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THE IMPACT OF SOCIOECONOMIC FACTORS ON ORGANIC COCOA PRODUCTION IN PALOLO DISTRICT SIGI REGENCY

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Abstract

This study aims to obtain information about the impact of socioeconomic factors on organic cocoa production in Palolo District, Sigi Regency. The hypothesis tested is that there is a positive effect between socioeconomic factors and cocoa production. The socioeconomic factors comprise nine indicators that affect cocoa production: (X1) the number of productive cocoa trees, (X2) compost fertilizer, (X3) eco-farming fertilizer, (X4) family labor, (X5) external labor, (X6) farming experience, (X7) frequency of attending agricultural extension sessions, (X8) number of dependents, and (X9) education. The method used is a survey method with descriptive quantitative data analysis techniques. The target population includes all cocoa farmers in the Palolo District, totaling 123 households. The research sample consists of 52 households using proportional random sampling techniques. Data collection techniques used a Likert scale questionnaire model. The research results indicate that the socioeconomic factors affecting organic cocoa production carried out by farming groups in Palolo District are highly significant, as seen in the independent variables: the number of productive cocoa trees, family labor, external labor, farming experience, frequency of attending agricultural extension sessions, number of dependents, education, and types of fertilizers, with a percentage of 95.40%, while the remaining 4.60% is attributed to other factors. Moreover, socioeconomic factors also partially affect the application of organic cocoa fertilizer usage, which can be observed in the variables of the frequency of attending agricultural extension sessions, farmers' education level, farming experience, and number of dependents.

Keywords: Socioeconomic, Cocoa Production, Organic.

1. INTRODUCTION

1.1 Background

The largest cocoa plantations in Indonesia are located on the island of Sulawesi, covering an area of 953,691 hectares or 60% of all cocoa plantations in Indonesia[1], [2]Central Sulawesi Province is one of the provinces that focuses heavily on regional economic development in agricultural commodities, where the agricultural sector plays a crucial role in the regional economy and contributes significantly to Gross Regional Domestic Product (GRDP), as well as serving as the largest job provider for the majority of the population in this region.

One of the flagship commodities of Central Sulawesi Province is cocoa[3], [4] This can be seen from its potential land area of 196,562 hectares spread across 11 districts in Central Sulawesi. The largest cocoa-producing area and the main cocoa production center in Central Sulawesi Province is located in Sigi Regency[5], [6]

This regency, part of the Sustainable Districts Circle (Indonesian: *Lingkar Temu Kabupaten* Lestari or *LTKL*), is 70% covered in forest and surrounded by beautiful green hills. The natural conditions of Sigi support cocoa plants to grow vigorously in the region.

Cocoa plants thrive optimally when grown at an altitude of 0-600 meters above sea level (masl), with a minimum temperature of 18-21 degrees Celsius and a maximum temperature of 20-32 degrees Celsius[7], [8] Supported not only by natural factors, cocoa farmers in Sigi are also diligent in caring for cocoa plants. For instance, to prevent attacks from cocoa pod borers (CPB), the community in Sigi uses bagging methods instead of insecticides. This practice is more environmentally friendly and supports the sustainability of cocoa plantations[9], [10]

In addition to using bagging methods, farmers in Sigi regularly prune cocoa leaves[11], [12] This is because CPB tends to attack moist cocoa plants. By conducting periodic pruning, the moisture level of the plants can be controlled, thereby reducing susceptibility to pests[13], [14] The combination of supportive natural factors and natural cocoa plant care methods results in better-quality cocoa beans. It is no wonder that cocoa produced by farmers in Sigi is known for its heavier fruit mass and smoother fruit skin surface.

Out of the total 27,885 hectares of cocoa plantations in Sigi, approximately 25,000 hectares are located in Omu Village, Gumbasa District. This village, located adjacent to Lore Lindu National Park, has the largest cocoa plantation area in Sigi.

In Sigi Regency, besides Omu Village in Gumbasa District, three farmer groups in Palolo District have successfully obtained Organic Cocoa Certificates.[15], [16] These groups are the Tunas Muda farmer group in Petimbe Village, the Sabarae farmer group in Karunia Village, and the Cahaya farmer group in Bahagia Village.

These groups have been nurtured for about five years by the Central Sulawesi Provincial Plantation and Livestock Office along with field officers, including agricultural extension workers from BPP Bahagia Palolo and TKP3D (Contracted Support Personnel for Regional Plantation Development) in Sigi Regency.

These cocoa farmers maintain their plants without using synthetic fertilizers or pesticides. In controlling pests and diseases, they do not use insecticides or fungicides due to threats to cocoa cultivation from cocoa pod borers (CPB) and Heliopolis pests. Diseases affecting the crops include fruit rot/anthracnose and cocoa dieback disease.

