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Analysis of the Determinants of Income of Corn Farmers in Stabat District, Langkat Regency

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ABSTRACT

This study aims to analyze the determinants of corn farmers' income in Stabat District, Langkat Regency. The main issue addressed in this research is the fluctuation of farmers' income influenced by various internal and external factors. The variables examined include land area, farming experience, informal education, selling price, productivity, technology adoption, and access to capital. This study employs a quantitative approach with a sample of 195 corn farmers selected using a structured sampling technique. Primary data were collected through questionnaires and direct interviews with respondents, while secondary data were obtained from relevant institutions and literature. Data analysis techniques used are Confirmatory Factor Analysis (CFA) to identify dominant factors and Multiple Linear Regression to examine both partial and simultaneous effects of the variables. Prior to analysis, classical assumption tests, including normality, multicollinearity, and heteroscedasticity tests, were conducted to ensure the validity of the regression model. The results show that simultaneously all independent variables have a significant effect on farmers' income. Partially, land area, informal education, and selling price have a positive and significant effect on income. The analysis also reveals that selling price is the most dominant variable in determining farmers' income. In contrast, technology adoption and access to capital do not show significant effects in the model. These findings imply the importance of maintaining price stability, improving market access, and strengthening farmers' capacity through extension services and training programs to enhance productivity and welfare. Furthermore, policy support from the government is needed to create a more sustainable agricultural system and reduce income volatility among corn farmers in the study area. In addition, improving infrastructure, strengthening farmer institutions, and enhancing access to market information are essential strategies to support income growth and long-term agricultural sustainability.

Introduction

Indonesia is a developing country with most of its population living in rural areas and relying on the agricultural sector as the main source of livelihood (Priyanta & Zulkarnain, 2024). Rural communities generally depend on the agriculture and plantation sectors for their livelihood (Kumawat et al., 2024). The agricultural sector has a strategic role in the economy because it provides food needs for the community (Mvelase & Ferrer, 2024). In addition, this sector also plays a role as a supplier of industrial raw materials and a source of foreign exchange for the country (Dou et al., 2024). From a development economics perspective, the progress of the agricultural sector is an important prerequisite for the success of industrialization (Lu, 2024).

One of the leading commodities in the food crop subsector is corn (*Zea mays* L.) which has high economic value. Corn is used as a food ingredient as well as a raw material for animal feed because of its fairly complete nutritional content. In Indonesia, corn not only plays a role in meeting domestic needs, but also contributes to export activities.

North Sumatra Province is one of the national corn production centers with a relatively high level of productivity. Langkat Regency as one of the corn-producing areas has productivity above the provincial average, thus showing great potential in the development of this commodity.

Stabat District as the administrative center of Langkat Regency has significant corn farming potential. However, the socio-economic conditions of farmers in this region still face various obstacles. Most farmers have a limited land area so that the business scale is small (Turnip, 2023). This limitation has an impact on the low ability to increase production and income.

In addition to land limitations, farmers also face internal obstacles such as limited business capital and low adoption of agricultural technology. The use of technology that is not optimal causes productivity to not reach its maximum potential (Saleh et al., 2024). On the other hand, external factors such as fluctuations in the selling price of corn also affect the income level of farmers. Unstable selling prices can reduce farmers' income and welfare (Hajrawati, 2024).

In recent years, corn production in Langkat Regency has decreased significantly. This condition shows that there are problems in the sustainability of corn farming. Although nominally farming income looks quite high, its seasonal nature causes income uncertainty for farmers.

Various previous studies have shown that land area is an important factor in determining farmers' production levels and income (Feliciano et al., 2023). Business capital also plays a role in supporting the smooth production process (Syahran, 2013). However, research that examines these factors simultaneously and comprehensively at the local level is still limited, especially in Stabat District.

Based on these gaps, this study aims to analyze the determinants of income of corn farmers in Stabat District, Lalat Regency. This study uses a quantitative approach with the

Confirmatory Factor Analysis (CFA) method and multiple linear regression to identify the dominant factors and measure the influence of each variable on farmers' income. The results of this study are expected to make an empirical contribution and become a basis for the formulation of policies that are more targeted in improving farmers' welfare.

Method

This study employs a mixed-method approach by combining quantitative and qualitative techniques to obtain comprehensive and valid findings. The research design focuses on analyzing the determinants of corn farmers' income in Stabat District, Langkat Regency, using Confirmatory Factor Analysis (CFA) and Multiple Linear Regression with the assistance of SPSS software.

The variables used in this study consist of one dependent variable and eight independent variables. The dependent variable is farmers' income (Y), measured as the difference between total revenue (TR) and total cost (TC) during one planting season. The independent variables include land area (X1), business capital (X2), technology adoption (X3), selling price (X4), land productivity (X5), informal education (X6), farming experience (X7), and access to capital (X8). Each variable is measured using appropriate scales, including ratio and ordinal scales based on their respective indicators.

