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ECONOMIC EFFICIENCY OF PORANG FARMING IN EAST LOMBOK REGENCY

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Abstrak

Tanaman porang sebagai salah satu komoditas pertanian unggulan bernilai ekonomis. Potensi tersebut ditunjukkan dengan permintaan ekspor Indonesia cukup baik selama beberapa tahun terakhir. Peningkatan luas areal tanam dan kelembagaan merupakan kebijakan untuk meningkatkan hasil produksi. Volume produksi belum mencapai target kebutuhan disebabkan skala usaha masih gurem dan porang menjadi introduksi usahatani komersil. Kabupaten Lombok Timur merupakan salah satu daerah yang berpeluang strategis didalam pengembangan usahatani porang dengan karakteristik agroklimat yang sesuai syarat tumbuh. Penelitian bertujuan untuk menganalisis efisisensi ekonomi usahatani porang di Kabupaten Lombok Timur. Lokasi penelitian ditentukan secara purposive di Kecamatan Sembalun, Kecamatan Masbagik, dan Kecamatan Pringgasela. Pengumpulan data secara sensus melibatkan seluruh anggota petani porang berjumlah 15 petani. Data diestimasi menggunakan Maximum Likelihood Estimation (MLE) program frontier 4.1c. Hasil penelitian menunjukkan bahwa faktor produksi yang berpengaruh nyata terhadap peningkatan nilai ekonomis adalah benih, pupuk SP-36, pupuk organik dan pestisida. Hasil estimasi efisiensi ekonomi usahatani porang telah efisien secara ekonomi. Hal tersebut ditunjukkan dengan nilai rata-rata efisiensi ekonomi petani porang 0,9111.

Kata kunci: *efisiensi ekonomi, faktor produksi, porang*

ABSTRACT

Porang (Amorphophallus muelleri B) or known as elephant yam as one of the leading agricultural commodities which has economic potential. This potential is shown by its export value over the last few years. The increase of planting area and its institutional board is a strategy to boost the production yields. The production volume has not reached the requirement because currently is still a small-scale business model and an introduction plant to commercial farming. East Lombok Regency has the opportunity to be a strategic region for pouring farming development due to its agro-climatic characteristics that met its growing conditions. This study aims to analyze the economic efficiency of porang farming in the East Lombok Regency. The research locations were determined purposively in Sembalun District, Masbagik District, and Pringgasela District. The data we're collecting through census involved 15 members of porang farmers. The data was estimated using the Maximum Likelihood Estimation (MLE) frontier 4.1c program. The results showed that the production factors that significantly affected the increase in economic value were seeds, SP-36 fertilizer, organic fertilizers, and pesticides. The estimation of the economic efficiency of porang farming economically had efficient. This is indicated by the value of the average economic efficiency of porang farmers 0.9111.

Keywords: *economic; efficiency; production; porang*

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Introduction

Porang (*Amorphophallus muelleri* B) is one type of tuber plant that has not been widely cultivated. The cultivation of porang is still limited to certain spots while market demand to fulfill industrial needs is high (Sukartono et al., 2020). According to the export volume of porang, it was increasing from 11,720 tons in 2019 to 14,568 tons in 2020 (Ministry of Agriculture, 2020). Hence, it has become a promising strategic potential for farmers. The various potential of industrial inputs has the opportunity as a source of income and employment that contribute quite high to regional economic development. The large opportunity to reach national and international markets makes pouring a priority commodity for the current government development. The government's steps in developing porang production with economic goals are the expansion of planting area, superior varieties, the use of fertilizers as needed, financing and implementation of good agricultural practice (GAP) (Coordinating Ministry of Economy, 2021).

The distribution of porang in Indonesia is mostly found on the island of Java. It can be developed outside Java at an altitude of 900 meters above sea level (Alifianto et al., 2013) East Lombok Regency is one of the areas that have the potential for porang cultivation. According to Yasin et al., 2021, porang plants can grow on all types of soil in HKm Lombok Island with the condition that the agro-climate is fertile, loose, and contains high enough organic matter. Several locations for the development of porang farming in East Lombok Regency include Sembalun District, Pringgasela District, and Masbagik District. Porang farming in East Lombok Regency is still relatively new, the existence of public awareness of the high selling price of porang tubers (export commodity) creates excitement for farmers to run porang farming. Regardless the risks are many, especially the farming experience in cultivating porang is still low.

