The influence of agricultural diversification on community income in East Taniwel District

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Abstract. This study entitled "The Effect of Agricultural Diversification on Community Income in the East Taniwel District". The research objective was to determine the relationship and influence of agricultural diversification on people's income in the East Taniwel District. The data used in this study are primary data from eight villages in East Taniwel District, West Seram District, Maluku Province. This data is the result of a baseline survey at the household level, where the sample is determined using the Slovin formula. The data analysis technique used is the application of the backward method in multiple linear regression modeling based on OLS. The results showed that there was a relationship and influence between agricultural diversification and the income of rural communities in East Taniwel District.

1. Introduction

Indonesia is an agricultural country, because most of the population works as farmers. Agricultural activities require land as agricultural land. Soil in Indonesia is known to be very fertile, so it is suitable for use as agricultural land. Humans in maintaining life always need clothing, food and housing, to fulfill their living needs they do a job (livelihood), because by working they will get results to make ends meet.

The Indonesian population is one of the basic assets for development which is quite influential in increasing national development, especially in the agricultural sector. Development in the agricultural sector is directed at increasing the income and level of welfare of the Indonesian people. Achieving agricultural objectives requires efforts to increase agricultural production. Increasing agricultural production can be done by intensifying and extending agriculture. Agricultural intensification is an effort to increase agricultural production through post-farming programs, consisting of land processing, use of superior seeds, irrigation, fertilization and pest control. Agricultural extensification is an effort to increase agricultural production by expanding agricultural land [1].
Land area as one of the factors of production which is the factory of agricultural products which has a large enough contribution to farming, the size of the production from farming is influenced by, among other things, the narrow area of land used [2].

[3] The economic development of the agricultural sector has the following roles:
1. Agriculture is the backbone of the economic development process and functions as an equalization effort from all its aspects in accordance with historical factors and opportunities for development.
2. Agricultural development supports people's businesses in the field of cultivation and processing technology as well as services in the processing and marketing of their products.
3. Agricultural development is a support capable of accommodating the entrepreneurial development of farmers in a rational direction.

The importance of agricultural sector development, especially farmers. The agricultural sector as a macro livelihood sector, namely farmers must be able to create prosperity, economic growth and new job opportunities. This success mainly depends on the opportunity for farmers to implement new methods and sell their produce at a fair price.

Most of the income they earn comes from cultivated agricultural products, but sometimes this income is not sufficient for their living needs, so it needs intensive handling of agricultural management so that the income they get can reach maximum results. The income of farmers is very dependent on the success of the plants they cultivate, so this research is entitled "The Effect of Agricultural Diversification on Community Income in East Taniwel District".

The area of East Taniwel District is in Seram Island Region, where in the north it is bordered by the Seram Sea, in the south by Inamosol and Elpaputih Districts, in the east by Central Maluku Regency, and in the west by Taniwel District [4]. In the District of East Taniwel, there are villages that are in lagging condition (80%) and around 20% are developing. There are some leading sectors that became one of the factors supporting the increase of economic activities in the province of Maluku. The rate of economic growth is an indicator of the success of the development of an area that can be seen in the GDP and per capita income, [5].

2. Literature review
2.1. Definition of agriculture
Agriculture is the activity of utilizing biological resources carried out by humans to produce food, industrial raw materials or energy sources, as well as to manage the environment, [6]. Agriculture is divided into two, namely smallholder agriculture and agricultural enterprises.

a. Smallholder farming is a family farming business where the main foodstuffs are produced, such as rice, secondary crops (corn, beans and tubers) and horticultural gardens, namely vegetables and fruits. Farming for the people is cultivated in rice fields, fields and yards.

b. Agricultural companies are agricultural enterprises that produce certain products with a uniform agricultural system under a centralized management system using various scientific methods and efficient processing techniques to obtain the maximum profit.

