**AGRISOCIONOMICS**
Jurnal Sosial Ekonomi dan Kebijakan Pertanian

ISSN 2580-0566 EISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
5(2): 8-18, November 2021

# THE DETERMINANTS OF PRODUCTION AND FEACIBILITY OF CHILI PEPPER IN PROVINCE OF SUMATERA UTARA

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Submitted 29 January 2020; Accepted 03 February 2021

**ABSTRAK**

Cabai besar merupakan komoditas hortikultura yang mempunyai potensi untuk dikembangkan di Provinsi Sumatera Utara karena cabai besar merupakan salah satu komoditas yang strategis dan mempunyai nilai ekonomi tinggi. Tujuan dari penelitian ini adalah untuk melihat faktor yang berpengaruh terhadap produksi cabai besar dan menganalisis tingkat kelayakan usahatani cabai besar. Penelitian ini menggunakan data *cross section* yang bersumber dari Badan Pusat Statistik Provinsi Sumatera Utara. Penelitian ini menggunakan analisis regresi linier berganda dan analisis *return cost ratio (R/C).* Hasil penelitian menunjukkan bahwa luas lahan, produktivitas dan rata-rata harga cabai besar memberikan pengaruh sebesar 93,12 persen sedangkan 6,88 persen dipengaruhi oleh variabel lain di luar model. Berdasarkan hasil pengujian secara simultan dan *partial* luas panen, produktivitas dan rata-rata harga cabai besar berpengaruh terhadap produksi cabai besar. Berdasarkan analisis *revenue cost ratio* (R/C) usahatani cabai besar layak untuk diusahakan karena menguntungkan secara ekonomis.
***Kata kunci:*** *cabai besar, faktor produksi, kelayakan usaha tani*

**ABSTRACT**

*Chili pepper is a horticultural commodity that has the potential to be cultivated in Sumatera Utara Province. It is a strategic commodity and has high economic value. This research aims to look at the factors that affect the production of chili pepper and analyze the feasibility of chili pepper farming. This research used cross-section data sourced from the Central Statistics Agency of Sumatera Utara Province. This research used multiple linear regression analysis and analysis of the return cost ratio (R / C. The results of the research showed that land area, productivity, and an average price of chili pepper gave an effect of 93.12 percent while 6.88 percent is influenced by other variables is based on the model. Based on simultaneous and partial harvesting test results, productivity and the average price of chili affect the production of chili pepper, based on the analysis of revenue cost ratio (R / C), chili pepper farming is feasible to be cultivated because it is economically profitable.*
***Keyword:*** *feasibility, chili pepper, factor of production*

## INTRODUCTION

The development of horticultural agribusiness, especially vegetables, is in line with the goal of agricultural development in Indonesia. The goal is to improve the standard of living of farmers more evenly through increased production and income. Horticultural commodities are potential commodities with high economic value (Chonani et al., 2014). The vegetable commodity as a priority to encourage agricultural growth in Indonesia is chili. Chili commodity is a strategic vegetable commodity and has high economic value. This commodity is also a source of income and employment opportunities that make a fairly high contribution to regional economic development(Balitbang, 2005).

Chili is an interesting horticultural commodity to be studied both in terms of

cultivation and marketing. Some of the studies that have been carried out include such as Kasymir (2011) who researched production efficiency and red chili farming income. Suwastawa (2010) also researched red chili farming in Bali. The same research was conducted by Andayani (2016), which examined the factors that affect the production of red chili. Dewi & Mariati (2013) conducted research on the factors that influence the price of chili pepper in Samarinda City. The same research was conducted by Nugrahapsari & Arsanti (2019) about the fluctuations and disparities of chili prices in Indonesia, while Nauly (2016) researched the fluctuations and disparities of chili prices in Indonesia.

North Sumatra Province is an area that has the potential to develop chili pepper plants. The production of chili pepper in 2018 was 1.5 million quintals with a harvested area of 15,905 hectares (BPS, 2019d). North Sumatra Province contributed 12.91 percent to the total production of chili pepper in Indonesia in 2018 (BPS, 2019d). This is an important reason for the development of chili pepper commodities in North Sumatra Province. Increasing agricultural production is one of the government's efforts in building resilient agriculture because agriculture plays an important role in people's lives (Rumintjap & Muis, 2014). The purpose of farming is to increase productivity and production to generate higher profit (Yusuf et al., 2014). Based on Deviani et al., (2019) profits can be maximized if farmers can manage the factors of production efficiently. Factors of production include land, fertilizers, seeds, pesticides, and technology.