The population in this study consists of 384 corn farmers in Stabat District. The sample size was determined using the Slovin formula with a 5% margin of error, resulting in 195 respondents. The sampling technique applied is probability sampling with a simple random sampling method to ensure that all members of the population have an equal chance of being selected.

This study uses both primary and secondary data. Primary data were collected through structured questionnaires and direct interviews with respondents to obtain quantitative and qualitative information. Secondary data were obtained from relevant institutions such as the Central Bureau of Statistics (BPS), local government offices, and agricultural agencies.

Data collection techniques include questionnaires, interviews, and field observations. Questionnaires are used to collect quantitative data related to research variables, while interviews and observations provide deeper insights into farming practices and challenges faced by farmers.

Data analysis was conducted in two stages. First, Confirmatory Factor Analysis (CFA) was used to test the validity and reliability of the research instruments and to identify dominant factors. Validity was assessed using factor loadings, while reliability was measured using Cronbach's Alpha with a threshold value of 0.70. Second, Multiple Linear Regression analysis was applied to examine the effect of independent variables on farmers' income, both partially and simultaneously.

Before performing regression analysis, classical assumption tests were conducted, including normality, multicollinearity, and heteroscedasticity tests, to ensure that the model meets the Best Linear Unbiased Estimator (BLUE) criteria. Hypothesis testing was carried

out using the F-test to examine simultaneous effects and the t-test to examine partial effects. Additionally, the coefficient of determination (Adjusted R^2) was used to measure the explanatory power of the model.

Results and Discussion

1. Overview of Farm Income Conditions

The results of the study show that corn farming in Stabat District has relatively stable economic conditions. Most farmers earn a gross income in the range of IDR 10,000,001 to IDR 15,000,000 per planting season, with a production cost structure in the range of IDR 3,000,000 to IDR 6,000,000. These costs are dominated by the purchase of seeds, fertilizers, pesticides, and labor. After deducting all production costs, the majority of farmers earn a net income of between IDR 6,000,001 to IDR 9,000,000 per planting season. This condition shows that corn farming activities still make a significant economic contribution to farmer households in the study area.

In general, the income structure reflects that corn farming is still financially viable, although the profit margin obtained by farmers is still moderate. This indicates that the efficiency of the use of production inputs is still the main room for improvement. Therefore, increasing productivity and cost efficiency is an important aspect in efforts to improve the welfare of corn farmers in Stabat District, especially through improving farm management.

2. Access to Financial Institutions

The results of the analysis showed that farmers' access to formal financial institutions was relatively good. As many as 78% of respondents stated that they did not experience difficulties in meeting the administrative requirements to obtain farm loans such as KUR or bank loans. In addition, 75.4% of respondents stated that the available loan products are in accordance with the needs of corn farming. This shows that formal financial institutions have been quite responsive to the financing characteristics of the agricultural sector.

From the process aspect, 77.4% of farmers consider that the disbursement of loan funds is fast and not convoluted. This efficiency is very important because planting time greatly determines the success of agricultural production. However, there are still 27.2% of farmers who feel that the burden of interest or loan repayment obligations is quite burdensome. In addition, access to informal financing is also still high, indicating that farmers still rely on a combination of formal and informal financing sources.

3. Results of Confirmatory Factor Analysis (CFA)

The results of the KMO test of 0.784 showed that the data had a good level of sample adequacy for further analysis. Meanwhile, the significant results of the Bartlett's Test (0.000) showed that the variables used were correlated and worthy of analysis using the factor method. The results of the initial extraction showed the formation of three main factors with an eigenvalue greater than 1. The three factors consisted of physical resource factors, human

resource quality, and market mechanisms. Each factor reflects a group of variables that have functional relationships in the field.

However, after the varimax rotation, the structure of the factors became clearer and narrowed down to the three most dominant main variables, namely selling price, land area, and informal education. These three variables had the greatest contribution in explaining the variation in farmers' income data. These results show that although there are eight initial variables, empirically only a few core factors actually play a role in shaping the income of corn farmers in Stabat District, making the model simpler and more interpretive.

4. Multiple Linear Regression and Statistical Testing

The results of the regression analysis showed that the model obtained was $Y = 10{,}040 + 0.668X_1 + 0.403X_2 + 0.329X_3 + e$. The three independent variables, namely selling price, land area, and informal education, were proven to have a positive influence on farmers' income. The results of the t-test showed that all independent variables had a partial significant effect on revenue, with a significance value of less than 0.05 each. Selling price had the most dominant influence compared to other variables.

