The Role of Coffee Based Agroforestry System to Regional Development in Dairy Regency

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Abstract – The main purpose of this study is to analyze the role of coffee-based agroforestry system in the economy of Dairi Regency, to determine the effect of coffee agroforestry on the development of Dairi Regency. The method used is descriptive analysis and quantitative analysis by using multiple regression. The data used is primary data by distributing questionnaires to 98 respondents and secondary data from the Central Bureau of Statistics of Dairi Regency. The results showed that coffee-based agroforestry system contributed 41.43% to harvested area, and 53.80% of coffee-based agroforestry system production. Coffee-based agroforestry system affects farmers' income in Sumbul District of Dairi Regency. Increasing production, selling price, agroforestry and land area will influence the change of community income in Sumbul sub-district by 1,933,673,66, - rupiah/month, which is bigger than the MSE of Dairi Regency in 2016 of 1,800,000.- indicates that production, selling price, agroforestry and coffee plant area have a significant effect on people's income. That is, any increase in production, selling price, agroforestry and coffee plant area will increase people's income. Coffee-based agroforestry systems have a positive impact on the development of the Sumbul Subdistirict region, Dairi regency. This can be seen from the backward linkage, such as the development of agricultural production facilities and forward linkage, the establishment of coffee milling business and the development of coffee culinary business in Dairi Regency.

Keywords – Production; Selling Price; Coffee-Based Agroforestry System; Income; Regional Development.

I. INTRODUCTION

Dairi Regency is one of the regencies in North Sumatra. Dairi Regency is also included in the development of Agropolitan Area Bukit Barisan Highland of North Sumatra. The largest plantation commodity of Dairi Regency is coffee. Coffee is a superior commodity of Dairi Regency which is very potential to be developed. Dairi Regency is the largest coffee producer in North Sumatera, which in 2014 contributed 8,621 tons to North Sumatera coffee. (Data of Plantation of North Sumatra, 2014). Of the total population of 279,090 people as much as 89% rely on agriculture as their livelihood. But in reality the agricultural sector has not been managed in a maximum way so that it does not give optimal results.

Farming is a combination that is composed of several factors such as natural production, labor, expertise and experience in the production process to produce output. While coffee productivity is influenced by plant population, fertilizer, pest control, disease and labor maintenance [1]. Agricultural development as an integral part of national development has a strategic role in national economic recovery.

Therefore, the development of rural areas is one of the main objectives of agricultural development so it is expected the development of competitive regional agribusiness in accordance with the comparative advantage of each region, sustainable, equitable and democracy [2].

According to Anwar [3], regional development is done to achieve regional development objectives covering aspects of growth, equity and sustainability of the dimension of location in space and related to the socio-economic aspects of the region.

Conversion of natural forests into agricultural land has led to various kinds of losses and problems such as decreasing soil fertility, erosion, flora and fauna extinctions, floods, droughts and even global environmental changes. This problem grew heavily over time as the increase of forest area converted to other business land. One attempt to overcome this problem is the agroforestry system as a new branch of science in agriculture or forestry. This science develops agroforestry systems that farmers have developed in tropical and subtropical climates.

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In the journal "Agroforestry Systems" Volume 1 No.1, pages 7-12 of 1982" [4] show some definitions of agroforestry, as follows:

Agroforestry is an integrated land use system, which has social and ecological aspects, is implemented through the combination of trees with crops and / or livestock (animals), either jointly or in rotation, so that from one unit of land is reached the optimal total plant or animal yield in a sense sustainable (PKR Nair)....... planting trees simultaneously with agricultural crops and/or farms, either within the scope of small families or large companies. Agroforestry is not the same as community forestry, but it is often appropriate for the implementation of community forestry projects "(L. Roche)

Furthermore Lundgren and Raintree [5] presented a summary of many definitions of agroforestry with the following formula:

Agroforestry is a collective term for land use systems and technologies, planned for one unit of land by combining woody plants (trees, shrubs, palms, bamboo etc.) with agricultural and / or animal crops and/or fish, conducted at the same time or alternately so as to form ecological and economic interaction between the various components that exist.