Besides being one of the leading vegetable commodities, chili peppers also play a role in the economy of North Sumatra Province. This commodity is one of the food commodities that contributes to inflation in North Sumatra Province (BPS, 2019b). This may be because chili is one of the commodities that have quite large price fluctuations. According to Sukmawati et al., (2016) chili price fluctuations can be caused by a large amount of supply and a large number of requests. The higher the number of offers, the lower the price, while the smaller the number of bids, the higher the price. Anwarudin et al., (2015) also explained that chili price fluctuations depend on supply. If the supply of chili is reduced or lower than demand, there will be an increase in prices. Otherwise, if the supply of chili exceeds the need, the price will fall. Suwastawa (2010) in his research explained that the production and selling prices affect the income of red chili because price fluctuations will affect the results of farming and the income earned by farmers.

Based on the description above, it is necessary to research the analysis of production and feasibility of chili pepper cultivation in North Sumatra Province. This study aims to analyze the factors that influence the production and efficiency of chili pepper farming in North Sumatra Province. The research results are expected to provide important information for local governments in formulating policies in the agricultural sector to improve farmers' welfare.

## RESEARCH METHOD

This is explanatory research using a method that explains the relationship between the independent and the dependent variables (Bangun, 2019). The data used in this research were secondary data sourced from publications published by the Central Statistics Agency of North Sumatra Province. The variables used in this research were the amount of chili pepper production in quintal units, chili pepper land area in hectares, chili pepper productivity in quintals per hectare, and the average price of chili pepper at the farm level according to the area in North Sumatra Province. 2018. This research also used data on expenditures and production values of chili pepper cultivation businesses in North Sumatra Province.

This research used multiple linear analysis methods to find out the relationship

between predictor variables and criteria variables. Data processing used STATCAL software. The multiple linear equation models is generally formulated as follows (Bangun, 2019; F. W. Sari & Bangun, 2019):

$$Y= a+b_1x_1 + b_2x_2+ b_3x_3 + \epsilon$$

In which:

y : chili pepper production (quintal)
a : constant
b : regression coefficient
$x_1$ : land area variable
$x_2$ : productivity variable
$x_3$ : variable average purchase price at farm level
$\epsilon$ : error

**Classic assumption test**

Classical assumption testing needs to be conducted before performing regression analysis (Haslinda & Muhammad, 2016). Classical assumption test includes normality, heteroscedasticity, and multicollinearity tests.

a. The normality test is defined as a test of the normality of the nuisance error/error used to see whether the independent and dependent variables in the model are normally distributed. Normality tests can be carried out using graphs or statistical tests with the help of statistical tools. This study uses the Kolmogorov-Smirnov test with the help of the STATCAL application. The data is normally distributed if the significance value is greater than the test significance ($p\geq0.05$) (Herawati, 2016; Setyadharma, 2010).
b. The heteroscedasticity test assesses whether there is an inequality of variance from the residuals for all observations in the linear regression model. This test is one of the classical assumption tests that must be performed on linear regression. If the assumption of heteroscedasticity is not met, then the regression model is declared invalid as a forecasting tool. A good regression should not occur heteroscedasticity. Heteroscedasticity testing can be conducted with the Glacier Test, Park Test, and Spearman Test with the help of the STATCAL application. The model does not have heteroscedasticity if the significance value is greater than the test significance ($p\geq0.05$)(Setyadharma, 2010).
c. Multicollinearity test is used to show the existence of more than one perfect linear relationship. Regression coefficients are usually interpreted as a measure of the change in the dependent variable if one of the independent variables increases by one unit and all other independent variables are held constant. To detect the existence of multicollinearity is to use the value of the variance inflation factor (VIF). If VIF is less than 10, then there is no multicollinearity in the model(Denziana, Indrayenti, & Fatah, 2014; Haslinda & Muhammad, 2016).

**Hypothesis Test**

Hypothesis testing includes hypothesis testing simultaneously and partially. Simultaneous hypothesis testing or commonly called the F test is a test of the significance of the model simultaneously (together). It aims to see the ability of all independent variables to be able to explain the diversity of dependent variables. The test criteria are as follows:

$$F = \frac{U/v1}{V/v2}$$

In which U and V represent independent random variables with degrees of freedom v1 and v2 ., respectively

The research hypothesis is as follows:

$H_0$ : There is no simultaneous effect of variables of land area, productivity, and the average price on chili pepper production in North Sumatra Province.
$H_1$ : There is a simultaneous effect of variables of land area, productivity, and the average price on chili pepper production in North Sumatra Province.

