Analysis of the Efficiency of Using Production Factors at Corn Farming in Kupang Regency, Indonesia

Lukas J.B.B. Hattu, Elly Lay, Johanes Sarong, Erna Giri
Department of Business Administration University of Nusa Cendana Kupang

Abstract: **This study aims to analyze and determine the efficiency of the use of production factors in corn farming in East Kupang District, Kupang Regency. By knowing whether or not the use of production factors is efficient, it can be recommended to farmers to increase or decrease the use of certain production factors, which in fact are based on the results of the analysis of their use is inefficient. The data analysis method used is by using the Cobb-Douglass production function, where the results of this analysis can be seen from the elasticity of the use of each production factor on the production results. Furthermore, determining the efficient use of a type of production factor is determined based on the amount of its Marginal Production Value (MPV).**

This research took place in the East Kupang sub-district, because this area is one of the vegetable and maize-producing areas that supply the community's needs for these commodities in Kupang district and also in Kupang City. The results showed that the production factors had a significant effect on production yields, but their use was still not efficient. Therefore, it needs to be further improved in order to achieve optimal efficiency.

Keywords: **efficiency, elasticity, production factors.**

I. INTRODUCTION

Agriculture is one of the main sectors that support people's lives, because the agricultural sector is the livelihood of most of Indonesia's population. Indonesia is an agricultural country. Departing from this, agriculture is one of the pillars of the national economy. This means that the agricultural sector plays an important role and should be the driving force of the country's economic activities. Based on 2019 BPS data, the population working in the agricultural sector is around 41,309,776 people or 39.02 percent of the total productive age population, while the remaining 60.98 percent are spread across various sectors outside of agriculture[1].

One of the food crop commodities that can play a role in the development of the agricultural sector is the corn. In Indonesia, corn is the second food commodity after rice and a source of calories or a substitute for rice as well as animal feed. The need for corn will continue to increase from year to year in line with the increase in the people's economic standard of living and the progress of the animal feed industry so that it is necessary to continue to increase its production.

Most of the people in Kupang Regency have been managing corn farming from generation to generation. Corn is one of the staple foods after rice. In addition, corn can also be processed into various other types of processed food that have economic value. Although the farmers have cultivated corn for a long time, not all of them have done it intensively. Most farmers only plant corn once a year during the rainy season. and after that it is no longer cultivated because of the absence of water. There are a small number of farmers who own land that has irrigation channels, allowing them to plant corn all year round, without waiting for the rainy season. This group usually intensively cultivates corn using weeds, fertilizers, and pesticides so that they produce more.

In accordance with the title of this study, the focus of this research is farmers who carry out intensive farming who plant throughout the year. This is based on the preliminary findings that they use various factors of corn production so as to produce results that are not the same size, even though the area cultivated is the same. This phenomenon indicates that there are farms that have not used the means of producing corn or its production factors efficiently.

II. LITERATURE REVIEW AND HYPOTHESIS

2.1. Production Concept

Production is an activity to add benefits or create benefits of form, time and place of production factors, which are useful for fulfilling consumer needs[2]. Another opinion states that production is all activities in creating and adding to the utility of a good or service. To carry out these activities, production factors are needed in the form of land, capital, labor and skills [3].

The same opinion was expressed by Mubyarto (1989) that production is the result obtained as a result of the operation of several factors of production at once, namely land, capital and labor[4].

Based on some of the concepts about production mentioned above, it can be concluded that production is an activity that uses production factors to produce or add value to a type of product in the form of goods or services. This added value or benefit can be due to changes in form, time and place. Production activities are always aimed at meeting the needs of human life.

2.2. Production Factors

Production factors are all input materials needed in the production process to produce a certain type of product. In general, the factors of production can be classified into materials or materials, either in the form of main raw materials or supporting materials, labor, production machines and equipment, and capital. In farming, the production factors are land, labor, seeds or seeds, fertilizers and drugs which are used to eradicate pests or weeds.