From some of the well-quoted definitions, agroforestry is a new term of traditional land-use practices that have the following elements:

- Land use system by humans
- Application of technology
- Components of annual crops and livestock
- The time of planting can be at the same time or alternately
- There are ecological, social, economic interactions

Here are some of the terms agroforestry system that developed in the community:

a. Social-Forestry
b. Community-Forestry and Farm-Forestry
c. Farm-forestry
d. Multiple Use Forestry
e. Forest Farming
f. Eco farming

Although humans are often labeled as environmental destroyers or forest destroyers, Hairiah K, et al [6] states that human intervention is often capable of transforming unproductive areas into productive ones even by altering a community in a balanced or climactic state to a sub-climax.

Basically agroforestry consists of three main components, forestry, agriculture and animal husbandry, where each component can actually stand alone as a form of land use system (Figure 1)
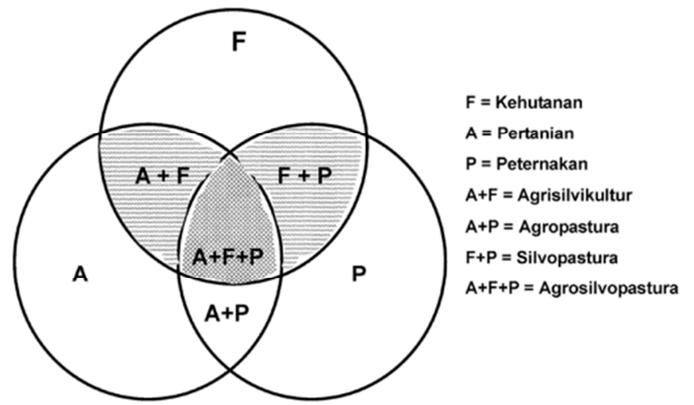

Figure 1. Scope of Land Use Agroforestry

The objective of the study:
To know the influence of coffee-based agroforestry system on regional development of Dairi Regency.

Research question
What is the effect of coffee-based agroforestry systems on regional development of Dairi Regency?

Significance of the study:
As reference material for the science of coffee development based on Agroforestry system and its relation with regional development.

II. MATERIALS AND METHODS

This survey research requires data comprising coffee-based agroforestry system area, agroforestry-based coffee production, selling price, farmer income in 2011-2015. The research was conducted in Bakal Gajah Village, Silima Pungga-pungga Sub-District, Tanjung Beringin Village, Sumbul Sub-District and Bintang Hulu Sub-District, Sidikalang Sub-district, Dairi Regency of North Sumatra Province. The time of research is April 2017 until May 2017. The type of research is descriptive quantitative. The population in this study were farmers in Bintang Hulu Village, Bakal Gajah Village and Pegagan Village Julu II, with 5126 households. The sample was determined using the Slovin formula [7]

$$n = \frac{5126}{1 + (5126)\ (0,1)^2}$$

n = 98,08 (rounded up to 98 people)

A. METHOD OF ANALYSIS

The method used to analyze the data is multiple regression model, by the formula:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + \varepsilon$$
Y = Income (Rupiah/ hectare/month)

X_1 = Coffee production (ton)
X_2 = Selling price of coffee (Rupiah/kg)
X_3 = Area of farmland (Hectare)
X_4 = Agroforestry system (Rupiah/hectare/month)
ε = *error term*
b_0 = constants
b_1 = regression coefficient

Descriptive analysis will provide explanation and elaboration of quantitative analysis results that have been processed computer to see how big the contribution of coffee-based agroforestry system to the regional economy and its influence on the development of Dairi regency.

B. HYPOTHESIS

The hypothesis in this study is as follows: "Agroforestry has an effect on the increase of coffee farmer income in Dairi Regency."

C. OPERATIONAL DEFINITION

Variabel	Operational Definition
Harvest area	The wide scale unit of coffee harvested in one growing season in hectares (Ha)
Coffee production	The amount of coffee harvest obtained within a month in Kg.
Selling price	The average selling price of dry coffee beans sold by farmers in rupiah/kg
Pendapatan petani	The amount of farmers' income from the sale of agricultural commodities, after deducting the production costs in one growing season in rupiah.

III. RESULT

A. PRODUCTION COST

TABLE 1 Average Production Cost Per Hectare

No.	Production cost (C)	Amount (Rp)
1.	Compost	204,545.45
2.	Labor	1,050,000.00
	Total Cost (TC)	1,254,545.45

Source: Primary Data, Processed, 2017

In accordance with the use of production factors per farmer, the larger production cost is labor of 1,050,000.00, - rupiah (83.69% of total production cost), compost cost 204,545.45, - rupiah (16.31% of total production cost).