The explanation of the test criteria can be explained if the F-count value is greater than the F-table value. It means that it rejects

Ho or accepts $H_1$ and vice versa. If the criterion is to reject $H_o$, it can be concluded that the independent variable can simultaneously explain the dependent variable, so that the model can be used and vice versa.

For partial hypothesis testing or commonly called t-test, it is intended to test whether an independent variable has a significant (significant) effect on the partially independent variable. The test criteria are as follows:

$$t_{count} = \frac{bi}{sbi}$$

in which:
Bi = partial regression coefficient
sbi = standard error of the partial standard coefficient
The research hypothesis is as follows:
$H_0$ : There is no partial effect on the variables of land area, productivity, and the average price on chili pepper production in North Sumatra Province.
$H_1$ : There is a partial effect of the variables of land area, productivity, and the average price of chili pepper production in North Sumatra Province.

The test criteria explain that if the t-count value is greater than the t-table value, it means that it rejects $H_o$ or accepts $H_1$ and vice versa. If the criterion is to reject $H_o$, it can be concluded that there are independent variables that have a significant effect on the dependent variable and vice versa.

**Business Feasibility Analysis**

One measure of business feasibility is the analysis of the return cost (R/C) ratio. Analysis of return cost ratio (R/C) is a comparison between revenue and costs (Baru et al., 2015; Hutapea, 2016; Sari et al., 2013; Siregar, 2011). The R/C formulation is as follows:

$$R/C = \frac{TR}{TC}$$

In which:
R/C :
TR : Total revenue
TC : Total farm production cost
With criteria:
R/C > 1 means that farming is feasible, economically profitable
R/C < 1 means that farming is not feasible and not economically profitable.

## RESULT AND DISCUSSION

**Chili Pepper Production of North Sumatra Province**

Chili pepper is one of the leading horticultural commodities in North Sumatra Province. Chili pepper is a leading vegetable comm odity because it has high economic value and the potential to continue to be developed. Based on Tsurayya & Kartika (2015), Leading commodities are feasible to be cultivated because they provide benefits to farmers and have an impact on labor absorption and the regional economy. Based on BPS (Central Bureau of Statistics) data, chili pepper made the biggest contribution to the production of vegetable agricultural commodities in North Sumatra Province in 2018(BPS, 2019c). Chili pepper production in 2018 was 1.5 million quintals, down 2.07 percent compared to chili pepper production in 2017. The decline in chili pepper production was influenced by a decrease in the chili pepper harvested area (BPS, 2019c). The growth of chili pepper production during the period 2016 to 2018 was 1.04 percent per year.

Chili pepper commodity is cultivated mostly in the North Sumatra region. Areas that become centers of chili pepper cultivation are Karo Regency, Simalungun Regency, and Batubara Regency. Karo Regency gave the largest contribution to the production of chili pepper at 31.08 percent, followed by Simalungun Regency at 25.73 percent, and Batubara Regency at 8.50 percent to the total production of chili pepper in North Sumatra Province.