According to Mosher AT (1998) defines farming as a place or part of the earth's surface where a farmer or farming family or certain other agency is farming or raising livestock. Farming is any organization made from natural sources, labor and capital aimed at increasing production and income in the agricultural sector[5]. When viewed from the point of view of agricultural development, the most important thing from farming is that farming must always change from time to time both in terms of size and structure, the implementation of farming should develop more efficiently. Farming is no longer carried out in a primitive manner, but must be more modern and productive in order to create an increase in the agricultural sector. The production factor itself is defined as all the sacrifices given to plants so that the plants are able to grow well and produce well. Producers need to know the types of production factors or inputs along with their quantity and quality. Therefore, to produce a product, a relationship between production factors (input) and production (output) is needed. This relationship between input and output is called a "factor relationship" (FR). In the FR mathematical formula is formulated as follows:

Y = f (X1. X2,. Xi, ... Xn)

Where: Y = Product / variable that is influenced by the factor of production X

X = Production factors or variables that affect Y

2.3. Efficiency Concept

Efficiency means the best ratio or ratio between input and output. This concept means that an activity is called efficient if certain inputs can produce the maximum output. Or a certain output can be achieved by sacrificing the lowest possible input. The definition of efficiency can be classified into 3 types, namely: technical efficiency, allocative efficiency (price efficiency) and economic efficiency[6]. An use of production factors is said to be technically efficient (technical efficiency) if the production factors used produce maximum products. It says price efficiency or allocative efficiency, if the value of the marginal product equals the price of the production factor concerned. It says economic efficiency if the agricultural business achieves technical efficiency while also achieving price efficiency. Furthermore, Soekartawi (2003) explains the concept of efficiency, which is a concept where all activities are simpler. The concept of efficiency is divided into 3 types, namely technical efficiency, price efficiency and economic efficiency[6]. A farmer is technically said to be more efficient than others if the farmer can physically produce higher using the same production factors. Meanwhile, price efficiency can be achieved by a farmer if he is able to maximize profits (able to equalize the marginal value of the product of each variable production factor with the price). Economic efficiency can be achieved if both efficiency, namely technical efficiency and price efficiency, are also efficient

2.4. Efficiency Measurement

Measuring the efficiency of the use of production factors in farming can be done by taking into account the amount of the marginal production value

(MPV) of each input used. Mathematically it can be determined as follows:

MPVx = Px or MPVx / Px = 1 Information:

MPVx = Marginal Product Value of goods x Px = price of goods x

Thus, the Marginal Production Value (MPV) of production factor X can be written as follows:

MPV = b.Y.Py / X or b. Ý.Py / X.Px Note:

b = elasticity of production Y = average production

Py = average production price

X = average number of production factors X Px = average price of production factors X

2.5. Hypothesis:

H0: The use of production factors in corn farming was efficient

H1: The use of production factors in corn farming was not efficient

III. RESEARCH METHODS

3.1. Research sites

This research is located in East Kupang District, Kupang Regency, East Nusa Tenggara Province. East Kupang Subdistrict was chosen as the research location with consideration because there are quite a lot of corn plantations developed in this area. Most of the needs of the people of Kupang city for vegetables and corn are produced in this area.

3.2. Population and Sample

In accordance with the title of this study, the population in this study are people who carry out intensive corn farming, namely those who carry out farming using complete production factors such as land, labor, seeds, fertilizers, and medicines. Thus, most people who only do traditional corn farming without using all the production factors completely and only once during the rainy season are not included in the population category of this study. Based on the results of a preliminary study, data on the distribution of the population of

corn farming in East Kupang sub-district were as many as 40 people.

The sample of this study was carried out by taking all members of the population into the research sample. Thus, the sampling technique used is saturated sampling[7].

3.3. Variables and Their Measurement

a. Production volume is the total yield obtained by a farmer in one corn planting period. The unit of measurement is the grain
b. Land area is the total area of land used for corn crop farming in one corn planting period. . The unit of measurement is square meters (m2)
c. Labor is the amount of adult time spent working by farmers to cultivate corn farming in one growing season. The unit of measurement is the Working Days of the People (HOK).
d. Seed is the number of corn seeds used in
e. Total Fertilizer is the total fertilizer used in corn farming for one growing season. The unit of measurement is kilograms (kg)
f. Amount of Medicines is the total of insecticides and pesticides used in corn farming for a period of the growing season. The unit of measurement is milliliters (ml).

