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The Effect of Increase of Coffee Plant Production on Development in Sidikalang Sub- District, Dairi Regency

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ABSTRACT

This study aims to analyze the effect of production factors on increasing coffee production in Sidikalang District agriculture. The study was performed in Dairi Regency, which consists of 15 (fifteen) districts, and the Sidikalang District is the focus of this research. This region was selected to be the research location because it is an area in Dairi Regency that has a significant harvest area/land area and largish production of coffee. This study can be grouped into quantitative data according to the data form and analysis. The Cobb-Douglass production function equation is the analytical method used in this analysis. The results showed that the production factors in increasing coffee production were land area, the number of workers, working time, use of fertilizers, the use of pesticides, seed varieties, processing methods, and farmer education simultaneously affecting coffee farmer production in the Sidikalang Sub-District, Dairi Regency. Partially the variables of land area, number of workers, time spent on work, use of fertilizers, use of pesticides, seed varieties, and processing methods show a positive and significant effect on coffee farmer production in Sidikalang District, Dairi Regency, while farmer education has a positive but not significant effect on farmer production

Keywords: *Coffee, factors of production, regional development*

1. INTRODUCTION

Most of Indonesia's coffee plants are distributed in areas such as southern Sumatra, southern Java, southern Sulawesi, Bali, and Nusa Tenggara, south of the equator. A small part of this plant is also found in areas north of the equator, such as the island of Sumatra, where it is found in the northern regions of Sumatra and Aceh. The coffee plant is not original to Indonesia, but originates from Africa, especially in Ethiopia (Najiyanti, 2008).

Coffee is also one of the plantation commodities which plays an important role in North Sumatra Province, where one of the centers or centers of coffee production is Dairi Regency. Dairi Regency consists of 15 (fifteen) districts, where one of the districts that cultivate coffee plants is Sidikalang District. The area of land and coffee production in Sidikalang District 2015-2019 can be seen in Table 1.

Table 1
Land Area, Production and Number of Farmers in Sidikalang District 2015-2019

Tahun	Luas Lahan (Ha)	Produksi (ton)	Jumlah Petani (KK)
2015	319,50	306.72	890
2016	320,10	326.50	890
2017	335,50	332.14	890
2018	255	354.77	900
2019	315	321.30	1.015

Sumber: BPS Kabupaten Dairi, Tahun 2020

The fluctuating area and production of coffee are thought to be due to the drastic and erratic drop in the selling price of coffee. Then there is a striking price difference between coffee beans and ground coffee or processed coffee. The selling price condition makes it very difficult for coffee farmers to develop because the majority of farmers in Sidikalang Sub-District only farm coffee but do not process coffee into coffee powder, as a result, some farmers switch to citrus crops.

The capital factor is an important factor in increasing coffee production when handling coffee plantations. In this case, capital is concerned with how much it costs to prepare the land, seeds, fertilizers, and labor

wages. In deciding how much coffee is produced, capital is the key factor. In Dairi Regency, especially the Sidikalang sub-district, capital is a problem for coffee farmers. Some coffee farmers experience limitations in providing capital for their coffee plantations, because of the Covid-19 coronavirus pandemic. This limited capital resulted in the process of preparing the land, seeds, fertilizers, and the payment of labor wages that were not optimal so that coffee production decreased. In Dairi Regency, the amount of capital for the management of coffee plantation land within one year is $\pm$ IDR 10,000,000 per hectare. Other factors that determine the results of coffee production apart from the capital are land area, the number of workers, time spent working, use of seeds, processing methods, and education.

The authors are interested in exploring and analyzing the issue of demand factors in increasing coffee production, based on the descriptions above.

2. LITERATURE REVIEW

The coffee plant is a tree-shaped plant species belonging to the Rubiaceae family and the *Coffea* genus. The coffee plant grows upright, has branches, and can reach 12 m in height. This plant has leaves that are oval with slightly tapered ends. The leaves grow opposite each other on stems, branches, and twigs.

Coffee has a branching system that is somewhat different from other plants. Coffee plants have several types of branches with different characteristics and functions, namely (Najiyanti, 2008): orthotropic branches are the branches that grow upright and straight, plagiotropic branches are the branches that grow on the main stem or reproductive branch and comes from primary shoots, secondary branches are branches that grow on the primary branch and come from secondary shoots, *kipas* branch is a reproductive branch that grows strong on the primary branch because the tree is old, *pecut* is a *kipas* branch that is not able to form a primary branch even though it grows strong enough, *balik* branch is a reproductive branch that grows on the primary branch and develops abnormally, water branch reproductive branches that grow rapidly and the internodes are relatively long and soft or contain a lot of water.