B. PRODUCTION, SALES AND INCOME

TABLE 2. Average Production and Income of Farmers per Hectare / year

No.	Description	Per Hectare / year (Rp)
1.	Production (ton) (Q)	1.09
2.	Sales (Rp.) (TR)	24.458.617.42
3.	Production cost (Rp) (TC)	1.254.545,45
4.	Income (Rp) (Y)	23.204.071,97

Source: Primary Data, Processed, 2017

Production of coffee (Q) per farmer averaged 1.18 tons or with an average productivity of 1.09 tons / hectare with the amount of about 1500 coffee / Ha and 204 stems of palm trees / Ha. Coffee-based system Agroforestry with candlenuts and avocado plants have a number of different plants with the agroforestry of palm trees ranging from 100 to 150 stalks of candlenuts or apokat. This is due to the spacing of candlenuts and avocado which is less common than the palm trees. From the above results indicate that the productivity of coffee commodities in three research location is moderately high.

Coffee produced by farmers is generally sold on the spot to the agent, with the average price (selling price, P) 22.100, - rupiah / kg. Differences in the price of coffee that occurs between farmers in general due to the quality of harvest. In accordance with the coffee production obtained, the total sales of coffee (TR) obtained by farmers on average 1,933,672.66, - rupiah/month.

While from the production of agroforestry, the average income of farmers is 2,709,753,79, - rupiah/month or with average monthly income of 25,812,82, - rupiah after deducting the production cost incurred by farmers in coffee farming (Y). Based on the result of research, that the average income of farmers from coffee farming based on agroforestry system is 25,913,825,76 rupiah - or with average income per hectare per month is 2,159,485.48 rupiahs.

C. THE INFLUENCE OF COFFEE-BASED AGROFORESTRY SYSTEM ON FARMERS INCOME

TABLE 3. Coefficient of Determination

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,996[a]	,992	,992	1,07527

a. Predictors: (Constant), Agroforestry, Selling price, Land area, Production
b. Dependent Variable: Income (Rp.Million)

The results of the analysis show the value of coefficient of determination (R2) of 0.992 which means that changes in variables will affect the change in income in the amount of 99.2%. While the rest of 0.8% explained by other variables that are not analyzed in this study, such as changes in agricultural inputs and changes in the number of workers.

TABLE 4. F Test

ANOVA[a]

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13862,462	4	3465,616	2997,396	,000[b]
	Residual	107,527	93	1,156		
	Total	13969,990	97			

a. Dependent Variable: Income

b. Predictors: (Constant), Agroforestry, Selling Price, Land area, Production

The F-count value of 2997.396 with significance of 0,000 means that simultaneously the variables of production, agroforestry, land area, and selling price significantly influence the people's income at 99% confidence level.

Based on the regression coefficient in Table 4, the regression equation of the influence of production and selling price of coffee to the income of the community in Sumbul District, Silima Pungga-pungga and Sidikalang, as follows:

$$Y = -23{,}137 + 0{,}364\ X_1 + 19.954\ X_2 + 1{,}106\ X_3 + 0{,}904\ X_4$$

TABLE 5 Regression Coefficient

Coefficients[a]

Model	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1 (Constant)	-23,137	1,980		-11,684	,000
Luas	,364	,985	,017	,370	,712
Produksi	19,954	1,015	,907	19,658	,000
Harga	1,106	,092	,117	12,071	,000
Agroforestry	,904	,057	,147	15,841	,000

a. Dependent Variable: Income (Rp. Million)

The regression equation shows that if the price of coffee increases 1 rupiah / kg, then the income of the community will increase to 1,106,000, -, rupiah with the other fixed variable. If the area of coffee increases 1 hectare, then the income of the community will rise 364,000, -, rupiah with the provision of other variables remain. If the agroforestry increases 1, -, rupiah then the public income will rise 904.000, -, rupiah with the provision of other variables remain.

Furthermore, the influence of each independent variable partially to the income of society shows that the significance of the t value of each variable is varied, so partially all the independent variables (selling price and agroforestry) have a significant effect on the people's income. That is, any increase in selling prices and coffee agroforestry will

increase people's income. It can also be seen that a higher variable effect on community income is coffee-based agroforestry systems.