IV. RESEARCH RESULTS AND DISCUSSION

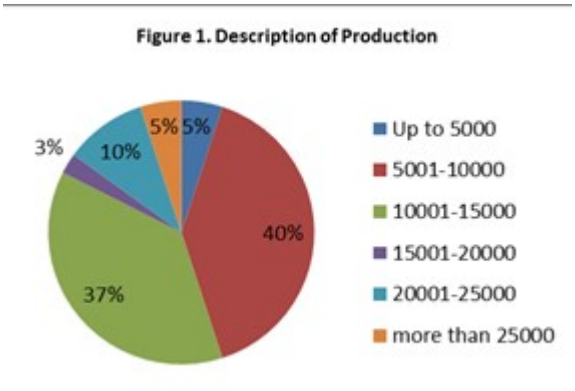
4.1 Description of Research Variables

1. Production (Y)

The yields studied were the yields of corn during the planting season that had just been obtained by the respondent farmers. The yield of corn farming in the East Kupang sub-district is measured in units of grains or cobs. This is done because the farmers harvest the corn when it is young and sell it in units of count of grains.

There are two important reasons why farmers prefer selling young corn to selling dry corn in kilograms. The first reason is that the selling price of young corn is considered to be more profitable than selling dry shelled corn. For example, the selling price of pulut manis type young corn that is charged to collectors is IDR 1,000 per grain. Meanwhile, if it is sold in the form of shelled dry corn, it is valued at IDR. 5,000 per kilogram. Meanwhile, to get one kilogram of shelled dry corn, it takes at least 9 to 10 ears of corn. Thus, farmers get more profit if they sell young corn compared to selling dry shelled corn. The second reason is that farmers can shorten the maintenance time of corn in the garden, thereby reducing costs, because the corn can be harvested earlier.

The results of the study provide an overview of corn production by farmers as shown in Figure 1.



The data in Figure 1 shows that corn production ranges from less than 5,000 heads to more than 25,000 heads. The majority of respondents produced corn between 5,001 to 10,000 heads (40%) for one growing season. Meanwhile, only 5% produces more than 25,000 heads per growing season.

2. Land Area (X1)

The land used for planting corn is garden land or rice fields that have a water source. This is necessary because corn farming is carried out after the completion of the rainy season. Thus, corn farmers' land will always be on the edge of the river or in the middle of rice fields that have wells as a source of water.

The land area cultivated by corn farmers varies, ranging from 25 acres or equal to 2,500 square meters, up to 1 hecto acres (10,000 square meters). The details about the area of corn farming are shown in Figure 2 below.

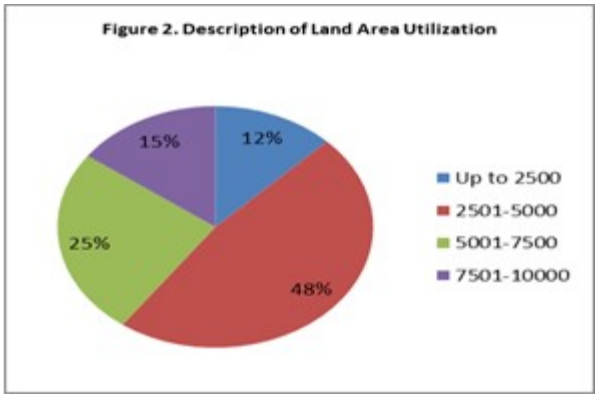


Figure 2 shows that the majority of respondents have arable land between 2,501 and 5,000 m2 for one growing season. Meanwhile, those with arable land area of 7.501 m2 to 10,000 m2 are only 6 people or 15%.

3. Seed (X2)

The seeds or seeds used by corn farmers are a type of pulut manis. This species is more desirable because it has a high buyer interest, and can be sold in the form of young corn kernels. Compared to other types of corn that are only

harvested after drying, pulut manis is more beneficial.