Farming is an organization of nature (land), labor and capital aimed at production in the agricultural field. The organization stands alone and is deliberately managed by a person or group of people as its manager. [7] Mention the types of agriculture, namely:

a. Traditional Agriculture (Subsystem)
Traditional agricultural production, if agricultural production and consumption are the same and only one or two kinds of plants (rice or maize) are the main source of foodstuffs. Low production and productivity due to the use of very simple equipment. The use of capital is small, while land and human labor are the dominant factors of production.

b. Traditional to Modern Agriculture

Agricultural diversification is a major logical step in the transition from traditional agriculture to modern agriculture. Staple crops no longer dominate agricultural production, because new cash crops such as; fruits, coffee, tea and others have started to be run together with simple livestock businesses. The use of simple tools such as small tractors and plow-pulling animals can be used to increase agricultural productivity. The use of superior seeds, fertilizers and good irrigation also increases agricultural production, so that farmers can obtain a better production surplus so that they can be sold to the market.
Agricultural diversification will minimize the impact of the failure to harvest staple crops and guarantee income security that never existed before.

c. Modern Agriculture

Modern agriculture or known as specialized agriculture describes the most advanced level of agriculture. This situation can be seen in more developed countries. Modern farms can vary in size and function. Nearly all types of wheat and maize farming in North America use highly labor-efficient mechanical equipment, from the largest types of tractors and modern types of harvesters to air-spraying techniques that allow a family to cultivate and plant thousands of hectare’s farmlands.

2.2. Agricultural diversification

Agricultural diversification is an effort to diversify the types of business or agricultural crops to avoid dependence on one agricultural product. Agricultural diversification can be done in two ways, namely:

1. Increase the types of agricultural activities, for example, besides farming, farmers also raise chickens and raise fish.
2. Increasing the types of crops in a certain area, for example, in addition to planting corn, fields are also planted.

Diversified agriculture is also known as mixed farming. Food availability is one of the subsystems in food security besides distribution and consumption. Therefore, it must be anticipated that availability is never less than demand.

2.3. Income

Income is the result of work or effort received by someone in the form of money or goods. Income is the result in the form of money or other material, which is achieved from the use of wealth or human services, [9].

Income becomes two definitions, namely:

1. Income in the form of money, namely: Salary or wages obtained from main work, part time work, overtime work and occasional work. Own business which includes net proceeds, commissions on sales and home crafts and from investors’ proceeds, namely income obtained from the rights of the land owner.
2. Income in the form of goods, namely in the form of: Payment of wages and salaries in the form of rice, medical treatment, transportation and housing, goods produced and commissions at home.

Income, namely: "Revenue is an increase in assets resulting in an increase in owner’s equity, but not because of the increase in new capital from the owner and not an increase in assets due to increased liabilities” explains that an increase in assets can be called revenue if the increase in assets is derived from contra performance received by the company for services provided to other parties. The increase or increase in assets will result in an increase in the owner’s equity.

3. Methodology

3.1 Location and data

The data used in this study are primary data from eight villages in East Taniwel District, West Seram District, Maluku Province. This data is the result of a baseline survey at the household level, where the sample is determined using the Slovin formula

\[ n = \frac{N}{1 + Ne^2} \]

Where \( n \) is the number of sample villages, \( N \) is the number of villages, and \( e \) is the tolerance limit (5%). The number of respondents sampled were 116 household heads spread across 8 villages, namely Makububui Village, Solea Village, Hatunuru Village, Maloang Village, Sohuwe Village, Uwen Pante Village, Tounusa Village, and Walakone Village.

3.2 Models and data analysis

The method used in this research is multiple linear regression modeling method. In general, multiple linear regression models are defined as follows:

\[ Y_i = \beta_0 + \beta_1X_{i1} + \beta_2X_{i2} + \cdots + \beta_kX_{ik} + \epsilon_i \]

with:
$Y_i$ is the value of the dependent variable, the $to-i$ observation; 
$\beta_0$ and $\beta_1$ ... $\beta_k$ are the parameters of the regression coefficient; 
$X_{ik}$ is the value of the k-th independent variable in the $to-i$ observation; 
$\epsilon_i$ is the random error value assuming that 
$$\epsilon_i \sim N(0, \sigma^2)$$
which means that the mean $E(\epsilon_i) = 0$ and the variance $Var(\epsilon_i) = \sigma^2$; $\epsilon_i$ and $\epsilon_j$ are not correlated so that the covariance value $Cov(\epsilon_i, \epsilon_j) = 0$ for all values of $i$ and $j$, $i \neq j$, $i, j = 1,2, ..., n$.