D. *CLASSIC ASSUMPTION TEST*

1. **Normality test**

Normality test in this research is done through graph analysis resulted by regression calculation with SPSS. From the graphical pattern, it can be concluded that the data used indicate normal because the spots spread around the diagonal line and its distribution follows the direction of the diagonal line (Figure 2 and 3). Thus the linear regression model in this case is feasible to use.
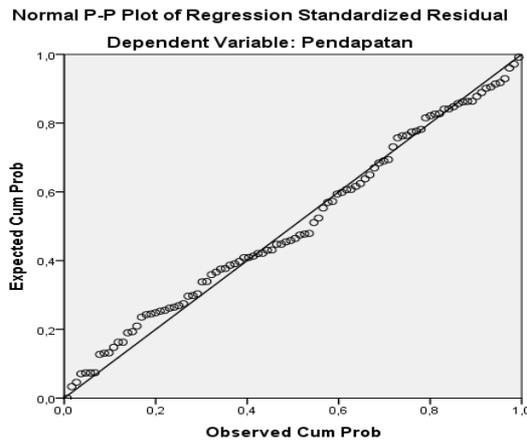

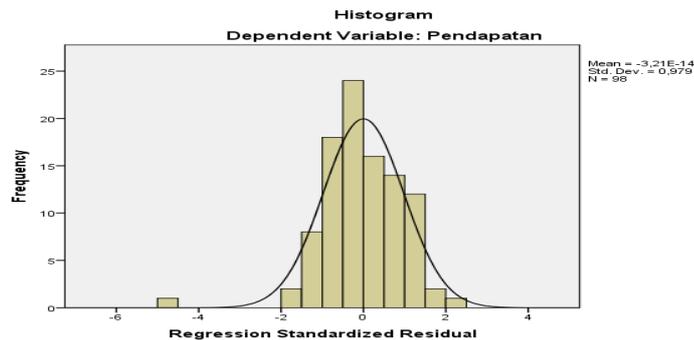Figure 2. Normality Test Results by Using Histogram

Figure 3. Normality Test Result by Using Normal P-P Plot

2. **Multicolinearity Test**

The results of multicollinearity testing can be seen in Table 4.16 as follows:

TABLE 6. Multicolinearity Test

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Luas	,039	25,533
	Produksi	,039	25,731
	Harga	,888	1,126
	Agroforestry	,965	1,037

a. Dependent Variable: Income

Source: Research Results 2017 (Data Processed)

Based on the results of data processing in Table 4:18 indicates that there are independent variables that have value Variance Inflation Factor (VIF) greater than 5, that the variable area and production does not occur multicollinearity problems.

IV. DISCUSSION

A. THE INFLUENCE OF COFFEE BEBASIS AGROFORESTRY SYSTEM TO REGIONAL DEVELOPMENT OF DAIRI REGENCY

In relation to regional development, the income of farmers growing coffee is 1,933,673.66 rupiah - higher than that of Dairi MSE of 1,800,000 rupiah in 2016. With agroforestry, farmers' income rate increased by 225,812, 82, - rupiah / month. So it is very necessary to increase the production of coffee-based coffee agroforestry system that has an impact in increasing coffee farmers' income in Dairi Regency. Based on the area of coffee harvest in Dairi Regency plus income from agroforestry, the income received by coffee farmers in Dairi Regency is 2,159,485.48, - rupiah / month much higher than the MSE of Dairi Regency. This income will affect the regional income, with the population in the Sumbul subdistrict of the year 2015 as many as 9,483 families, the income that can be donated by the coffee agroforestry is 20.478 billion rupiah. Thus, coffee-based agroforestry systems affect the income and economy of Dairi Regency.

Furthermore, Tarigan [8] explains that in terms of regional development, the linkage of a sector to other sectors can be seen from backward linkage and forward linkage. The coffee commodity in Dairi Regency will provide a backward linkage to the development of agricultural production facilities such as seeds, fertilizers and pesticides, and the current cultivation industry is coffee cereals. Currently in Sidikalang subdistrict, there are at least 10 business units (in the form of cafes) provider of quality coffee drinks and much more spread in Dairi. Furthermore, it will provide forward-linkage, where the increase of coffee production in Dairi Regency will encourage the establishment of coffee milling business and culinary business development.