Respondents' descriptions based on the number of seeds used are shown in Figure 3

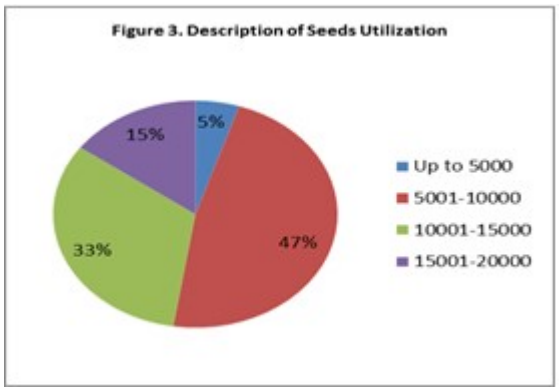
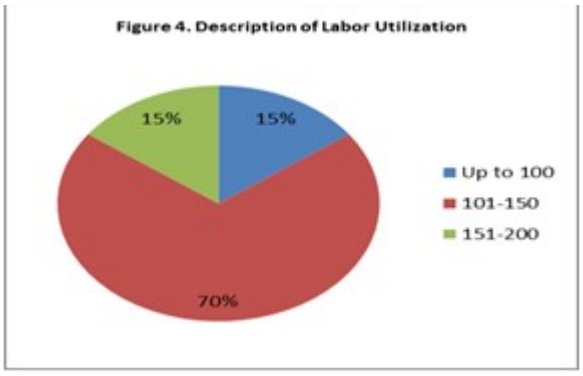


Figure 3 shows that the use of corn seeds varies from one respondent to another. This follows the size of the area under cultivation, of course. The larger the cultivated land area, the greater the number of seeds needed to plant it. The use of seeds starts from less than 5,000 grams to 20,000 grams. Most of the respondents (47%) used seeds between 5,001 and 10,000 grams. A further 33% used seeds between 10,001 to 15,000 grams. Meanwhile, those using the least amount of seeds used up to 5,000 grams of seed, which was 5% of respondents.

4. Labor (X3)

The labor force who works in corn farming in East Kupang District is on average male workers, with a total workforce of 1 to 5 people, depending on the size of the area cultivated. The amount of workforce that is calculated is in units of working person days (HOK). Each HOK is equivalent to 1 adult worker who works 8 hours a day. The distribution of the HOK amount is shown in Figure 4.



The data in Figure 4. shows that the use of labor is ranging from less than 100 HOK to 200 HOK. Most of the respondents (70%) employ a workforce of between 101 and 150 HOK. While the rest use labor between 151 to 200 HOK (15%), and up to 100 HOK (15%).

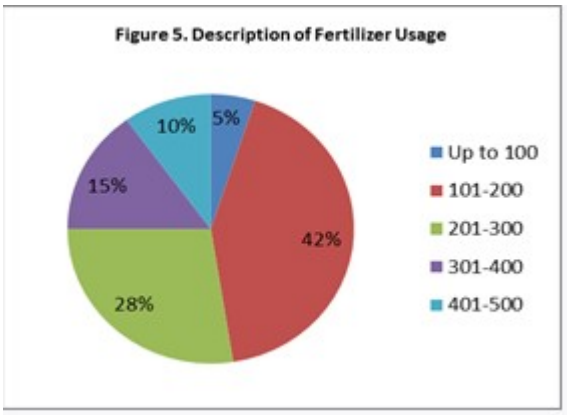


Figure 5. Shows that the use of fertilizer starts with 100 kilograms up to 500 kilograms. Most of the respondents (42%) used fertilizers between 101 and 200 kilograms. Meanwhile, the smallest use of fertilizer is up to 100 kilograms (5%).

The majority of respondents work alone or employ family members whose wages are not calculated. However, to be able to calculate the efficiency of the use of labor, every day a workforce is assessed based on the prevailing daily wage or usually paid in the research area. This value is the opportunity cost or the loss of the opportunity to work elsewhere, as a result of working in the corn farming business.

5. Fertilizer (X4)

Urea fertilizer is a type of fertilizer used by all respondents studied. Therefore, urea represents the X4 variable to describe the fertilizer used. The amount of fertilizer used in corn farming during the planting period in 2020 is as shown in Figure 5.