An Adjusted R^2 value of 0.213 indicates that 21.3% of farmers' income variations can be explained by the model, while the remaining 78.7% is influenced by other factors outside the study such as climatic conditions, price policies, and market dynamics. The results of the F test also showed a significant value ($F = 18.542$; $p < 0.05$), which indicates that the regression model is simultaneously feasible to be used to explain the factors that affect the income of corn farmers in Stabat District.

5. Discussion of Determinant Variables

a. Selling Price

Selling price is proven to be the most dominant factor in determining farmers' income. This shows that farmers' income is highly dependent on market mechanisms and fluctuations in corn commodity prices. Theoretically, this is in accordance with the concept of total income (Total Revenue = Price × Quantity), where price changes will have a direct impact on the total income of farmers. At the local level, farmers are still highly dependent on prices determined by middlemen or corn refineries, so farmers' bargaining positions are relatively limited. This condition makes prices a very sensitive variable for farmers' welfare. Thus, price stabilization is an important factor in maintaining the sustainability of corn farmers' income in the research area.

b. Country Size

Land area has a positive and significant influence on farmers' income. This shows that business scale is still an important factor in determining income levels in the corn farming sector. The more land is managed, the greater the production potential produced, and the higher the cost efficiency per unit of output. This condition reflects the economic scale of corn farming in Stabat District. Empirically, farmers with larger land tend to have higher incomes than farmers with narrow land. This shows that land ownership is still the main

production asset. These findings are also consistent with the Cobb-Douglas theory of production function which places land as the main factor of production in determining agricultural output.

c. Informal Education

Informal education has a positive and significant effect on farmers' income. This shows that increasing the knowledge capacity of farmers through counseling and training has a real impact on farming performance. Farmers who actively participate in extension activities tend to be better able to manage production inputs efficiently, such as fertilizer use, pest control, and better cultivation techniques. This increase in knowledge has an impact on reducing production costs and increasing crop yields, which in turn increases farmers' net income. These results are in line with human capital theory which emphasizes that investment in education and knowledge will increase individual productivity.

d. Non-Significant Factors

Some variables such as capital, experience, technology, and access to capital did not appear as the main determinants in the final model. This was due to relatively homogeneous conditions among the respondent farmers. Access to capital and technology is relatively uniform so it is not a major differentiating factor in income. In addition, farming experience is not always followed by knowledge updates relevant to current agricultural conditions. This condition shows that structural factors such as price and land have a stronger influence than certain individual factors. Thus, the increase in farmers' income is determined more by external economic factors and knowledge capacity than by experience alone.

6. Tables, Fiqgures, and Formulas

Table 1. Income Distribution of Corn Farmers in Stabat District

Yes	Questions	Answer	Frequency	Introduce yourself
1.	The income from my corn harvest is already satisfactory (as expected).	Disagree	4	2,1
		Disagree	36	18,5
		Agree	104	53,3
		Strongly agree	51	26,2
		Strongly Disagree	0	0
		Total	**195**	**100**
2.	My corn farming income is enough to meet the needs of the daily family food consumption needs.	Disagree	2	1
		Disagree	42	21,5
		Agree	106	54,4
		Strongly agree	45	23,1
		Strongly Disagree	0	0
		Total	**195**	**100**
3	The income from corn is able to finance the needs of the	Disagree	8	4,1
		Disagree	34	17,4
		Agree	107	54,9
		Strongly agree	46	23,6

		Strongly Disagree	0	0
		Total	**195**	**100**
4.	Corn farming net income I tend to be stable from the growing season to the next growing season.	Disagree	11	5,6
		Disagree	45	23,1
		Agree	116	59,5
		Strongly agree	23	11,8
		Strongly Disagree	0	0
		Total	**195**	**100**
5.	I was able to set aside part of the corn revenue for savings or new investment capital.	Disagree	18	9,2
		Disagree	66	33,8
		Agree	95	48,7
		Strongly agree	16	8,2
		Strongly Disagree	0	0
		Total	**195**	**100**
6.	The income I receive from the corn crop tend to be stable and do not have Differences conspicuous between the dry season and the rainy season.	Disagree	6	3,1
		Disagree	57	29,2
		Agree	103	52,8
		Strongly agree	29	14,9
		Strongly Disagree	0	0
		Total	**195**	**100**
7.	Average corn production per growing season	< 100 kg	12	6,2
		100 - 400 kg	46	23,6
		401 - 600 kg	71	36,4
		601 - 800 kg	44	22,6
		> 800 kg	22	11,3
		Total	**195**	**100**
8	Average selling price of corn	< IDR 3,000	9	4,6
		IDR 3,000 – IDR 4,000	47	24,1
		IDR 4,001 – IDR 5,000	75	38,5
		IDR 5,001 – IDR 6,000	52	26,7
		> IDR 6,000	12	6,2
		Total	**195**	**100**
9.	Total gross income per growing season	< IDR 5,000,000	22	11,3
		IDR 5,000,000 – IDR 10,000,000	43	22,1
		IDR 10,000,001 – IDR 15,000,000	59	30,3
		IDR 15,000,001 – IDR 20,000,000	48	24,6