Coffee plants that are well cared can produce at the age of 2.5–3 years. Coffee plants grown in lowland areas bear fruit faster than those grown in upland areas. In the first harvest, the number of cherries picked was low. After the plant is 7 - 9 years old, this amount will rise from year to year and will hit its peak. The coffee cherries are collected when ripe to produce high-quality yields, which is suggested by the red berries. The time it takes to be selected (ripe fruit) from flower buds is 8 - 11 months for Robusta coffee and 6 - 8 months for Arabica coffee.

More than 90% of coffee plants in Indonesia are cultivated by the people. The application of the technology used is still simple, this results in low coffee production and quality. To overcome this, the steps that need to be taken by farmers are as follows (Najiyanti, 2008): To grow superior Arabica coffee varieties on suitable soil, substitute old plants with recommended superior new plant varieties (rejuvenation), apply the right cultivation techniques, all planting systems, pruning, fertilizing, pest and disease control as well as shade management, harvesting systems are implemented and processing is accurate, whether in collecting, processing, drying or sorting.

The production function is a function that shows the technical relationship between physical production results (output) and production factors (input) which is known as a factoring relationship (Hanafie, 2010). The conventional division of production factors is the land, labor, and capital.

Two capital that must be fulfilled in entrepreneurship is mental capital that is in the form of dreaming, striving, being ready to fail, and being successful, according to Chandra in Royan (2004). Meanwhile, money is physical capital. According to Case and Fair (2007), capital is a value produced by the economic system that will be used in the future as an input to produce other goods and services. Physical or tangible capital, social capital, and intangible capital are the primary categories of capital. In the agriculture sector, the workforce is farmers. The application of the agricultural development process depends on the role of the farmer.

Soil is a natural body arranged in a profile. In the soil substance, there are 4 (four) main components that support the possibility of plant life, namely minerals, organic matter,

water and air. The position and condition of these components greatly determine soil fertility or land use for farming (Hanafie, 2010).

Development is an effort to change, according to Hadi (2000), based on a particular decision of perspective that can not be separated from experience, the facts of the situation at hand, and the interests of the parties that make decisions on development. Development is a planned shift from one condition to another that is better, according to Tjahja (2000).

Pasaribu (2009) states that the factors of capital production, land area, and labor have a significant effect on patchouli production and the impact of patchouli agriculture on the development of the Sitellu Tali Urang Jehe Subdistrict, Pakpak Bharat Regency, indicating an increase in income, job opportunities and land area for farmers from 2004 and the year 2007.

Hutauruk (2009) states that formal education has a positive but insignificant effect on coffee plant productivity in North Tapanuli Regency. The contribution of coffee plant productivity to regional development in North Tapanuli Regency can be seen from the income, labor absorption, the growing development of agricultural shops and collectors, and the establishment of a coffee bean processing factory in Siborongborong District.

Research Hypothesis

The factors of land area, labor, working time, use of fertilizers, use of pesticides, seed varieties, processing methods, and farmer education have a positive effect on coffee production in Sidikalang Sub-District.

3. RESEARCH METHODOLOGY

The study was performed in Dairi Regency, which consists of 15 (fifteen) districts, and Sidikalang Sub-District. is the focus of this study. The region was chosen to be the research location because Sidikalang Sub-District in Dairi Regency has a reasonably wide harvest area/land area and coffee production. This study can be classified as quantitative data according to the form of data and analysis.

The population in this study were 1,015 coffee farmers who live in Sidikalang Sub-District, Dairi Regency. Furthermore,

using the Taro Yamane equation, the total sample size was 91.03 people and rounded up to 91 respondents. Respondent samples were taken proportionally in each village with probability sampling.