To manage these pests and diseases, they use organic insecticides and fungicides, including Beauveria bassiana and Trichoderma sp. Changing farmers' dependency on synthetic pesticides is challenging, where each week cocoa farmers are encouraged to learn to observe the details of CPB pests, including their life cycle, attack methods on cocoa pods, and efforts to disrupt the life cycle of CPB. [17], [18]

The impact of the Cocoa Plantation Development Program on economic aspects includes transitioning farmers' livelihoods from traditional to modern agriculture and creating business opportunities for cocoa farmers[19], [20] The social-cultural impacts include the weakening of the binding strength of cultural values and norms in traditional cocoa cultivation due to the introduction of new cultural values and norms brought by newcomers or immigrants[21], [22].

Based on the phenomena observed in Sigi Regency, the researcher was motivated to explore the dissertation topic titled *“The Impact of Socioeconomic Factors on Organic Cocoa Production in Palolo District, Sigi Regency.”*

Additionally, reducing the production costs of organic cocoa can also enhance environmentally friendly cocoa productivity[22], [23] Organic cocoa plants will have a strong immune system against pests and diseases, and the soil texture will be more fertile[24] According to data from the Sigi Regency Agriculture Office, the area developed for Organic Cocoa in Palolo District spans 161.67 hectares, with an average annual production of approximately 1.7 to 2 tons per hectare, as detailed in Table 1.1 below:

Table 1.1: Organic Cocoa Cultivation Area in Palolo District

No	Village Name	Farmers	%	Cocoa Farm Area (Ha)	%	Farmer Group Name
1	Petimbe	20 HH	16.3	37	22.9	Tunas Muda
2	Bahagia	18 HH	14.6	25	15.5	Cahaya
3	Karunia	19 HH	15.4	26	16.1	Sabarae
4	Berdikari	19 HH	15.4	26.77	16.6	Itikari Meno
5	Sintuwu	14 HH	11.4	14.40	8.9	Masagenae
6	Sintuwu	33 HH	26.8	32.50	20.1	Dahlia
	Total	123 HH	100	161.6	100	-
	Average	-	16.66	26.93	16.66	-

Source: Sigi Regency Agriculture Office.

Table 1.1 provides an overview of the organic cocoa cultivation areas in Palolo District, with the largest land area being 37 hectares in Petimbe Village, notably higher due to its more extensive agricultural land compared to other villages. Several factors contribute to the relatively low productivity, including inefficient use of production factors by farmers and a lack of capital for developing their cultivation practices.

1.2 Research Problem

Based on the background outlined above, the research questions for this study are as follows:

A. What is the impact of farmers' socioeconomic factors on the production of organic cocoa?

B. What is the effect of farmers' socioeconomic factors on the adoption of organic cocoa cultivation practices?

1.3 Research Objective

Based on the background and the research questions outlined, the objective of this study is to identify and analyze the impact of socioeconomic factors on the production of organic cocoa in Palolo District, Sigi Regency.

1.4 Research Utility

The findings of this dissertation are expected to provide benefits to the community, government, and the advancement of scientific knowledge, detailed as follows:

1) Theoretical Aspect

This research is expected to contribute ideas towards the development of scientific knowledge, especially in the field of organic cocoa commodity agriculture.

2) Practical Aspect

This research is intended to provide input as a basis for consideration by the local government and the community of Sigi Regency, Central Sulawesi Province, particularly the local authorities in Palolo District, and future researchers related to Organic Cocoa Commodities.

2. RESEARCH METHODS

2.1 Type of Research

The quantitative research used in this study is explanatory. explanatory research is an explanatory study that highlights the causal relationships between research variables and tests hypotheses that have been previously formulated." Explanatory descriptive aims to explain the relationships between two or more phenomena or variables. Therefore, this study will explain and analyze the extent of socioeconomic factors on the production of organic cocoa in Palolo District, Sigi Regency, Central Sulawesi Province.

2.2 Research Location

The research location is the place where the researcher conducts activities to collect the necessary data to address the defined problem. According to, the best approach to selecting a research location involves maintaining substantive theory, venturing out, and exploring the field to see if there is a match and reality as found on the ground. Practical and geographical limitations such as time, cost, and effort should also be considered when choosing a research location. Based on this perspective, the researcher has chosen the research location at Lore Lindu National Park, specifically in Palolo District, Sigi Regency, considering that:

1) Palolo District, Sigi Regency, has three organic cocoa farmers, which meets the established criteria and provisions.
2) It is a moral obligation for researchers focusing on agricultural science, in this case, related to the development of Organic Cocoa, to help cocoa become a premier commodity again and not be overlooked.