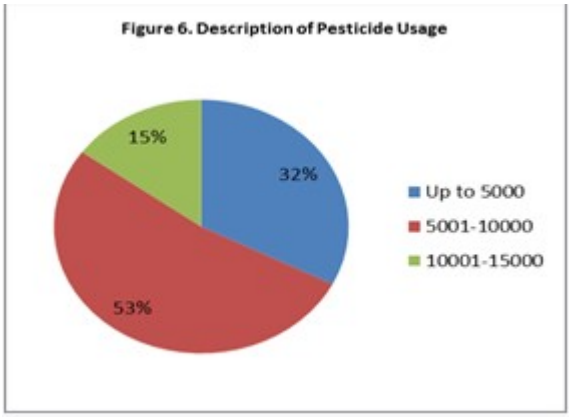


Figure 6. Shows that the use of pesticides ranges from 0 to 15,000 milliliters. Most of the respondents (53%) used pesticides ranging from 5,001 milliliters to 10,000 milliliters. The smallest use of pesticides is between 10,001 to 15,000 milliliters (15%).

6. Pesticides (X5)

The types of pesticides used are pest control liquid with the

following details of use

4.2. Relationship between Production Factors and Corn Production

Table 1. The Effect of Production Factors on Production Results

No	Variable	RC	t	SV	Remarks
1	Land Area	,385	3,795	,001	Significant**
2	Seeds	,143	1,740	,004	Significant *
3	Labor	,501	3,795	,001	Significant **
4	Fertilizer	,374	4,215	,000	Significant **
5	Pesticide	-,032	-,425	,674	NS

Information:

** significant on the 95% confidence level

*significant on the 90% confidence level

*NS = insignificant

To determine the relationship between production factors and production results, multiple linear regression analysis was used and the following results were obtained:

The relationship between production factors and corn production can be determined using the Cobb-Douglass production function model. The results of the analysis carried out resulted in the following models:

Log Y = Log 1,278 + 0,385log X1 + 0,143log X2 + 0,501logX3 + 0,374logX4 – 0,032logX5

Information:

Y = Corn production (grain)

X1 = Land area (m2)

X2 = seed (gram)

X3 = Labor (HOK)

X4 = Fertilizer (kg)

X5 = Pesticide (milliliter)

The results of the determination test (r2) show that the r2 value is 0.985, which means that 98.5% of the variation in production results can be explained by the production factors that are included in the model. While the remaining 1.5% is explained by other variables that are not researched or not included in the model such as climate, natural conditions, and the influence of other factors that cannot be known with certainty.

a. The Effect of Land Area on Production Results

Land area is one of the factors of production that had a significant effect on production results. This means that the larger the cultivated area, the greater the production results obtained. Based on research results. It is known that land area had a positive and significant effect on corn production. This can be proven by the t value of 3.795 which is greater than the t table value for the 95% confidence level of 2.03. The land area regression coefficient of 0.385 is the elasticity of land area to production yields, each additional 1% of land area will result in an increase in production yield of 0.385.

b. Effect of Seeds on Production Results

The corn seeds planted have a positive effect on corn production. The more seeds used, the greater the yield obtained. According to the research results, it was found that seeds had a positive and significant effect on production yields. . This can be proven by the t count value of 1.740 which is greater than the t-table value for the 90% confidence level of 1.69. The seed regression coefficient of 0.143 is the elasticity of the seeds to the yield, each addition of 1% of seeds will result in an increase in yield of 0.143%.

c. Effect of Labor on Production Results

Labor has a role in cultivating agricultural land so that it can be planted with corn. In addition, the workforce also plays a role in caring for corn such as watering, weeding, spraying pesticides and other activities in order to produce healthy corn that can be marketed to consumers. Therefore, labor has a positive effect on production results. The results showed that labor had a positive and significant effect on corn production. The proof of the effect of the tgers was carried out through the results of the t test of 3,795 which was greater than the t- table value of 2.03. The labor regression coefficient of 0.501 is the elasticity of the workforce to the output, each additional 1 percent of the workforce will result in an increase in production output of 0.501%.

d. Effect of Fertilizer on Production Results

Fertilizer is one part of the corn production facilities. The use of fertilizers is intended to increase the quality and quantity of corn production. The type of fertilizer commonly used by all farmers is urea. The results showed that the fertilizer variable had a significant effect on corn production. The t-count value of 4.215 is greater than the t-table value of 2.03. The fertilizer regression coefficient of 0.374 is the elasticity of the fertilizer to the yield, each addition of 1 percent of fertilizer will result in an increase in production yield of 0.374%.

e. Effect of Pesticides on Production Results

The results showed that Pesticides had a negative and insignificant effect on production results. This occurs because the excessive use of drugs in relatively large quantities indicates an attack by pests and plant diseases which affect the decline in production. Therefore, the Pesticides variable had no significant effect on production results. This is evident from the t-count value of -0.425 is smaller than the t-table value of 2.03. The negative regression coefficient shows that an increase in the use of drugs had an effect on reducing production yields, although this effect was not so real.