Table 2
Population and Sample of Coffee Farmer Households (CFH) per Village

No	Village	Total Population of CFH	Total Sample of CFH
1	Sidiangkat	85	$85/1015 \times 91 = 8$
2	Batang Beruh	226	$226/1015 \times 91 = 20$
3	Bintang Hulu	43	$43/1015 \times 91 = 4$
4	Kalang Simbara	73	$73/1015 \times 91 = 7$
5	Bintang	41	$41/1015 \times 91 = 4$
6	Kalang	60	$60/1015 \times 91 = 5$
7	Kota Sidikalang	215	$215/1015 \times 91 = 19$
8	Belang Malum	43	$43/1015 \times 91 = 4$
9	Kuta Gambir	56	$56/1015 \times 91 = 5$
10	Huta Rakyat	129	$129/1015 \times 91 = 12$
11	Bintang Mersada	44	$44/1015 \times 91 = 4$
Total		1015	91

The data collection technique used was a questionnaire. To answer the research hypothesis, the factors of land area, labor, time spent working, fertilizer use, pesticide use, seed varieties, processing methods, and farmer education have a positive effect on coffee production in Sidikalang Sub-District using the Cobb-Douglass production function equation.

4. RESULT

Overview of Dairi Regency

Dairi Regency is one of the regencies/cities in North Sumatra Province. Geographically, Dairi Regency is located at a position of $2^{\circ} 15' - 3^{\circ} 32'$ North Latitude, $90^{\circ} 00' - 98^{\circ} 31'$ East Longitude with an altitude ranging from 500-1670 meters above sea level. Dairi Regency has an area of 1927.82 km² consisting of 15 sub-districts and 169 villages/wards. Dairi Regency is bordered to the north with Aceh Tenggara Regency, NAD Province, to the south with Pakpak Bharat Regency, to the east to Samosir Regency, to the west to Aceh Selatan Regency, NAD Province.

Dairi Regency has a tropical climate with an average humidity of around 79% per month, rainfall ranges from 120 to 331 mm per month with the highest periodic period in September 2009, rainy days per month ranging

from 8-20 days with large rainy days. in May-June 2009. The average wind speed is around 0.42 m / s with an evaporation rate of about 3.9 mm / day. The minimum monthly air temperature is 22.2 ° C and the maximum is 31.9 ° C.

Figure 1
Dairi Regency Administration Map

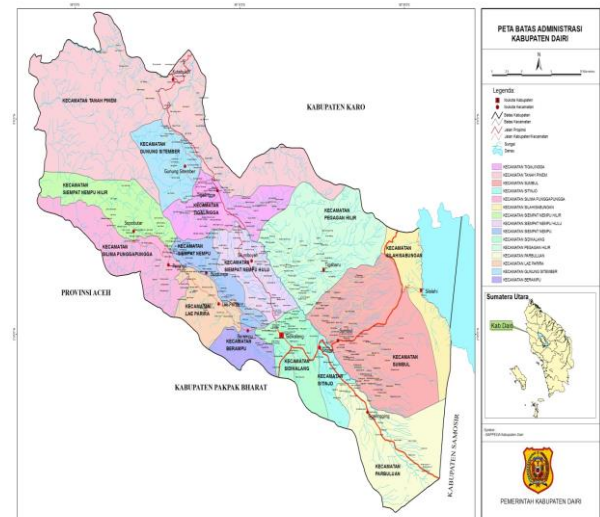


Table 3
Respondent Characteristics

Variabel	Category	Frequency	Percentage
Age	36-40	22	24.18
	41-45	36	39.56
	46-50	25	27.47
	> 50	8	8.79
Level of education	Primary	15	15.73
	Elementary	41	46.07
	Highschool	35	38.20
Gender	Male	78	85.71
	Female	13	14.29
Workforce	2	30	32.96
	3	35	38.46
	4	3	3.30
	5	3	3.30
	6	20	21.98
Land area (Ha)	0 – 0.5	4	4.40
	0.6 – 1,0	57	62.64
	> 1,0	30	32.96

The various ages of the respondents indicated that the respondents in this study involved the community at various levels and shows that different levels of age, education and women were involved in the coffee farming activities of the Sidikalang Sub-District. The number of workers varies and indicates that Sidikalang Sub-District coffee farming activities include individuals with a workforce of 2 to 6 people. The various coffee

plant areas illustrate that coffee farming activities in Sidikalang Sub-District are still on a small scale, namely 0 - 2 Ha.