In recent years, many farmers in East Lombok Regency have started to run porang farming, either on their land, fields, or forests. However, farmers are still hesitant to cultivate porang on a large scale due to their less knowledge regarding its economic value. Therefore, research on the economic benefits of porang cultivation is very important. Research on the economic efficiency of porang farming needs to be carried out as a consideration of sustainability and making decisions on the use of production factors to increase production while increasing the economy of farmers. Moreover, farming is always faced with an uncertain environment so that farmers need to allocate the use of production factors in achieving full economic efficiency. The purpose of this study was to examine the economic efficiency of porang farming in the East Lombok Regency.

Literatur Review

Porang Farming

Porang is a tuber plant that is commonly found in tropical and sub-tropical climates at a temperature of 25-35 ºC (Sari & Suhartati, 2015). Porang body structure reaches more than 1 meter depending on age and level of soil fertility. The optimum growth cycle of this plant comes 4-6 years with a tuber weight range of more than 3-9 kg (Purwanto, 2014). The characteristics of seeds are 8-22 cm long, 2.5-8 cm wide, and 1-3 cm in diameter (Ganjari, 2014). Porang has two types of tubers, namely word tubers and stem tubers. The word tubers are found on each leaf stalk while the stem tubers are in the soil. Usually what is often used as seeds/seedlings are word tubers because they are cheaper than stem tubers. This also depends on the desire for maintenance if you want a short harvest life then use stems and vice versa. The characteristics of the porang tubers include symmetrical rounds on top that form a basin. With the shape of the leaves, there are spots as a differentiator with similar plants. Porang development is generative through seeds and flowering after 3-4 years by producing more than 250 seeds per flower.

Porang plants can grow well through intensive management, including land preparation, maintenance, and timing of harvest. The best depth for planting porang is 5 cm to 15 cm (Sari & Suhartati, 2015). The size of the planting depth is determined by the size of the tubers used. If the bulbs are used in a larger size, then deeper planting is needed, otherwise, the smaller tubers have a shallower planting depth. The maintenance of

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porang is different from other types of plants. This plant does not really need intensive maintenance. Maintenance carried out, for example, is limited to fertilizing with a scale of 1-2 times and spraying pesticides. The pest and disease that still has no solution for porang producers is the tuber borer caterpillar which causes the tubers to rot. Porang's environment is located at an altitude of 900 meters above sea level (Alifianto et al., 2013). However, its existence is complicated to find because of the uneven distribution. Therefore, the porang plant becomes a strategic business as a new economic source. Economically, production per hectare can reach 24 tons with a total of 6,000 seedlings (Yasin et al., 2021).

Economic Efficiency Stochastic Frontier Model

Efficiency is used to measure the economic performance of a company or farm. The measurement of efficiency begins with the concept developed by (Farrell, 1957) and (Coelli et al., 2005), which defines efficiency as the ability of a company or farm to produce maximum output with the use of a certain number of inputs.

Efficiency is the amount of output obtained per certain input. Thus, a farm is said to be efficient when the use of fewer inputs results in higher output. Farrell, 1957 and Coelli et al., 2005 classifies efficiency into two models, namely technical efficiency and allocative efficiency. Technical efficiency reflects the ability of producers to obtain maximum output by using a certain number of inputs. Allocative efficiency explains how to use inputs proportionally at each input price and certain technology so that maximum output and profit are obtained. Economic efficiency is the result of multiplication between technical efficiency and allocative efficiency, meaning that the output produced is technically efficient and allocative.

The economic efficiency measurement model that is widely used is the frontier production function approach introduced by Farrell, (1957). The frontier production function is used to measure how the actual function of the frontier function is. This function reflects the maximum output that can be generated using a certain combination of inputs (Coelli et al., 2005).

Miller et al., 1985, defines the frontier production function as the easiest and most practical function in presenting the ideal production resulting from the use of production factors at the level of existing knowledge and technology. The comparative advantage of the frontier production function is its ability to analyze the technical efficiency and inefficiency of a production process. This happens because the frontier production function model includes an error and an undefined random factor in the production function. Thus, when presenting technical efficiency in a model there is a standard error.

