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Factors affecting revenue of cocoa farmers in Biru-biru District, Deli Serdang Regency, North Sumatra

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Abstract. One of the agroforestry patterns developed in Biru-biru sub-district is the combination of Cocoa and Mindi trees. Cocoa becomes the main crop while the mindi wood becomes a shade and a hedgerow plant that can be sold for wood as a building material. The objectives of research are to know cocoa agroforestry cultivation system, the level of productivity of cocoa and the marketing channel of cocoa commodity in Biru-biru District. Data collection was done through in-depth interview, questionnaire, and Focus Group Discussion (FGD). The number of respondents to be determined in accordance with the number involved in this activity. The technique of determining the sample to be interviewed is by snowball sampling. Data analysis was done by multiple linear regression with SPSS tool. Factor affecting income are education, age, length of business, time work a day, width of land, capital, price, production, institutional farmer, and quality of cocoa. The result of the analysis shows that the factors that have a significant effect on cocoa farmer's income are capital and production. The cocoa marketing channel in Biru-biru sub-district is from farmers to collectors then directly to exporters.

1. Introduction

Cocoa is one of Indonesia's foreign exchange commodities because of the large demand for cocoa coming from foreign countries. However, the constraints faced are improving cocoa plantation systems and structures to improve cocoa production in Indonesia. Among other areas of land, cultivation systems, skills and knowledge of farmers, technology development including the marketing system by providing a decent price at the level of cocoa farmers

North Sumatra is one of the producers of cocoa plantations to be exported. The total area and cocoa production of North Sumatra province in 2017 based on data from the Directorate General of Plantation is 57,922 ha and 17,582 tons. The distribution of cocoa plants in North Sumatra covers 26 districts and cities. For the largest production is found in Deli Serdang District 1,726 Ton. One of the cocoa producers in Deli Serdang Regency is Biru-biru District.

The marketing activities of Biru-biru Sub-district of Deli Serdang Regency are oligopsony. Buyers come from some of the village's collecting merchants and the products they sell are raw materials (cocoa beans). Prices tend to be stable and the products sold are generally cocoa although there are some other crops such as duku, coconut, mindi, and others. Cocoa marketing is done by direct purchase by the village collectors. Then village merchants sell their produce to exporters for export.

previous research states that The agricultural marketing system is a unified sequence of marketing institutions that perform marketing functions to facilitate the flow of agricultural products from the



initial producers to the hands of the end consumer and vice versa facilitate the flow of money, the value of products created by productive activities undertaken by marketing institutions, the final consumer into the hands of early producers in a commodity system [1,2]

The Purpose of research are (1) To know cocoa agroforestry cultivation system in Biru-biru District, Deli Serdang Regency, North Sumatera Province (2) To know the level of productivity of cocoa in District of Biru-biru, Deli Serdang Regency, North Sumatera Province and (3) To know the marketing channel of cocoa commodity in Biru-biru District, Deli Serdang Regency, North Sumatera Province.

2. Material and Methods

This study uses primary and secondary data in the form of cross-section data. Cross section data are sourced from the research respondents, namely cocoa farmers and village collectors. Secondary data sources obtained from the Central Bureau of Statistics, Department of Plantation and Trade Office. The technique of determining the sample to be interviewed is by snowball sampling [3].

2.1. Analysis of cocoa cultivation system

The analysis conducted descriptively using interviews and simple data collection. The data were from cocoa farmers and cocoa farmers in Biru-biru sub-district. The collected data is then tabulated and grouped for analysis according to the research needs.

2.2. Analysis of factors affecting the income of cocoa farmers

The analysis was using the Cobb-Douglass function equation. The equations used is Cob Douglas production function, as follows:

$$Y = \beta_0 X_1^{\beta_1} \cdot X_2^{\beta_2} \cdot X_3^{\beta_3} \cdot X_4^{\beta_4} \cdot X_5^{\beta_5} \cdot X_6^{\beta_6} \cdot X_7^{\beta_7} \cdot X_8^{\beta_8} \cdot X_9^{\beta_9} \cdot X_{10}^{\beta_{10}} \cdot \mu \quad (1)$$

Where:

Y= Revenue; X1= education; X2= Age; X3= length of business; X4= Time work a day; X5= width of land; X6= capital; X7= Price; X8= production; X9= Institutional farmer; and X10= Quality of cocoa.