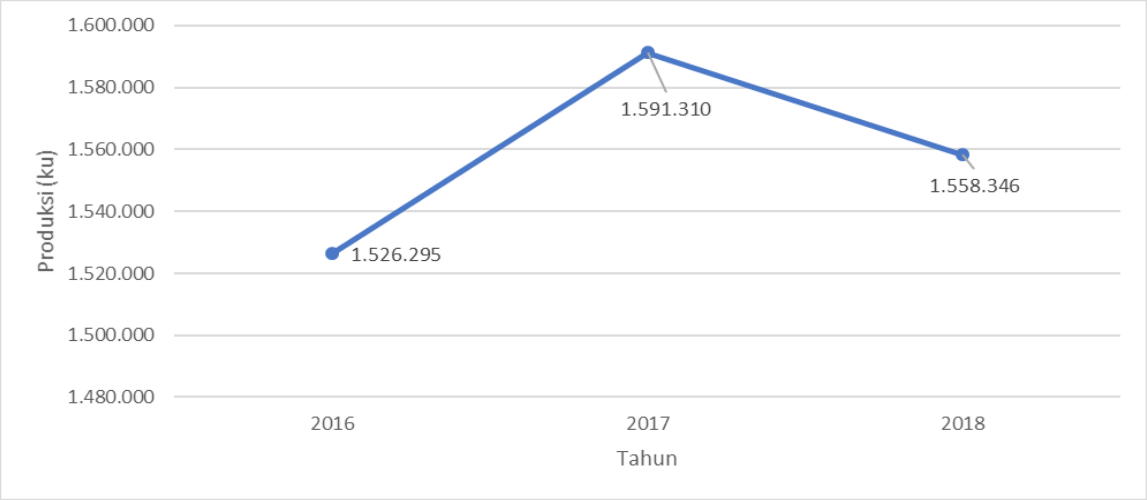


**Figure 1.** Chili Pepper Production in North Sumatra Province 2016-2018 (Quintal)
Source: BPS, 2019

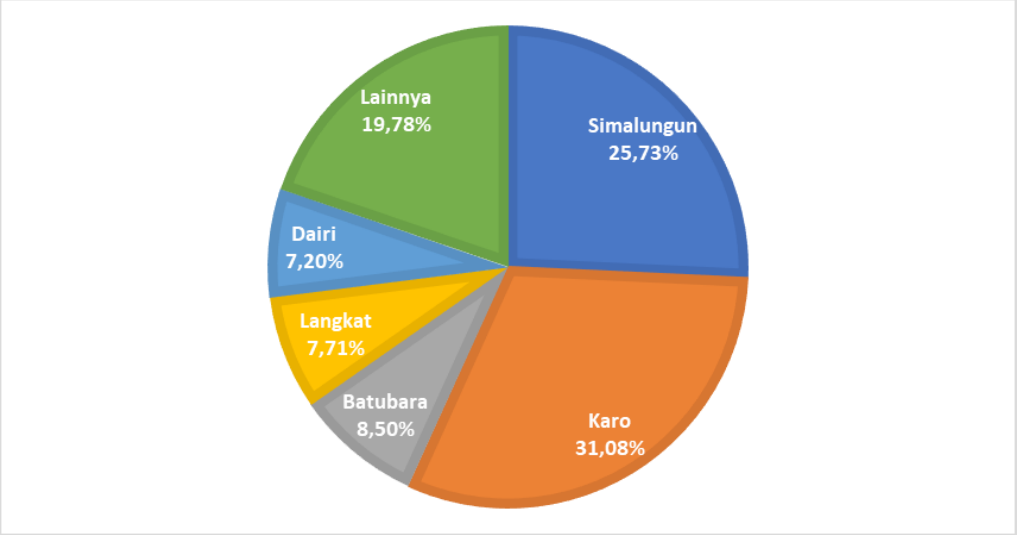


**Figure 2.** Contribution of Chili Pepper Production in North Sumatra Province by Regency/City in 2018
Source: North Sumatra Province BPS, 2019

**Multiple Linear Regression Analysis**

Multiple linear regression was used to analyze the effect of variables on land area, productivity, and the average price on chili pepper production in North Sumatra Province. The assumption test is carried out before testing the model. The results of data processing using STATCAL, the data in this research has passed the classical assumption test. The results of the normality test using the Kolmogorov Smirnov Test showed that the data were normally distributed, as evidenced by the p-value whose value was greater than the 5 percent significance value. The problem of heteroscedasticity was not found in this study because based on the results of testing with the Glejser test, there was no variance inequality of all research variables. The problem of multicollinearity was also not found in this study.

Based on the VIF value, all research variables have a VIF value less than 10. Completely the results of the classical assumption test can be seen in Table 1.

Based on the test results obtained linear regression equation as follows:
Chili pepper production = -114,52 + 89,5 harvested area + 686,42 productivity + 2,94 Farmers' average purchase price + ϵ

**Table 1.** Classical Assumption Test Results Multiple Linear Regression Analysis

| Variable | Classic assumption test | | |
|---|---|---|---|
| | *Test Kolmogorov Smirnov (p-value)* | Glejser Test *(p-value)* | VIF |
| Residual | 0,368 | 0,11 | - |
| Land area | | 0,28 | 1,08 |
| Productivity | | 0,11 | 1,45 |
| Average price | | 0,15 | 1,36 |