Measurement of efficiency using the stochastic frontier model formulated by (Jondrow et al., 1982). The technical efficiency of farming is described as the ratio of the observed output or actual production (Yi) to the highest output or potential production (Yi*) at the available technology level. The value of technical efficiency starts from zero to one (0 <Tei< 1), where the closer to one the farm indicates full efficiency. Technical efficiency is formulated as follows.

$$TE = \frac{Yi}{Yi^*} = \frac{E\,(Yi|Ui,Xi)}{E\,(Yi|Ui=0,Xi)} = [\exp(-U_i)] \qquad (1)$$

Economic efficiency will be achieved if both technically and allocatively efficient farming. Economic efficiency is the ability possessed by farmers in production to determine a predetermined number of outputs. The value of economic efficiency is the same as technical efficiency, which is between 0 to 1. The frontier cost function to estimate the level of economic efficiency is formulated as follows.

$$Ci = g\,(Yi, Pi, \alpha) + \varepsilon i,\ \ i : 1, 2, 3,....,n \qquad (2)$$

Note:
Ci : total cost of production
Yi : the resulting output
Pi : input price
α : cost function parameter
i : error term

Allocative efficiency is the ratio of the total cost of production using actual factors to the total cost of production using optimal and technically efficient factors.

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$$EA = \frac{EE}{TE} \qquad (3)$$

Note :
EA : Allocative efficiency
EE : Economic efficiency
ET : Technical efficiency

Research Methods

The determination of the research location was carried out purposively, namely the center for the development of porang farming in East Lombok Regency with the consideration of porang plants as new plants as well as having economic value with export potential. The study was conducted in June-September 2021. Sampling was carried out through a census of porang farmers in East Lombok Regency, including Masbagik District, Pringgesela District, and Sembalun District with a total sample of 15 farmers.

Data analysis using stochastic production function frontier computational program 4.1c. Estimation of economic efficiency parameters is carried out simultaneously using the Maximum Likelihood Estimation (MLE) method. Economic efficiency is determined by lowering the frontier stochastic cost function. The equation for the cost function of porang farming is as follows.

$$\text{Ln } C = \beta_0 + \beta_1 \ln P_1 + \beta_2 \ln P_2 + \beta_3 \ln P_3 + \beta_4 \ln P_4 + \beta_5 \ln P_5 + + \beta_6 \ln P_6 + \beta_7 \ln P_7 + \beta_8 \ln P_8 (v_i - u_i) \qquad (4)$$

Note :
C : Total Cost Production (Rp)
β_0- β_7 : Estimator parameters (β_0- $\beta_5 > 0$)
P_1 : Production (kg)
P_2 : Price of seeds (Rp/kg)
P_3 : Price of organic fertilizer (Rp/kg)
P_4 : Price of NPK fertilizer (Rp/kg)
P_5 : Price of Urea fertilizer (Rp/kg)
P_6 : Price of SP-36 fertilizer (Rp/kg)
P_7 : Price of pesticide (Rp/lt)
P_8 : Payment of labor (Rp/HOK)
v_i-u_i : *Error term* (v_i), inefficiency effect model (u_i)

Economic efficiency is the ability possessed by farmers in production to determine a predetermined number of outputs. The value of economic efficiency ranges from 0 to 1. If the distribution of values is greater, it indicates that porang plants are fully efficient. On the other hand, a small efficiency value means that porang farming is not yet economically efficient. Economic efficiency is formulated as follows.

$$EE = E\,[\exp(-U_i \mid \varepsilon)] \qquad (5)$$

The estimation results of the stochastic frontier program with the maximum likelihood estimation (MLE) method produce cost-efficiency. Therefore, the level of economic efficiency of porang farming is obtained by using the following formula (Ogundari & Ojo, 2007).

$$EE = \frac{1}{\text{Cost Efficiency (CE)}} \qquad (6)$$

Result and Discussion

The Use of Production Factors

The production of porang farming is the result of the work of many factors. Distortion of the use of production factors according to the needs of land and crops can produce the highest output. Starting from a combination of land use, seeds, fertilizers (Urea, NPK, SP-36, Organic), and pesticides. The distribution of land tenure of farmers is on average 0.1973 ha with a productivity level of 8,133.33 tons/ha (Table 1). The planting area is still narrow because new farmers are using land that was not used before. Meanwhile, currently, the cultivation of porang plants has been carried out in paddy fields as a transition to less profitable farming commodities.