10 coffee culinary business in Dairi Regency, able to accommodate more than 80 workers with average wage 1,200.000, - rupiah / month. This indicates that coffee culinary business opportunity in Dairi Regency is still wide open and impact on the opening of job field for Dairi Regency community. With the high enthusiasm of coffee lovers, it is expected to be a motivation for coffee farmers to keep trying to improve the quality and maintain the natural balance through agroforestry. For example, in Padang Sidempuan precisely in Sipirok, coffee entrepreneurs "Green Coffee" dare to buy dry coffee beans at high prices three times the market price if the coffee beans are in accordance with the standards desired by the company.

The role of the government is expected in the effort to improve the quality of coffee in Dairi Regency, both through agricultural extension and coffee seedlings with quality that has been standardized. In addition to agricultural techniques, the promotion of culinary tourism coffee is also needed by culinary entrepreneurs to be able to maintain the competition of the coffee business with other regions, Sidikalang coffee with its consistency and distinctive aroma is expected to restore the image of Sidikalang coffee is getting dimmer.

Coffee agroforestry is expected to increase the income of coffee farmers and also conserve nature by planting forest crops with Multi Purpose Tres Species that can provide additional income for coffee farmers, so as to realize the quality of coffee products, environmentally friendly and sustainable.

Factors Supporting Coffee Potential Development in Dairi Regency:

1. Appropriate Agroclimate for Coffee Development

Dairi Regency is a plateau area, has several types of land. The type of soil is generally a type of soil of liparite which is the result of the eruption of Mount Toba with an area of about 103,812 ha (53.85%) spread throughout the district. This type of soil is suitable for coffee plantations.

2. Land Availability

The total area of Dairi Regency is 192,780 ha, and which is used for plantations is 32,779 ha or the most widely used compared to other agricultural sectors. The most extensive plantation area used for coffee plantations is 18,999 ha, based on data from Dairi in numbers year 2012 published by the Central Bureau of Statistics, in Dairi Regency there is unemployed or unemployed land of 7,313 ha.

3. Farmer's Experience

Based on the results of interviews of researchers with resource persons are farmers in Sumbul and Sidikalang Subdistricts that coffee farming has long been attended by them and has been a source of family income since from several generations above them. Knowledge of farming coffee also have a lot of them know because since childhood they have been invited to farm coffee in field. Likewise with their offspring since childhood has been invited to the field to help farm coffee for example to harvest the coffee that has been cooked. Thus knowledge of their coffee farming will be hereditary.

4. Location of Coffee Development Close to Provincial Capital as Export Market Entrance

Dairi Regency is measured from its capital, Sidikalang, only about 150 km away with the provincial capital of Medan. In addition, the relatively good road condition between Sidikalang and Medan also supports the opening of export gate for coffee commodity of Dairi Regency.

5. Access Transportation

In general, the transportation routes within Dairi Regency can be used well, starting from inter-village roads and between sub-districts. This can facilitate the activities of population mobility and coffee production. Likewise, the transportation routes between Dairi Regency and other districts are adequate and can be used properly.

6. Identity of Sidikalang coffee that has been known outside Dairi Regency

Dairi from the past has been known by the name of Sidikalang coffee. This is because from the first Dairi Regency can produce coffee with large quantities and with good quality and delicious flavor. Even according to the observation of researchers many residents outside Dairi regency familiar with Sidikalang Coffee.

V. CONCLUSIONS AND SUGGESTIONS

A. CONCLUSION

Based on the research results Role of Coffee-based Agroforestry system On Regional Development in Dairi Regency obtained the following conclusions:

Coffee agroforestry activities significantly affect the development of the region in Dairi Regency. From the result of research indicate that there is an increase of average income per farmer equal to 225,812.82, - rupiah/month. Partially shows that the production, price, land area and pattern of agroforestry have an effect on the income of society. This can be seen from the backward linkage, which is the development of efforts to provide agricultural production facilities and forward linkage such as the establishment of coffee milling business and the development of coffee culinary business in Dairi Regency.

B. SUGGESTION

In connection with the research results, it is recommended that the government and other stakeholders are also advised to facilitate the establishment of coffee agroforestry processing industry which will also encourage the development of livestock business in Subdistrict of Sumbul, Silima Pungga-pungga and Sidikalang.

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