Source: Results of data processing, 2020

Constant value -114,52 showed that the production of chili pepper was – 114,52 if there was no influence of other variables. The variable area of land had a positive effect on the variable of chili pepper production. The regression coefficient for the land area was 89.57. It means that chili pepper production would increase by 89.57 percent if the land area increased by 1 percent. The regression coefficient of the productivity variable was 686.42. It means that the production of chili pepper would increase by 686.42 percent if the productivity of chilies pepper increased by 1 percent. The average coefficient of chili pepper prices was 2.94. It means that the production of chili pepper will increase by 2.94 percent if the average price of chili pepper increases by 1 percent. The regression equation model showed that the variables of land area, productivity, and the average price had a positive effect on the variables of chili pepper production in North Sumatra Province. The results of this research were in line with research conducted by Revavindo & Bangun (2016) who concluded in his research that land area and price affect corn production in Karo Regency. Research conducted by Hasan (2010) also concluded that the variables of land area and productivity play a role in increasing food crop production in East Java. Habib (2013) in his research on the factors that affect corn production, concluded that land area, seeds, and fertilizers play an important role in increasing corn production.

Based on the results of the calculation of the coefficient of determination ($R^2$) the effect of variables on land area, productivity, and the average price of chili pepper on the production of chili pepper was 93.12 percent while 6.88 percent was affected by other variables outside the model. The results of this research were in line with research conducted by Pranata & Damayanti (2016) that production factors have an effect of 96.9 percent on the production of curly red chili in Sigi District.

Simultaneous testing showed that the variables of land area, productivity, and the average price of chili pepper affected the production of chili pepper in North Sumatra Province. This result was based on a significant value that was smaller than the test significance value at the 5 percent confidence level. Research conducted by Andayani (2016) concluded that production factors that included land area, productivity, and labor had a simultaneous effect on red chili production in Majalengka Regency. Ummah (2011) in her research on the analysis of the efficiency of the use of production factors in red chili farming in Magelang Regency also concluded that land area and productivity have a simultaneous influence on the production of curly red chili.

Partial testing of the variables of land area, productivity, and the average price of red chili had a significant effect on the production of chili pepper in North Sumatra Province. The results of simultaneous and partial model testing can be seen in full in Table 2.

**Land Area**

Based on the results of the partial test analysis, the land area had a significant effect on the production of chili pepper. The regression coefficient of the land area was 89.61. It means that the land area had a positive effect on increasing the production of chili pepper.

**Table 2.** Multiple Linear Regression Analysis Results

| Independent variable | Coefficient | t-statistics | Significance |
|---|---|---|---|
| Constant | -114,83 | -4,14 | 0,000 |
| Land area | 89,61 | 17,17 | 0,000 |
| Productivity | 687,06 | 5,62 | 0,000 |
| Average Price | 2,95 | 3,21 | 0,003 |
| $R^2$ | | 0,9381 | |
| Adjusted $R^2$ | | 0,9312 | |
| F-statistics | | 136,2887 | |
| Probability of F-statistic | | 0,0000 | |

Source: Results of data processing, 2020

An increase of 1 percent of the land area will have an effect of 89.61 percent on the production of chili pepper. Land area was closely related to production. It means that the addition of the chili pepper area would affect the increase in chili pepper production in North Sumatra Province. Based on Noer & Anggraeni (2016), Land is the main factor in production activities. It will determine how much product is produced. Sunarti (2013) also argued that planting area plays a role in increasing production. Research conducted by Sarina et al., (2015) about the factors that affect the production of red chili in the village of Kampung Melayu concluded that the area of land affects the increase in red chili production. The increased land area will increase the resulting production.

Asgar et al., (2019) in their research on factors that affect patchouli production in Tolele Village also concluded that land area has a positive effect on increasing production, and increasing land area will increase population and tend to increase production.

**Productivity**

Productivity had a significant effect on the production of chili pepper based on the results of the partial test. The productivity regression coefficient was 687.06. It indicated that productivity had a positive effect on increasing the production of chili pepper in North Sumatra Province. An increase in productivity of 1 percent will increase the production of chili pepper by 687.06 percent. Productivity covered in this research was the use of seeds, fertilizers, and pesticides. Based on Deviani et al., (2019) proper use of seeds, fertilizers, and pesticides can be beneficial for increasing agricultural production. Based on data released by BPS, spending on seeds, fertilizers, and pesticides for chili pepper cultivation per hectare per growing season is 52.66 percent (BPS, 2019a). This showed that productivity had an important role in increasing the production of chili pepper in North Sumatra Province. Kasymir (2011) in his research on production efficiency and business income of red chilies in Penengahan District, concluded that productivity, especially pesticides, affected red chili production. Harahap (2013) in his research on the efficiency of using chili farming production factors in Sumowono District also concluded that seeds and fertilizers affect the production of red chilies. Saptana et al., (2016) also believed that the proper use of fertilizers and pesticides will help increase red chili production.