Input Types	Units	Average
Land areas	Acres	0,1973
Seeds	Kg	198,67
Organic Fertilizer	Kg	426,67
Urea Fertilizer	Kg	0,67
SP-36 Fertilizer	Kg	10
NPK Fertilizer	Kg	14,33
Pesticide	Lt	2,25
Labor	HOK	13,94
Production	Kg/ha	813,333
Productivity	Ton/ha	8,133

Seed is a very important production factor in porang farming. The allocation of seeds will

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determine the quantity and quality of the porang plant production sector. Porang seeds sourced from the local area are obtained collectively (locally). The locality of farmer-cultivated seeds is the impact of limited access to hatcheries (capital, porang nursery business, and storage). So that production, quality, and productivity are still low. The types of seeds used by porang farmers include spores, frogs, and tubers. The average need for porang seed production factors is 198.67 kg.

Fertilizer is a material that contains more than one nutrient that is added to plants as a growth regulator. As a farmer's effort in increasing land fertility according to plant needs and increasing production. The most use of fertilizer production factors is organic fertilizer, 86 percent as basic fertilizer, the rest using chemical fertilizers. The use of chemical fertilizers such as Urea fertilizer, NPK fertilizer, and SP-36 fertilizer is less than 13 percent. The average distribution of organic fertilizer use is 426.67 kg/ha, 0.67 kg/ha Urea fertilizer, 14.33 kg/ha NPK fertilizer, and 10 kg/ha SP-36 fertilizer (Table 1).

Pesticides are materials used to control plant pests and diseases. The types of pesticides used by porang farmers include antracol, furadan, and prepaton. The average use of pesticides is 2.25 liters/ha. The provision of pesticides for porang plants is currently still limited, especially in weed control. The percentage of farmers using pesticides is no more than 13 percent. Pests of plant diseases that are still an obstacle that cannot be overcome with pesticides are fruit borer caterpillars and fungi. This increases the risk of farm losses.

Labor is a production factor that plays an important role in farming. The workforce consists of workers within the family and workers outside the family. Most of the use of labor is allocated to land processing, seed planting, and harvesting activities. The rest, such as maintenance and fertilization, still utilize family labor. The average distribution of labor in porang farming is 13.94 HOK.

Table 1. The Average Use of Production Factors

Estimating the Stochastic Frontier Production Function of Porang

The model that is used to obtain the production function, as well as economic efficiency, is the stochastic frontier Cobb-Douglas estimating method Maximum Likelihood Estimation (MLE) frontier computing program 4.1c. The results of the stochastic frontier estimation are presented in Table 2, the value of sigma squared (σ2) of 0,0161 is stated to be significant at the level of = 5%.

This means that the error term inefficiency (μi) is normally distributed. Gamma value (γ) of 0,9347 with an at-ratio of 1,1976 shows 93,47% of the residual variation in the model is more dominant due to technical inefficiency (μi) the remaining 6,53% is due to noise in the measurement. If all error terms are caused by noise (vi) the inefficiency coefficient parameter value becomes meaningless (Kusnadi et al., 2011)

Table 2. Estimation Result of Stochastic Frontier Production Function of Porang

Variable	Coefisien	Std. Error	t-ratio
Constanta	4,8724 ***	0,9629	5,0599
Seeds	1,1122 ***	0,1509	7,4353
Organic Fertilizer	0,0075	0,0135	0,5532
Urea Fertilizer	-0,7042 **	0,3208	-2,1950
SP-36 Fertilizer	0,3688 **	0,1596	2,3108
NPK Fertilizer	-0,2007	0,1375	-1,4596
Pesticide	0,9354 **	0,3449	2,7119
Labor	-0,5415 ***	0,0626	-8,6475
Sigma-squared	0,0161	0,0155	1,0441
Gamma	0,9347	0,7804	1,1976
Log-likelihood function OLS	15,539		

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Log likelihood function MLE	16,748
LR test of the one-sided error	2,4178

Source: Primary data, 2021
Note:
*** = α 1%; t table 1% = 3,012276
** = α 5%; t table 5% = 2,160369
* = α 10%; t table 10% = 1,770933

The log-likelihood function value of MLE (16,748) is greater than the log-likelihood function of OLS (15,539), which indicated that the model in this study is good enough to describe the actual condition of porang farming. The results of the analysis of the stochastic frontier production function with the variables of seed, SP-36 fertilizer, organic fertilizer, and pesticide provide predictive parameters that are positive so that the cost function reduction can be carried out. Meanwhile, the variables of Urea fertilizer, NPK fertilizer, and labor showed negative estimation parameters. This means that it can increase the farming costs. The computational frontier program estimation 4.1c concludes that the influence factors in porang farming activities are seeds, urea fertilizer, SP-36 fertilizer, pesticides, and labor.