2.3. Farmers Income Analysis and Business Feasibility

Farm income formula:

$$Pd = TR - TC \quad (2)$$

Where:

Pd = Revenue; TR = Total acceptance; and TC = Total Cost

R/C stands for the return cost ratio, otherwise known as the ratio or ratio between acceptance and cost. Math can be written as follows:

$$a = R / C \quad (3)$$

$$a = \{(Py \cdot Y) / (FC + VC)\} \quad (4)$$

Where:

R = Acceptance; C = Cost; Py = Price of output; Y = Output; FC = Fixed cost; VC = Variable Cost. Under the condition: If $R/C > 1$ then efisien to be implemented; If $R/C = 1$ then break even; and If $R/C < 1$ is not efficient to implemen

2.4. Marketing channel analysis

For the analysis of marketing channels conducted descriptively using interviews and data collection simple. The data are from cocoa farmer respondents and also collecting traders in Biru-biru sub-district. The collected data is then tabulated and grouped for analysis according to the research needs.

3. Results and Discussion

3.1. Cocoa agroforestry cultivation system in Biru-biru sub-district, Biru-biru district, Deli Serdang regency, North Sumatra province.

According to [4], groforestry system is a settled the agricultural system contains many types of plants (tree-based) that are planted and treated with cropping patterns and forest-like ecosystems. Within this system are covered by a wide variety of components such as trees, shrubs, seasonal plants and grasses in large quantities. The management of cocoa agroforestry in Anyar District during the 1st to 7th years consists of 5 stages: land clearing, planting, maintenance, harvesting, and post-harvesting.

Table.1 Results of linear regression analysis of factors affecting the income of cocoa farmers in Biru-biru sub-district

No	Variable	Coefficient	t	Sig.	Information
1	Education	-0.355	-1.367	0.112	Non-significant
2	Age	-0.226	-0.538	0.595	Non-significant
3	Length of Business	0.94	0.320	0.751	Non-significant
4	Time Work a Day	0.032	0.182	0.856	Non-significant
5	Width of Land	0.116	0.747	0.461	Non-significant
6	Capital	0.419	2.417	0.022	Significant
7	Price	4.993	1.129	0.268	Non-significant
8	Production	0.588	2.571	0.016	Significant
10	Quality of Cocoa	-	-0.953	0.348	Non-significant
		0.780			
	F	7.87			
	Coefficient of Determination (R ²)	0.731			
	R ² Square Adjusted	0.638			

Significant in $\alpha < 0.05$

The value of the determination coefficient (R²) produced is 0.731. This means that the output factors of cocoa farmers' income are explained by the free variable of 73.1% while the rest, as much as 26.9% variation is explained by other variables outside the model.

Cocoa agroforestry cultivation system in Biru-biru sub-district uses intercropping of cocoa plants with several other plants. Among other cultivation of cocoa and timber mindi. Mindi is a wood that has a mild canopy, so the sun can still enter on the plants beneath it. The combination of cocoa agroforestry and mindi is an ecologically appropriate combination. In addition to the mindi plant, the agroforestry system in Biru-biru sub-district also combines with fruit plants such as Durian, Duku, Jambu and others.

Cocoa is one of the income of Biru-biru farmers. The age of the Cocoa plant in Biru-biru sub-district ranges from 5 years and above. There are even some farmers who have done the plant rejuvenation. For regular harvesting is done within 2 weeks. With a relatively large amount depending on the land area of farmers. Area of farmers varies there is still a narrow land with an area of less than 1 Ha until that has landed up to 2 Ha. The ownership status of the land is the private property of about 80% and the other 20% rents the land on a profit-sharing system with the landowner. For information for farmers in Biru-biru sub-district was obtained from the extension of various government agencies and there were several farmer groups who had joined with pandawa association.

3.2 Analysis of production functions

To analyze the factors that influence the income of the cocoa farmer in Biru-biru sub-district, the Cobb-Douglas formula consists of ten independent variables, Data analysis was done by multiple linear regression with SPSS tool.

3.2.1. *Education (X1)*. The education level of cocoa farmers in the Biru-biru sub-district is generally low. Biru-biru sub-district farmers are mostly still graduated from elementary and junior high school graduates. But about 10% of the Biru-biru sub-district farmers have undergraduate education and also have other occupations besides farming. For education does not significantly affect cocoa farmers' income with the assumption that each additional 1% level of input will reduce the output of cocoa farmer income by 0.355%.