4.3. Analysis of the Efficiency of Using Production Factors

In accordance with the formulation of the hypothesis that has been stated in Chapter 2, the efficiency analysis of the use of production factors is intended to determine whether the use of production factors in corn farming is efficient or not. The efficiency measure used in this analysis is price efficiency or allocative efficiency. A measure of whether or not the use of production factors is efficient is reflected in the amount of marginal production value (MPV) for each production factor, with the following conditions:

- MPV = 1 means efficient
- MPV <1 means it is not efficient, so it needs to be reduced
- MPV > 1 means it is not efficient, so it still needs to be added

Based on these criteria, then an analysis is carried out to determine the amount of the MPV value as listed in table 2.

Table 2. Efficiency 0f sing Production Factors

Production Factors	bi	Y	Py	X	Px	bi .Y . Py	X .Px	MPV
Land Area	0,385	12387,5	1000	5587,5	500	4769188	2793750	1,707092
Seeds	0,143	12387,5	1000	11,05	125000	1771413	1381250	1,282471
Labor	0,501	12387,5	1000	130,87	30000	6206138	3926100	1,580739
Fertilizer	0,374	12387,5	1000	260	3000	4632925	780000	5,939647

Based on the results of the analysis in table 2, it shows that the use of production factors in corn farming in East Kupang District, Kupang Regency is inefficient. This is evident from the magnitude of the MPV value for all production factors greater than 1. Thus the hypothesis H0 is rejected, and H1 is accepted for the hypothesis that has been formulated. To achieve efficiency in the use of production factors, it is still necessary to increase the number of production factors, especially for production factors that have the greatest MPV value.

V. CONCLUSIONS AND RECOMENDATION

Based on the discussion in the previous chapters, it can be concluded that Production factors Land area, seeds, labor, fertilizers and pesticides simultaneously had a significant and positive effect on corn production incorn farming in East Kupang District, Kupang Regency. This is evident from the magnitude of the F-count value which is greater than the F-table value. Partially the area of land, seeds, labor and fertilizers also had a positive and significant effect on the yield of corn in corn farming in East Kupang District, Kupang Regency. This is evident from the magnitude of the t-count value which is greater than the t-table value. The use of land area, seeds, labor and fertilizers was also not efficient, as evidenced by the amount of MPV that is greater than 1. Thus, to achieve efficiency in the use of these production factors, it is necessary to increase the number.

Partially, pesticide had a negative and insignificant effect on the yield of corn production in corn farming in East Kupang District, Kupang Regency. This is evident from the value of the t-count which is smaller than the t-table value, and the regression coefficient was negative. This occurs because the use of pesticides was intended to eradicate pests and diseases in corn plants, so that under certain conditions, the use of large amounts of pesticides indicates that there are many pests and diseases that result in decreased production.

Based on the conclusion, can be recomended for the managers of corn farming in East Kupang sub- district, Kupang regency to continue to increase the volume of corn production by adding or increasing the number of production factors that had a significant effect on production yields. In order to increase the efficiency of the use of production factors, it is suggested that the production factors that have not been efficiently used, which is indicated by the amount of MPV that was greater than 1, need to be added.

REFERENCES

[1]. Anonimous. 2019. NTT dalam Angka 2019. BPS Provinsi NTT.
[2]. Reksohadiprojo S. 2000. Manajemen Produksi dan Operasi. BPFE UGM. Yogyakarta
[3]. Assauri S. 2008. 2008. Manajemen Produksi dan Operasi. LPFE UI. Jakarta
[4]. Mubiyarto. 2001. Pengantar Ekonomi Pertanian. LP3ES Jakarta.
[5]. Mosher AT. 1998. Menggerakkan dan Membangun Pertanian. CV Yasaguna Jakarta
[6]. Soekartawi. 2003. Teori Ekonomi Produksi. Rajawali Press. Jakarta
[7]. Sugiyono. 2014. Metode Penelitian Bisnis. Alfabeta. Bandung.