Sigi Regency is a major cocoa producer in Central Sulawesi, but very few cocoa farmers use organic materials. Therefore, the researcher has a vision and hope that in the future, all cocoa farmers will switch to organic materials in agriculture, particularly for cocoa, as this will enhance cocoa production itself.

2.3 Population, Sample, and Sampling Technique

Regarding the sample, according to a sample is a subset that represents the number and characteristics of the population. This study uses a non-probability sampling technique for sample collection.defines non-probability sampling as a sampling technique that does not provide an equal chance or opportunity for each element or member of the population to be selected as a sample[25], [26] The most straightforward and ready-to-use method to be conveyed to those new to research is to use the largest possible sample." Thus, the sample size in this study is 52 households, detailed as follows:

Table 2.1: Number of Samples for Organic Cocoa Development in Palolo District

No	Village Name	Farmers	Farmer Group Name
1	Petimbe	10 HH	Tunas Muda
2	Bahagia	5 HH	Cahaya
3	Karunia	8 HH	Sabarae
4	Berdikari	10 HH	Itikari Meno
5	Sintuwu	6 HH	Masagenae
6	Sintuwu	13 HH	Dahlia
Total		52 HH	

Source: Primary Data after Processing

2.4 Data Analysis Techniques

A. Production Factor Analysis

The production function analysis is used to verify the first hypothesis in this study. The analysis model used is the Cobb-Douglas production function analysis, represented by the following equation:

$$Y = \beta_0 X_1^{\beta 1} + X_2^{\beta 2} + X_3^{\beta 3} + X_4^{\beta 4} + X_5^{\beta 5} + X_6^{\beta 6} + X_7^{\beta 8} + X_8^{\beta 8} + X_9^{\beta 9}$$

To make it linear, it is transformed into natural logarithm form, thus altering the equation to:

$$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + \beta_8 \ln X_8 + \beta_9 \ln X_9 + \mu$$

Description:

Y : Cocoa Production

β_0 : Constant

$\beta_0 - \beta_9$: Regression Coefficients of the variables

X_1 : Number of Productive Cocoa Trees

X_2 : Compost Fertilizer

X_3 : Eco-farming Fertilizer

X_4 : Family Labor

X_5 : External Labor

X_6 : Farming Experience

X_7 : Frequency of Attending Extension Services

X_8 : Number of Dependents

X_9 : Education

μ : Term of Error

B. Classical Assumption Test

The initial step in the analysis of this study is the classical assumption test. This test is a prerequisite that is conducted before proceeding with further analysis of the collected data.

C. Multicollinearity Test

This test is designed to determine if each independent variable is linearly related or correlated with others. To ascertain whether the data exhibits multicollinearity, the following assumptions are made:

1. If the Variance Inflation Factor (VIF) > 10 and Tolerance < 0.1, the data are considered to contain multicollinearity.
2. If the VIF < 10 and Tolerance > 0.1, the data are considered not to contain multicollinearity.

D. Heteroskedasticity Test

The heteroskedasticity test is performed to determine whether the regression model has a uniform variance of errors. To find out if the data contain heteroskedasticity, the following assumptions are made:

1. If, from the Glejser test results, the significance value of the independent variables against the absolute residuals is < the set significance level (0.05), the data are considered to contain heteroskedasticity.
2. If, from the Glejser test results, the significance value of the independent variables against the absolute residuals is > the set significance level (0.05), the data are considered not to contain heteroskedasticity.

3. RESULTS AND DISCUSSION

3.1 General Overview of the Research Location

Palolo District is a multi-ethnic community formed by migration from outside areas. The formation of the Palolo District generally represents the socio-agrarian characteristics within its villages. Therefore, it is important to provide this overview as an introduction and to frame the agrarian context of the community at the research location. The description in this section begins with the geographic and socioeconomic conditions, followed by a demographic overview of each village that explains the history of the area's formation.

3.2 Socioeconomic Impact of Farmers on Organic Cocoa Production

3.2.1 Factors Affecting Cocoa Production

The results of the multiple regression analysis using the Cobb-Douglas model with SPSS version 24 are shown in Appendix 1. The ANOVA of factors influencing cocoa production in Palolo District, Sigi Regency, is as follows:

Table 3.1: ANOVA of Factors Affecting Cocoa Production

Source of Variation	df	Sum of Squares	Mean Square	F-value	Sig
Regression	8	8.705	1.088	199.333	0.000
Residual	68	0.371	0.005		
Total	76	9.076			