3.2.2. *Age (X2)*. Cocoa farmers in the Biru-biru sub-district are productive-aged farmers of 90% and about 10% of farmers are elderly about 65 years old and above. For the age of the cocoa farmers did not significantly affect the negative coefficient value with the assumption that any increase of farmer age input by 1% will reduce the cocoa farmer's income output by 0.226%.

3.2.3. *Length of bussiness (X3)*. The business activities run by cocoa farmers in Biru-biru sub-district have been hereditary. So the length of business run by farmers in the Biru-biru sub-district for cocoa farming has been going on for more than twenty years. About 5% of cacao planted there have entered the rejuvenation period. At this time the cocoa plants have not produced because of the age of the young plants. For a long time, cocoa farmers did not have a significant effect on the assumption that each 1% increase in inputs will increase cocoa farmer income output by 0.94% and other factors are considered constant.

3.2.4. *Time work a day (X4)*. According [6] that time as an economic resource of farm households can be allocated to the following activities: (1) Activities that generate income, (2) Non-revenue-generating activities (3) Relax and (4) Time spent on gaining skills. The amount of working hours devoted to an activity is influenced by labor productivity in this activity. It means the higher labor productivity encourages people to devote more work time. Cocoa farmers in the Biru-biru sub-district use the time to farm only about 3 times a week. Except during harvest time, farming activities are done every day for two weeks.

For the work time of cocoa farmers no significant effect that each 1% increase in the input of work time will increase the income of cocoa farmer income by 0.032% with the assumption that other factors are considered constant.

3.2.5. *The width of the land (X5)*. According to [7] farmers can be grouped based on the area of farming land are: Farmers are narrow (<0.5 Ha), Farmers group (0.5 - 2 Ha), Group of wide farmers (> 2 Ha) and Farmer groups are not landed. Differences between farmers groups based on the area of land will affect the source and distribution of income. The distribution of cocoa farmers in the Biru-biru sub-district by land area is as follows: (1) Group of narrow farmers amounted to 12 people, (2). Farmers are 22 people and (3) Group of wide farmers amounted to 7 people. For the land area of cocoa farmers is not significant effect that every additional input of land area of 1% will increase the income of cocoa farmer output by 0.116% with the assumption that other factors are considered constant

3.2.6. *Capital (X6)*. For capital, there is a real effect that each addition of 1% input method will increase the output of cocoa farmer income by 0.419% with the assumption that other factors are considered constant. The real effect of capital is due to the increase in capital, the farmers can increase the productivity of farming.

3.2.7. *Price (X7)*. The determination of cocoa price is determined from the quality of cocoa produced by farmers. The quality of cocoa-based on farmers' selling price is divided into 3 categories (1), Good Quality at IDR 33,000, (2) Medium Quality with price IDR 28,000 and (3) Low Quality with price IDR 23,000. But the selling price of cocoa is not always the same depending on the fluctuations in cocoa prices in the world. For the price of cocoa, there is no significant effect that every 1% increase in the input of business will increase the output of cocoa farmer income by 4.993% with the assumption that other factors are considered constant.

3.2.8. *Production (X8)*. The average production of Biru-biru farmers is 25,508 kg. This is due to the cocoa farming in the Biru-biru sub-district has been going on for quite a long time, which is about twenty years so that many plants are rejuvenated and become unproductive plants or young plants. For the production of cocoa farmers has a significant effect that each 1% increase in the input of business will increase the output of cocoa farmer income by 0.58% with the assumption that other factors are considered constant

3.2.9. *Institutional Farmer (X9)*. The cocoa farmers institution in the Biru-biru sub-district is quite good with the cooperation of the farmers with the municipal and district government agencies. But there are a small number of farmers who are still reluctant to participate actively in the institutional. For cocoa farmer institute no significant effect which means that every addition of 1% old business input will increase the income of cocoa farmer output by 0.11% with the assumption that other factors are considered constant

3.2.10. *Quality of cocoa (X10)*. The quality standard is determined as a benchmark for quality control oversight bodies. Each part of the cocoa beans to be exported must meet the requirements of the quality standard supervised by the designated supervisory agency appointed.