3.3. Procedure
1. Determine the dependent variable and the independent variable in the model.
2. Preprocessing data, the aim is to determine the characteristics of the data (variables) used in the study.
3. Build a linear regression model by estimating parameters using the Ordinary Least Square (OLS) method.
4. Selecting significant independent variables in the model (backward elimination)
   This process is usually carried out using the t test, F test
5. Examination of the goodness of the model uses the coefficient of determination
6. Perform model diagnostic checks.
   This stage is often called the classic assumption test (from the ordinary least square / OLS estimation method or least squares method), which is checking for the absence of multi collinearity between independent variables, then checking assumptions on model residuals such as normally distributed residuals, no serial correlation to the residuals, and residual variance that is constant (homoscedasticity).
7. Model interpretation.

4. Results and discussion
4.1. Data characteristic
The sample in this study were household heads in 8 villages in East Taniwel District, Maluku Tengah Regency, Maluku Province. To facilitate the analysis, the eight villages are structured as follows: Village 1 is Makububui Village; Village 2 is Solea Village; Village 3 is Hatunuru Village; Village 4 is Maloang Village; Village 5 is Sohuwe Village; Village 6 is the village of Uwen Pante; Village 7 is Tounusa Village; and Village 8 is Walakone Village. Visually, the conditions of income and agricultural diversification in the eight villages are shown in Figures 1 and 2, where Figures 1 - 8 on the (horizontal) axis shown in both figures are a symbol of Village 1 - Village 8.

![Figure 1. Average income in 8 villages of East Taniwel District (IDR)](image-url)
Figure 1 shows that the income condition in Village 1 - Village 5 in 1 sales period is very small, namely less than (IDR) 400,000, while the average income in Village 6 - Village 8 is more than (IDR) 1,000,000. The lowest average income was found in Village 4 (Maloang village), while the highest was in Village 7 (Tounussa village). Statistical figures on the average income in the eight villages are shown in Table 1.

Agricultural diversification was carried out by the heads of households in the eight villages. This business includes the use of available agricultural land. One of the efforts made by the head of the household (community) in the eight villages is the diversification of food plants, namely increasing the types of plants on the available land. Types of cultivated crops are tubers, coconut, oil palm, nutmeg, cloves, cocoa, and bananas. Visually, the agricultural diversification undertaken by the eight villages is shown in Figure 2.

Figure 2 shows that the plant found in all villages is coconut, while the oil palm plant is only found in 1 village, Solea Village. Villages that have a diversity of plants are Tounussa Village and Sohuwe Village. The statistical description of the seven variables is shown in Table 1. Based on the results of graphic analysis, Tounussa Village is the village that has the most diversity of plants and is also the village with the highest average income in East Taniwel District. On the other hand, Maloang Village is the village that has the lowest average income and has relatively little plant diversity. Based on this analysis, there is a relationship between agricultural diversification and income in the East Taniwel District.
Table 1. Descriptive statistics for each variable

| Variable | INCOME | TUBERS | COCONUT | PALM | NUTMEG | CLOVE | COCOA | BANANA |
|----------|--------|--------|---------|------|--------|-------|-------|--------|
| Mean     | 764,240.8 | 29.69  | 58.85   | 0.78 | 12.24  | 8.59  | 4.95  | 23.18  |
| Maximum  | 1,710,000.0 | 83.33  | 81.25   | 6.25 | 50.00  | 37.50 | 25.00 | 83.33  |
| Minimum  | 184,078.1  | 0.00   | 43.75   | 0.00 | 0.00   | 0.00  | 0.00  | 0.00   |
| Std. Dev. | 647,049.1 | 29.14  | 12.88   | 2.21 | 16.00  | 13.10 | 8.76  | 29.74  |
| Obs.     | 8       | 8      | 8       | 8    | 8      | 8     | 8     | 8      |

4.2. Analysis of the effect of agricultural diversification on income

Analysis of the effect of agricultural diversification on income uses a statistical approach, namely applying multiple linear regression methods to model data. The dependent variable used is average income (INCOME), while the independent variable is the percentage of household heads who plant tubers, coconut, oil palm, nutmeg, cloves, cocoa and banana (the notation is adjusted to the type of plant). The estimation results of the linear regression model are shown in Table 2.

