of this study is in line with the research conducted by Eliyatiningsih & Mayasari, (2019), which shows the value of technical efficiency, price efficiency, and economic efficiency, namely 0.92, 1.63, and 1.94. This shows that chili farming in Wuluhan Subdistrict, Jember Regency, has not been efficient.

Table 2 shows that the use of red onion farming production factors in the Brebes Subdistrict shows that the overall results of the production factors used as variables have not reached price efficiency. It is indicated by the calculation result of the price efficiency of the production factor used, which is still more than 1, which is 46.60. This value indicates that production factors are inefficient regarding allocative or price. This inefficiency occurs because there is inefficiency in the combination of the production factors used. The farmers are still not able to maximize the potential benefits that can be obtained. Therefore, adding inputs in production factors is necessary to be more efficient and achieve maximum profit.

The result of this study is in line with the research conducted by Setiawan & Prajanti (2011), which shows the result of price efficiency. It is known that corn farming in Grobogan Regency obtained a calculation result of 1.53563, so corn farming in Grobogan Regency is still not efficient in terms of price.

The result obtained from the calculation of economic efficiency for red onion farming in the Brebes Subdistrict is 33.45. The economic efficiency calculation results are more than 1, meaning that the red onion farm in Brebes

Subdistrict is not economically efficient. The results of the calculation of economic efficiency are more than 1, meaning that shallot farming in Brebes Subdistrict is not economically efficient. In order for the red onion growing in Brebes Subdistrict to be economically efficient, production parameters must be raised.

A farmer is technically said to be more efficient than another if the farmer can physically produce higher production using the same production factors. Meanwhile, a farmer can achieve price efficiency if he can maximize profits (capable of equating the product marginal value for each variable production factor with its price). Economic efficiency can be achieved if both efficiency, namely technical efficiency and price efficiency, also achieve efficiency (Yotopoulos & Nugent, 1976; Ciri et al., 2020; Kheirabadi & Nagamune, 2019).

The result of this study is in line with the research conducted by (Setiawan & Prajanti, 2011) then (Eliyatiningsih & Mayasari, 2019; Chen et al., 2022; Seok et al., 2018), which shows the calculation of economic efficiency. The result is more than one and is declared economically efficient.

From the result of the study, the government, through the Department of Agriculture and Food Security in Brebes Regency and the Agricultural Extension Center in Brebes Sub-district, has empowered red onion farmers in Brebes Subdistrict, Brebes Regency by providing counseling and assistance to individuals and farmer groups to increase the production of red onion farming and increase the welfare of the farmers in the form of face-to-face or collaboration with GSM radio (holding counseling via radio broadcasts) then using the media magazine published by the Department of Agriculture of the Brebes Regency within 1 (one) year publishing 2 (two) magazines namely "Suluh Tani" which contains the works of extension workers on technology for agriculture. The explanation of good seeds or seedlings (Interview with Mr. Fx. Heri Priyono, S.P. as the Agriculture Service of Brebes Regency on August 4, 2022).

Other obstacles faced by farmers in preparing input factors (labor) include labor from other regions due to techniques or skills in land or land processing. Certain regional people only own planting skills, so farmers have to bring in or employ those people.

Furthermore, Mr. Heri said there is no proper mechanization in cultivating red onion. It differs from planting rice. It can use a tractor to plow the land. It is concluded that the cultivation of red onion from the beginning of land processing to harvest does not use mechanization.

The most prioritized criterion in empowering red onion farmers in Brebes Regency is government policy, with a weight value of 33.3%. Then, the second priority criterion is cultivation, with a weight value of 30.7%. Meanwhile, the last priority criterion is post-harvest, with a weight value of 8.3%. The most prioritized alternative in the Red Onion Farmer Empowerment Strategy in Brebes Regency is the policy support for determining the cost of goods sold with a weight value of 17.4%, followed by the alternative of assistance to farmers on the second priority with a weight value of 16.1%. Meanwhile, the last priority alternative is counseling and education on effective post-harvest handling, with a weight value of 1.1%.

The findings in this study are that the most prioritized criterion in the strategy for empowering onion farmers in Brebes Regency is government policy. Farming is one of the livelihoods that plays a critical role for the people of Brebes. However, many farmers are not yet prosperous because when harvesting, the selling price of onions often drops. As with other farms, prices will fall when there are large quantities of the same harvest (Sangleswai et al., 2015; Abdulkadir, 2015). In this case, the government's role in controlling the price of onions is needed. In addition to price issues, onion farming is also constrained by the low quality of human resources for farmers. The quality of human resources is an essential aspect and has a strong influence on producing high agricultural productivity (Koye et al., 2022; Maniriho et al., 2020). The majority of onion farmers are elderly and have a low educational background. Therefore, there is a need for regular training and mentoring to improve the competence of farmers.

CONCLUSION

Based on the results and discussion, it can be concluded that the average value of the technical efficiency of red onion farming is 0.718. This means that the number is less than 1, which means that the use of production factors in red onion farming is not technically efficient, so reducing production factors is necessary. Reducing the use of production factors in red onion farming can be done by reducing the use of production factors of NPK fertilizers and pesticides. The use of red onion farming production factors in the Brebes Subdistrict shows that the result of the overall production factors used as variables has not reached price efficiency. The calculation result of the price efficiency of the production factor used is still more than 1, which is 46.60. The result obtained from the calculation of economic efficiency for red onion farming in the Brebes Subdistrict is 33.45. The calculation result of the economic efficiency is more than 1, meaning that red onion farming in Brebes Subdistrict is not yet economically efficient. To achieve economic efficiency, it is necessary to add production factors so that the red onion farming business in Brebes Subdistrict achieves economic efficiency.

The most prioritized criterion in empowering red onion farmers in Brebes Regency is government policy, with a weight value of 33.3%. Then, the second priority criterion is cultivation, with a weight value of 30.7%. Meanwhile, the last priority criterion is post-harvest, with a weight value of 8.3%. The most prioritized alternative in the Red Onion Farmer Empowerment Strategy in Brebes Regency is the policy support for determining the cost of goods sold with a weight value of 17.4%, followed by the alternative of assistance to farmers on the second priority with a weight value of 16.1%. Meanwhile, the last priority alternative is counseling and education about effective post-harvest handling, with a weight value of 1.1%.

The suggestion that can be given in this study is that the government, especially the agricultural department, needs to improve the extension program to be able to advance farming, especially red onion farming. The government can provide counseling on efficient and profitable red onion ways and techniques and cultivation to improve farmers' welfare. This research has limitations in the scope of one area, so further research is expected to expand the scope of the research area.

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