Table 2. Cocoa quality standards by the size of cocoa beans

Size	Number of Seeds/100 gram
A	Maks 85
A	Maks 100
B	Maks 110
C	Maks 120
S	>120

The international quality standards that are eligible to be traded in the international market (Cocoa merchantable quality) based on SNI 01 - 2323 are as follows: (1) Cocoa beans must be fermented, dried (7% moisture content), free of smoky seeds, free from abnormal odors and foreign odors and free from evidence of counterfeiting, (2) Cocoa beans must be free from live insects and (3) Cocoa beans in one part (packing) must be of a uniform size, free from broken seeds, broken seeds and broken pieces of skin, and free of foreign objects.

The quality of cocoa does not significantly affect the negative coefficient value, which means that every 1% increase of cocoa quality input will decrease cocoa farmer income output by 0.78% with the assumption that other factors are considered constant. Of the 10 independent variables that significantly affect the income of cocoa farmers in the Biru-biru sub-district is the production (*X8*) and capital (*X6*). While that did not significantly affect the income of cocoa farmers were Education (*X1*), age (*X2*), length of business (*X3*), work time a day (*X4*), width of land (*X5*), price (*X7*), institutional farmer (*X9*) and quality of cocoa (*X10*)

According to [8], it can be clearly seen that major changes are needed in order to sustain the production. To be sustainable and future-oriented it should not only be sustained but developed into a thriving business for farmers. Therefore, the income of farmers must be doubled or even tripled. This

can only be achieved by substantially increasing yields, producer price and farm sizes, and simultaneously diversifying the source of income of farmers.

3.3. Farmers income analysis and business feasibility

The average production of cocoa farmers in the Biru-biru sub-district is 25,508 kg. The selling price of each farmer is Rp 28,048 / kg. For a total cost of Rp.850.243 per year. The number of expenses incurred very little because the farmers' fixed costs are limited to the provision of fertilizers and pesticides. For farmers, the cocoa farmers of Biru-biru sub-district have their own land and for labor use labor that comes from families such as wife or children. The size of cocoa farmer's acceptance at Biru-biru sub-district is Rp 11,390,000 per year with the total net income of 10,539,000 / year. The cocoa business feasibility analysis in the Biru-biru sub-district is 13.39. With a value greater than 1 then it can be concluded that cocoa farming in Biru-biru sub-district is beneficial.

Table 3. Production, Price, Revenue, Cost and Revenue of Cocoa Farmers Biru-biru Sub-district in 2017

No.	Description	Value
1	Production (Q)	25,508 kg
2	Price (P)	1,150,000
3	Revenue (R= P*Q)	466,990,000
4	Total Cost (TC = FC + VC)	34,860,000
5	Total Income (\square = TR-TC)	432,130,000.
6	Feasibility (R/C)	13.39

3.4. Cocoa marketing channel in Biru-biru District Deli Serdang Regency, North Sumatra Province

The marketing of cocoa in Sibiru-biru sub-district consists of only one channel of village farmers, collecting traders and exporters. Farmers directly sell agricultural produce to collecting traders because of the limited means of transportation owned by farmers in the village. Another reason is that of limited funds owned by farmers, so they choose to sell their crops quickly to directly earn money to meet daily needs.

The price level of cocoa is determined by the collecting traders. Cocoa prices do not fluctuate too sharply. Price is determined by the quality of cocoa beans produced by farmers. The low-price set by traders on cocoa products also causes the increase of cocoa farmers did not increase as expected.

According to [1], the magnitude of the price received by farmers is generally influenced by marketing channels, the longer the channel will cause the cost and profit taken by each marketing agency to increase so that margins increase. Selection of marketing channels will affect the number of marketing margins that will ultimately affect the size of the price received by farmers. The collector traders in the Biru-biru sub-district are only a few people. Generally, they collect the crops from the farmers then sell back to the exporters in Medan. For the difference between the selling price of the farmers to the collectors and exporters is influenced by several factors. Among others, such as packaging, damage to production and also fluctuations in cocoa prices.

4. Conclusion

The conclusion the research is (1) Cultivation of cocoa farming in Biru-biru sub-district is agroforestry cultivation by combining cocoa and other crops in a land with intercropping system (2) Factors affecting the income of cocoa farmers in Biru-biru sub-district and significantly affect the capital and production. While education, age, length of business, work time a day, width of land, price, institutional farmer and quality of cocoa have no significant effect on cocoa farmer income (3) Cocoa farming in Biru-biru sub-district is beneficial with R / C of 13.39 and (4) There is only one cocoa marketing channel in Biru-biru sub-district is farmers, collectors, and exporters.

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