The Economic Efficiency of Porang Farming

The economic efficiency of each porang farmer is the inverse of the cost efficiency obtained by estimating the derivative of the frontier cost function. It means that economic efficiency is the ratio of technical efficiency with allocative that has been fully efficient. The derivative of the frontier cost function of the estimated production function of porang farmers is as follows (Table 3).

Table 3. Result of Deriving Frontier Cost Function Production Function Porang

Variable	Parameters	Coefisien
Constanta	P_0	0,572
Production	P_1	0,105
Price of seeds	P_2	1,122
Price of organic	P_3	0,007
Price of urea	P_4	0,704
Price of SP-36	P_5	0,368
Price of NPK	P_6	0,200
Price of pesticide	P_7	0,935
Payment of labor	P_8	0,541

The analysis results of the dual cost derivative function are used to measure economic efficiency. Economic efficiency is obtained by analyzing the input side of production with the average output price prevailing at the farm level. The distribution of the economic efficiency values of each farmer can be seen in Table 4 as follows.

Table 4. The efficiency of Porang Farming Economic Value

Economic Efficiency	Farmers	Percentage (%)
0,70-0,75	1	6,67
0,76-0,80	0	0,00
0,81-0,85	1	6,67
0,86-0,90	4	26,67
0,91-100	9	60,00
Total	15	100
Minimum		0,7119
Maximum		0,9828
Average		0,9111

Source: Primary Data, 2021

The average index of economic efficiency is 0,9111 with the lowest efficiency distribution being 0,7119 and the highest is 0,9828. It can be explained that porang farming is economically feasible to cultivate. In line with Suharyanto, (2015) explaining if the efficiency value> 70 means that the farm is feasible to run. In achieving the average degree of economic efficiency, porang farmers can achieve the highest level of efficiency, so they can save 7,29 percent of costs (1-0,9111/0,9828). Farmers who are not fully efficient can save costs by 27,98 percent (1-0,9111/0,7119).

The minimum level of economic efficiency of farmers is farmers who have just started porang

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farming. The limited information on input and output prices as well as the combination of production factors in increasing the amount that is still lacking or reducing excessive use has caused the cost efficiency of farming to have not been achieved. The approach in achieving the feasibility of efficiency is carried out through porang farmer groups where together with farming management, production factors will always be available at reasonable prices through group members. In addition, the ratio of excessive use of inputs is offset by their high selling price as the sustainability of farming (Jakiyah & Nurhidayah, 2019).

Economic efficiency ultimately aims to increase prices and yield productivity (Suharyanto, 2015). The allocation use of the production factors determines the success of productivity. Based on the results, the productivity of farmers who have reached the maximum degree of efficiency is higher than the minimum number of farmers. Those who have high economic productivity are the driving farmers as farmers who provide production factors. Therefore, the cost of using production factors varies and is highly dependent on the type of seed used.

The distribution costs are still high on several production factors such as seeds, organic fertilizers, and labor. The average price of tuber seeds is Rp. 11,266 per kg, frog seeds are Rp. 150,000 per kg. The high price of seeds is due to the difficulty of cultivation and the limited quantity. The average price of organic fertilizer is Rp. 1,500 per kg. More than 70 percent of porang farmers buy organic fertilizer from local farmers at low prices. However, the high production factor of organic fertilizer used will be followed by the high cost of purchasing organic fertilizer. While the average value of labor costs is Rp. 10,599 per HOK equivalent to labor costs of Rp. 72,333 per day.Z

Conclusion

Porang farming in East Lombok Regency is carried out on paddy fields and agroforestry. Economically, porang farming is feasible to cultivate. This is evidenced by the coefficient of the estimated average economic efficiency of 0.9111. Production factors that significantly affect the increase in economic value are seeds, SP-36 fertilizer, organic fertilizers, and pesticides. Farmers who have or have not reached the level of efficiency still have the same opportunity to achieve the highest efficiency. Maximum profit can be achieved through farm management, especially the use of production factors and higher selling prices as well as determinants of access to information.

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