Production Factors Affecting Coffee Plant Production

By using multiple regression equations, the production equation function is formed in the factors that affect production. The variables that are considered to influence the production of this coffee plant are: land area (X_1), workforce (X_2), working time (X_3), use of fertilizers (X_4), use of pesticides (X_5), seed varieties (X_6), processing method (X_7), and farmer education (X_8). All of these variables are simultaneously entered into the multiple regression equation.

Table 4
Coefficient of Determination

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.927 ^a	.859	.845	.14898

a. Predictors: (Constant), farmer education, seed varieties, processing method, use of fertilizer, use of pesticides, land area, working time, workforce

b. Dependent Variable: Production

Source: Primary Data Processed, 2020

The result of the calculation of the value of R Square is 0.859. This means that 85.9 percent of coffee plant production can be explained by independent variables of land area, workforce, working time, use of fertilizer, use of pesticides, seed varieties, processing method, and farmer education) above.

Table. 5
Simultaneous Test Results

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	11.057	8	1.382	62.278	.000 ^a
	Residual	1.820	82	.022		
	Total	12.877	90			

a. Predictors: (Constant), farmer education, seed varieties, processing method, use of fertilizer, use of pesticides, land area, working time, workforce

b. Dependent Variable: Production

Sumber : Data Primer Diolah, 2020

Simultaneous statistical test with a probability level of 0.000, thus it can be concluded that $P = 0.000 < \alpha = 0.05$, which means that H_a is accepted. This means that the

independent variables (land area, number of workers, time spent on work, use of fertilizers, use of pesticides, seed varieties, processing methods, and farmer education) are significant in explaining coffee farmer production.

Table 6
Statistical test-t

Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.
	B	Beta		
1 (Constant)	-.284		-2.154	.034
Land are	.382	.341	3.636	.000
Workforce	.081	.326	2.992	.004
Working time	.057	.181	2.276	.025
Use of fertilizer	.087	.106	2.057	.043
Use of pesticide	.074	.092	2.050	.044
Seed varieties	.078	.097	2.273	.026
Processing method	.083	.091	2.156	.034
Farmer education	.004	.005	.110	.913

a. Dependent Variable: Production

Based on Table 6 and the description above, the multiple regression equation can be formulated as follows:

$$Y = -0,284 + 0,382X_1 + 0,081X_2 + 0,057X_3 + 0,087X_4 + 0,074X_5 + 0,078X_6 + 0,083X_7 + 0,004X_8$$

The multiple regression equation model is significant:

1. A constant value of -0.284 means that if the independent variables (land area, number of workers, time spent working, use of fertilizers, use of pesticides, seed varieties, processing methods, and farmer education) are considered constant, then the production of coffee plants is -0.284 tonnes/ha/year.
2. The variable of land area has a positive effect on coffee plant production with a coefficient value of 0.382, meaning that each addition of 0.1 Ha of the land area will increase the production of coffee plants by 0.382 tonnes/ha/year.
3. The variable number of workers has a positive effect on coffee plant production with a coefficient value of 0.081, meaning that every addition of 1 person to the

number of workers will increase the production of coffee plants by 0.081 tonnes/ha/year..

4. The working time variable has a positive effect on coffee plant production with a coefficient value of 0.057, meaning that each additional 1 hour of working time will increase the production of coffee plants by 0.057 tonnes/ha/year.
5. Fertilizer use variable has a positive effect on coffee plant production with a coefficient value of 0.087, meaning that any change in fertilizer use from no use to fertilizer use will increase coffee plant production by 0.087 tonnes/ha/year.
6. The pesticide use variable has a positive effect on coffee plant production with a coefficient value of 0.074, meaning that any change in pesticide use from no use to pesticide use will increase coffee plant production by 0.074 tonnes/ha/year.
7. Seed variety variables have a positive effect on coffee plant production with a coefficient value of 0.078, meaning that any change in seed varieties from local varieties to superior seed varieties will increase coffee plant production by 0.078 tonnes/ha/year.
8. The processing method variable has a positive effect on coffee plant production with a coefficient value of 0.083, meaning that any change in processing methods from traditional to modern methods will increase coffee production by 0.083 tonnes/ha/year.
9. The educational variable has a positive effect on coffee plant production with a coefficient of 0.004, meaning that each additional farmer education will increase the production of coffee plants by 0.004 tonnes/ha/year.