Source: SPSS Analysis Results, 2024

Table 1 indicates that F_{value} = 199.33 with Significance 0.000 < 0.01 (α = 1%) rejects the null hypothesis, meaning that the independent variables—number of productive cocoa trees, family labor, external labor, farming experience, frequency of attending extension services, number of dependents, education, and type of fertilizer (dummy)—

simultaneously affect cocoa production. The statistical test results are consistent with information obtained from interviewed informants including 1. Tunas Muda farmer group in Petimbe Village with 20 households, 2. Cahaya farmer group in Bahagia Village with 18 households, and 3. Sabarae farmer group in Karunia Village with 19 households, 4. Itikari Meno in Berdikari Village with 19 households, 5. Masagenae in Sintuwu Village with 14 households, 6. Dahlia in Sintiwu Village with 33 households. These farmer groups produce organic cocoa based on the number of households by managing all aspects from planting to marketing of Organic Cocoa Beans as advised during extension sessions.

The effect of each independent variable on the dependent variable is analyzed using t-tests, shown in Table 4.2.

Table 3.2: Estimation Results of Cobb Douglas Production Function Parameters for Cocoa Farming

Variable	Coefficient	Standard Error	t-value	Sig
Intercept	6.533			
Number of Productive Cocoa Trees	0.902	0.073	12.402	0.000
Family Labor	0.647	0.127	5.095	0.000
External Labor	0.656	0.044	15.013	0.000
Farming Experience	-0.015	0.040	-0.367	0.715
Frequency of Attending Extension	0.178	0.041	4.304	0.000
Number of Dependents	0.028	0.022	1.265	0.210
Education	0.080	0.037	2.176	0.033
Dummy (Type of Fertilizer)	0.126	0.056	2.251	0.028
Adjusted Determinant Coefficient (R^2) 0.954				

Source: SPSS Analysis Results, 2024

The adjusted determinant coefficient (R^2) of 0.954 indicates that 95.40% of the variation in cocoa production can be explained by the independent variables such as the number of productive cocoa trees, family labor, external labor, farming experience, frequency of attending extension sessions, number of dependents, education, and type of fertilizer, while the remaining 4.60% is explained by other factors not included in the model such as climatic conditions, among others.

3.3 Socioeconomic Impact on the Adoption of Organic Cocoa

The results of logistic regression analysis using SPSS version 24 are shown in Appendix 2, comparing Block 0 and Block 1 to test the model's fit.

Iteration History[a,b,c]			
Iteration		-2 Log likelihood	Coefficients
			Constant
Step 0	1	99.308	.667
	2	99.296	.693
	3	99.296	.693
a. Constant is included in the model.			
b. Initial -2 Log-Likelihood: 99.296			
c. Estimation terminated at iteration number 3 because parameter estimates changed by less than .001.			

Block 0 Table (before independent variables are included): With N=78, the -2 Log Likelihood value is 99.308, which is greater than the Chi-Square (χ^2) table value of 98.48 (χ^2 table at Degree of Freedom (DF) = N – 1 = 77, Probability 0.05 = 98.48).

This indicates that the null hypothesis (H0) is rejected, showing that the model without independent variables does not fit the data.

3.4 Table of Variable Test Results in the Equation

Variables in the Equation									
		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Frequency of Attending Extension Services	2.168	.803	7.292	1	.007	8.744	1.812	42.192
	Education	2.205	.822	7.200	1	.007	9.071	1.812	45.405
	Farming Experience	.038	.040	.900	1	.343	1.039	.960	1.124
	Number of Dependents	.212	.337	.393	1	.531	1.236	.638	2.394
	Constant	-3.323	1.385	5.756	1	.016	.036		
a. Variables entered in step 1 include frequency of attending extension services, education, farming experience, and number of dependents.									

The table for Variables in the equation indicates that the variables "Frequency of Attending Extension Services" and "Education" have a Wald test p-value (Sig) < 0.05, meaning these variables significantly affect the use of organic fertilizers in the model. The "Frequency of Attending Extension Services" has a Wald Sig value of 0.007 < 0.05, rejecting H0 and thus significantly influencing the occurrence of using organic fertilizers. Similarly, the "Education" variable has a Wald Sig value of 0.007 < 0.05, also rejecting H0, meaning the education of farmers significantly affects the occurrence of using organic fertilizers.

4. CONCLUSION

Based on the results and discussions presented in this study, the following conclusions can be drawn:

1. Socioeconomic factors significantly affect organic cocoa production conducted by farmer groups in Palolo District, with a percentage of 95.40%, while the remaining 4.60% is attributed to other factors.
2. The socioeconomic factors of farmers have a partial effect on the adoption of organic cocoa, as evidenced by variables such as the frequency of attending extension services, farmers' education level, farming experience, and number of dependents.

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