		> IDR20,000,000	23	11,8
		Total	**195**	**100**
10.	Total production costs per growing season	< IDR 3,000,000	23	11,8
		IDR 3,000,000 – IDR 6,000,000	79	40,5
		IDR 6,000,001 – IDR 9,000,000	60	30,8
		IDR 9,000,000 – IDR 12,000,000	23	11,8
		> IDR 12,000,000	10	5,1
		Total	**195**	**100**
11.	Net income per growing season	< IDR 3,000,000	26	13,3
		IDR 3,000,000 – IDR 6,000,000	57	29,2
		IDR 6,000,001 – IDR 9,000,000	63	32,3
		IDR 9,000,001 – IDR 12,000,000	32	16,4
		> IDR 12,000,000	17	8,7
		Total	**195**	**100**

Table 2. Farmers' Perception of Research Variables (Land Area, Business Capital, and Technology Adoption)

Yes	Statement	Answer	Frequency	Percentage (%)
1	The land area that I am working on is sufficient to increase my income	STS	0	0.0
		TS	5	2.6
		KS	29	14.9
		S	113	57.9
		SS	48	24.6
	Total		**195**	**100**
2	The more corn I have, the more income I get	STS	0	0.0
		TS	0	0.0
		KS	33	16.9
		S	96	49.2
		SS	66	33.8
	Total		**195**	**100**
3	If I have additional capital, I plan to increase the area of corn fields	STS	0	0.0
		TS	0	0.0
		KS	10	5.1
		S	134	68.7

		SS	51	26.2
	Total		**195**	**100**
4	Small land ownership makes me have to be more intensive in the use of cultivation technology	STS	0	0.0
		TS	26	13.3
		KS	23	11.8
		S	118	60.5
		SS	28	14.4
	Total		**195**	**100**
5	I'm not worried about losing my main job even though my corn field is limited	STS	10	5.1
		TS	13	6.7
		KS	21	10.8
		S	121	62.1
		SS	30	15.4
	Total		**195**	**100**
6	I have enough capital to buy the means of production on time	STS	0	0.0
		TS	13	6.7
		KS	18	9.2
		S	107	54.9
		SS	57	29.2
	Total		**195**	**100**
7	Access to capital makes it easier for me to increase my corn farming yields	STS	0	0.0
		TS	14	7.2
		KS	23	11.8
		S	103	52.8
		SS	55	28.2
	Total		**195**	**100**
8	I can manage the cost of corn production well every planting season	STS	0	0.0
		TS	4	2.1
		KS	31	15.9
		S	112	57.4
		SS	48	24.6
	Total		**195**	**100**
9	The capital I use gives me a commensurate profit	STS	0	0.0
		TS	13	6.7
		KS	21	10.8
		S	109	55.9
		SS	52	26.7
	Total		**195**	**100**
10	I use superior corn seeds as recommended	STS	0	0.0
		TS	3	1.5

		KS	20	10.3
		S	108	55.4
		SS	64	32.8
	Total		**195**	**100**
11	I apply planting spacing according to technical recommendations	STS	0	0.0
		TS	5	2.6
		KS	25	12.8
		S	96	49.2
		SS	69	35.4
	Total		**195**	**100**
12	I do balanced fertilization according to the dosage	STS	0	0.0
		TS	4	2.1
		KS	18	9.2
		S	102	52.3
		SS	71	36.4
	Total		**195**	**100**
13	I implement integrated pest and disease control	STS	0	0.0
		TS	2	1.0
		KS	20	10.3
		S	104	53.3
		SS	69	35.4
	Total		**195**	**100**
14	I apply good harvest and post-harvest handling	STS	0	0.0
		TS	0	0.0
		KS	18	9.2
		S	101	51.8
		SS	76	39.0
	Total			**100**

Figure 1. Interview with Corn Farmer Respondents in Stabat District

Figure 2. Corn Harvest and Postharvest Activities in Stabat District

Conclusion

This study aims to identify the determinants that affect the income of corn farmers in Stabat District. The results of the analysis show that farmers' income is not determined by a single factor, but by a combination of production factors, human resource capacity, and interrelated market mechanisms. Selling prices have proven to be the most dominant factor in influencing farmers' incomes, which shows that farmers' welfare is very sensitive to market price fluctuations. In addition, land area and informal education also play a significant role in increasing income through increasing production capacity and efficiency of farm management.

Overall, the increase in the income of corn farmers in Stabat District is influenced by the integration of structural and non-structural factors. Therefore, efforts to improve farmers' welfare need to be focused on price stabilization, land use optimization, and strengthening farmers' capacity through agricultural education and counseling.

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