**The Average Price of Chili Pepper**

The results of the partial test proved that the average price of chili pepper had a significant effect on the production of chili pepper in North Sumatra Province. The regression coefficient of the average price of chili pepper was 2.95. It means that the average price of chili pepper had a positive effect on the production of chili pepper in North Sumatra Province. An increase in the average price of chili pepper by 1 percent would increase the production of chili pepper by 2.95 percent. Based on Saptana et al., (2016) price increase will have an impact on

increasing production. According to Wahed (2015), Price plays an important role in improving the welfare of farmers. The increase in agricultural commodity prices will affect farmers' income. Revavindo & Bangun (2016) In his research on the effect of corn production factors in Karo Regency, he also concluded that the price affected increasing production. Tamalonggehe et al., (2015) also concluded in his research on the factors that affect the production of snake fruit in Sitaro Regency that the price affects the increase in production, every price increase will increase the production of salak.

**Farming Feasibility Analysis**

The success of chili pepper farming in North Sumatra Province was illustrated by the results of the analysis of revenues for the costs incurred (R/C). This farming analysis showed how much income would be obtained by farmers from each cost incurred for chili pepper farming activities.

Expenditures in chili pepper farming consisted of production costs, labor wages, and other expenses. Production costs incurred for the cultivation of chili pepper commodities per hectare per growing season were IDR 71.71 million. Labor wages were the largest component of expenditure, amounting to IDR 38.07 million or about 53.09 percent of the total production cost (BPS, 2019a). The income received by farmers per hectare per planting season is 112.1 million rupiahs. The income obtained from chili pepper farming depends on the number of products produced. Based on Baru et al., (2015) revenue was influenced by the size of the production and the quality of chili production. Complete details of receipts and fees can be seen in Table 3.

Income is one of the measuring tools for the success of agricultural cultivation. Based on Siregar (2011) income from farming provides an overview of the success of farming. Farming income obtained is the difference between revenue and costs incurred for cultivating agricultural commodities. Based on the calculation results, the income received by chili pepper farmers in North Sumatra Province was 40.36 million. The income obtained from chili pepper farming is profitable for farmers.

**Table 3.** Revenue and Production Costs of Chili pepper Plants per hectare per growing season in North Sumatra Province in 2018

| No | Information | Value (000 Rp) |
|---|---|---|
| 1. | Total Revenue | 112.076,7 |
| 2. | Total Production Cost | 71.714,8 |
| | Seed | 1.944,6 |
| | Fertilizer | 11.714 |
| | Pesticides/Fungicides | 6.498,6 |
| | Fuel | 685,9 |
| | Electricity | 73,7 |
| | Protective net | 103,1 |
| | Mulch | 2.627,9 |
| | Container, Polybag, Ajir (enforcement tools made of babu sticks or bamboo sticks), Rope | 2.082,8 |
| | Labor | 38.072,8 |
| | Land lease | 4.253,4 |
| | Other Expenditure | 3.658 |
| 3. | R/C | 1,56 |

Source: North Sumatra Province BPS, 2019

The results of calculating the feasibility of farming with revenue cost ratio (R/C) the feasibility level of chili pepper farming was 1.56. It illustrated that by spending 1 rupiah, the farmer would get an income of 1.69 rupiahs. This showed that chili pepper farming in North Sumatra Province was feasible because it was economically profitable.

The results of this research supported the research conducted Suwastawa (2010) who researched red chili farming in Sinduwati Village, who concluded that red chili farming is very feasible because it provides large profits. Rasidin et al., (2018) in their research on the income and marketing feasibility of red chili in Watangpulu District also concluded that red chili farming is feasible.

## CONCLUSION AND SUGGESTION

The results of the test using multiple regression techniques show that land area, productivity, and the average price of chili pepper have an effect of 93.12 percent. 6.88 percent are affected by other variables outside the model. Based on the results of simultaneous and partial tests of harvested area, productivity, and the average price of chili pepper affect the production of chili pepper. According to the revenue cost ratio analysis, chili pepper farming is feasible because it is economically profitable.

Increasing the income of chili pepper farming by optimizing production factors which include the use of appropriate seeds, fertilizers, and pesticides as well as land optimization. There needs to support from the local government, especially from the Department of Agriculture, especially regarding cultivation techniques to increase farmers' knowledge and skills that can increase farmers' production and income.

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