Table 2. Estimated model parameters and VIF value

| Variable | Coefficient | Std. Error | t-Statistic | Prob. | VIF |
|----------|-------------|------------|-------------|-------|-----|
| C        | 729613.9    | 169533     | 4.303669    | 0.0126|     |
| NUTMEG   | -82290.9    | 17879      | -4.602658   | 0.01  | 5.456159 |
| CLOVE    | 93000       | 21644.25   | 4.297414    | 0.0127| 5.362388 |
| BANANA   | 10459.99    | 4212.143   | 2.483294    | 0.068 | 1.046502 |

Table 3. Simultaneous test and model determination coefficient

|          | F-statistic | Prob (F-statistic) | R-squared | Adjusted R-squared |
|----------|-------------|--------------------|-----------|--------------------|
| Model    | 7.971382    | 0.03661            | 0.856703  | 0.749231           |

Table 4. Residual analysis

| Normality | Serial Correlation | Heteroscedasticity |
|-----------|--------------------|---------------------|
|           | (Jarque-Bera Test) | (Breusch-Godfrey LM Test) | (Breusch-Pagan-Godfrey Test) |
| JB Stats. | Prob.              | BGLM Stats.         | Prob.               | BPG Stats.         | Prob.   |
| Model     | 0.233              | 0.89                | 1.076               | 0.58               | 0.307   | 0.31    |
The results of the multi-collinearity assumption test on the model show that the VIF value of each coefficient is less than 10 (Table 2). This shows that there is no correlation between the coefficients in the model (multi-collinearity does not occur). The results of the assumption test on the residual model are shown in Table 4. The table shows that the residuals are normally distributed, because the probability value of JB stats is more than $\alpha = 5\%$. In addition, there is no serial correlation between residuals (no auto relation occurs), because the BGLM Stats probability value is more than $\alpha = 5\%$. Table 4 also shows that the residual model is free from heteroscedasticity, because the probability value of BPG stats is more than $\alpha = 5\%$. Based on the results of the model assumption test, the model obtained is an appropriate and good model in describing the characteristics of the data.

4.3. Model Interpretation

The results discussed in this section are based on the model coefficients obtained in Table 2. Based on Table 2, the NUTMEG coefficient is negative. This means that, if the number of household heads who plant nutmeg has increased, it can reduce the average income. This shows that there is a cost burden experienced by the head of the household who grows the nutmeg plant in the East Taniwel District, so that it can cause losses. These costs can be in the form of operational costs for planting, harvesting, production, and even sales. On the other hand, the CLOVE and BANANA coefficients are positive. This shows that planting cloves and bananas can increase the average income for household heads in East Taniwel District. Based on Table 2, planting clove plants provides greater benefits than banana plants.

5. Conclusion

Agricultural diversification has been carried out by the community in East Taniwel District with the aim of increasing household income. The process of agricultural diversification carried out by the village community in East Taniwel District is an effort to plant several types of plants which are the main commodity. Based on the results of data analysis, there is a relationship between agricultural diversification and income. This is supported by the model obtained based on the backward elimination method in multiple linear regression modeling based on OLS. The model is an appropriate model and is good at describing the characteristics of the data. In the regression model, there are 3 types of plants planted by the community in East Taniwel District which significantly affect income, namely nutmeg, cloves, and bananas. Based on the coefficient of determination, income can be influenced by the cultivation of nutmeg, cloves and bananas by 75%, while 25% by other factors outside the model. These results indicate that the recommended plants for planting in the East Taniwel District are cloves and bananas, because they can increase their income compared to nutmeg.

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