5. DISCUSSION

Production Factors Affecting Coffee Plant Production

a. Land area

The results showed that the area of land had a positive and important effect on the production of coffee plants. This finding suggests that the wider the area of land, the higher the yield of coffee plants. Few wealthier farmers with wide-field fields, middle farmers with medium land, and small farmers with narrow land depending on the area of land they own. In micro terms, the

influence of land in agriculture is seen from land tenure, arable land area, and land value. The results of this study are in line with research by Pasaribu (2009) which concluded that land area has a significant effect on crop production.

b. Workforce

The number of workers has a positive and significant effect on the production of coffee farmers in the Sidikalang Sub-District. These results indicate an increasing number of workers, the production of coffee farmers will increase. This is attributed to the hypothesis of Cobb-Douglas that efficient production is affected by the workforce. The number of workers is very influential on the amount of production, according to coffee farmers, because they still use manual machinery in the production process, so they need more workers.

Mulyadi (2003) suggests that workers are the population of working age (aged 15-64 years) of the total population in a country that can produce goods and services if there is a demand for workers, and if they are willing to participate in these activities. Machfudz (2007) states that labor is a production factor that is important to consider in the production process in sufficient quantities, not only seen from the availability of employment but also the quality and type of workers. The results of this study are in line with research by Pasaribu (2009) which concluded that farmer production is significantly influenced by the workforce variable.

The workforce in the agricultural sector is farmers. The implementation of the production process in agriculture depends on the role of human resources. The role of the farmer as workforce in agriculture is as a worker, the farmer himself who runs the farm. In practice, the farmer does not work alone but is assisted by other workers such as his wife and children. Children over ten years old are considered productive workers..

c. Working time

The work time spill has a positive and significant effect on the production of coffee farmers in the Sidikalang Sub-District. These results indicate that with the increase in the amount of time spent working, the coffee farmers' production will increase. This result is following the Cobb-Douglas theory which states that production output is affected by working time.

Machfudz (2007) states that the workforce factor in the production is an important factor to consider in the production process in sufficient quantities, not only in terms of the availability of employment but also the quality and type of workforce.

d. Use of Fertilizers and Pesticides

The use of fertilizers and pesticides has a positive and significant effect on the production of coffee farmers in the Sidikalang Sub-District. These results indicate the increasing use of fertilizers and pesticides, the production of coffee farmers will increase. This result follows the theory of Cobb-Douglas that effective production is affected by capital. According to coffee farmers, the volume of output is significantly impacted by capital (use of fertilizers and pesticides).

In agricultural development, the availability of adequate and timely capital is an important and strategic factor, according to Hanafie (2010). Agricultural capital is the money used for the purchase of agricultural processing facilities consisting of seeds, agricultural machinery, fertilizers, pesticides, etc. Capital in this form is physical capital. Apart from physical capital, human capital is also needed in agriculture to manage and increase agricultural production.

e. Seed Varieties

In the Sidikalang Sub-District, seed varieties have a positive and important impact on the development of coffee farmers. These results indicate that the production of coffee farmers will increase by using superior varieties compared to using local varieties. This finding is following the theory of Cobb-Douglas, which notes that seeds impact production output.

f. Processing method

In the Sidikalang Sub-District, the processing method has a positive and significant effect on the production of coffee farmers. These findings suggest that the yield of coffee farmers will increase using modern processing methods compared to traditional processing methods. This result follows the theory of Cobb-Douglas, which notes that processing methods impact production output.

g. Farmer education

Farmer education has a positive and insignificant effect on coffee farmer production in Sidikalang Sub-District. These results indicate that the higher the education of farmers, the production of coffee farmers will

increase. Education is a form of investment in the field of human resources that plays a role in increasing economic growth. This investment is a long-term investment because the benefits can only be felt after ten years (Atmanti, 2005). According to Simanjuntak (2001), the relationship between the level of income at the level of education is because by assuming that the higher the level of education, the higher the level of employee productivity and ultimately affect the level of income.

6. CONCLUSION

Production factors such as land area, number of workers, time spent working, use of fertilizers, use of pesticides, seed varieties, processing methods, and farmer education simultaneously affect the production of coffee farmers in Sidikalang Sub-District, Dairi Regency. Partially the variables of land area, number of workers, time spent working, use of fertilizers, use of pesticides, seed varieties, and processing methods show a positive and significant effect on the production of coffee farmers in Sidikalang Sub-District, Dairi Regency, while farmer education has a positive but not significant effect on farmer production.

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