

Research Article

The Role of Agriculture in Reducing Poverty Levels in Rural Areas in North Sumatra

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Abstract: The objective of this study is to analyze the role of the agricultural sector in reducing the level of poverty in rural areas of North Sumatra Province. The data used are secondary time series data covering the period 2015–2024, obtained from the Central Bureau of Statistics (BPS) of North Sumatra and other official sources. The variables used include the poverty rate as the dependent variable, and agricultural output growth, agricultural labor, and agricultural investment as independent variables. Data analysis was conducted using multiple linear regression with the assistance of the SPSS program. The results of the study show that agricultural output growth and agricultural investment have a negative effect on the poverty rate, meaning that an increase in these two variables is able to reduce the level of poverty in North Sumatra. Meanwhile, agricultural labor does not show a significant effect on poverty. These findings emphasize the importance of increasing productivity and investment in the agricultural sector as a strategy for poverty reduction in rural areas.

Keywords: Agriculture; Investment; Labor; North Sumatra; Poverty.

1. Introduction

Poverty in rural areas remains a major problem in development across many regions of Indonesia, including North Sumatra. Although the government has implemented various initiatives such as assistance programs and infrastructure development, the poverty rate in many villages remains relatively high compared to urban areas. This condition is caused by the significant dependence of rural communities on the agricultural sector, which is vulnerable to changing climatic conditions, price fluctuations, limited capital, and low productivity.

The growth of agricultural output has a direct effect on improving the welfare of rural communities. When production increases whether due to land expansion, the adoption of modern technology, or improved efficiency farmers' income rises, leading to better household consumption capacity. Suryahadi and Sumarto (2003) from the SMERU Research Institute stated that growth in the agricultural sector contributes the most to poverty reduction in Indonesia compared to other sectors, as most poor people live in rural areas and depend on agriculture. Therefore, inclusive agricultural sector growth that empowers small farmers can serve as a key factor in sustainably reducing poverty rates.

Based on the development data of the agricultural sector in North Sumatra during the period 2015–2024, there have been changes in several key indicators. The poverty rate, agricultural output growth, labor, and agricultural investment show varied dynamics throughout the period. The complete data can be seen in Table X.

Table 1. Complete Data.

Year	Poverty Rate	Agricultural Output Growth	Agricultural Labor	Agricultural Investment
2015	9.85	3.1	35	1100
2016	9.55	2.7	34.8	1200

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2017	9.22	3	34.2	1280
2018	9.1	2.9	33.9	1360
2019	8.83	2.1	33.7	1420
2020	8.75	1.9	33.5	1450
2021	8.49	2.8	32.8	1620
2022	8.15	3.4	32.2	1700
2023	7.67	3.1	31.9	1800
2024	7.19	3.7	31.5	1950

The objective of this study is to empirically examine how agricultural output growth, agricultural labor, and agricultural investment affect the level of poverty in rural areas of North Sumatra (Restiatun, Udi, & Rosyadi, 2023; Ardiansyah, Diartho, & Lestari, 2020). By understanding the extent of the effect of each independent variable on poverty, more appropriate policies can be recommended so that the agricultural sector can contribute more effectively to poverty alleviation in rural communities (Septiadi & Nursan, 2016).

2. Literature Review

Poverty is a complex social and economic issue encompassing multiple dimensions (Adawiyah, 2020). This problem is not only related to a person's low income but also to inequalities in social and cultural structures, as well as to the economic policies implemented. In rural areas, poverty is often closely linked to the condition of the agricultural sector, which serves as the main source of livelihood for the community. Therefore, understanding the role of the agricultural sector is essential to determine the extent to which rural economic growth can reduce poverty levels, particularly in North Sumatra Province.

In general, low-income groups allocate a large portion of their income to purchasing basic foodstuffs (Syahputri, Lubis, & Anggraini, 2023). An increase in agricultural production especially food commodities can lower food prices, thereby reducing this spending burden (Syahputri et al., 2023). Consequently, the proportion of income spent on food decreases. The agricultural sector plays a vital role in driving the economy in developing countries and affects the level of public welfare (Tiara Monica, 2024). In many developing nations, agriculture remains the primary source of income for the majority of the population, particularly in rural areas (Pane, 2024). In recent years, various studies have shown a strong linkage between agricultural sector progress and poverty reduction. Increases in agricultural yields are directly associated with improvements in the living conditions of low-income groups, particularly in relation to food price challenges (Timmer, 1997).

Agricultural output growth has a direct effect on improving rural welfare. When production increases whether due to land expansion, the adoption of modern technology, or greater efficiency farmers' income rises, and household consumption capacity improves. Suryahadi and Sumarto (2003) from the SMERU Research Institute stated that growth in the agricultural sector contributes the most to poverty reduction in Indonesia compared to other sectors, as most poor people live in rural areas and depend on agriculture. Therefore, inclusive agricultural sector growth that empowers small farmers can be the key to sustainably reducing poverty levels.

According to Suryahadi and Sumarto (SMERU), growth in the agricultural sector is the most important factor contributing to poverty reduction in Indonesia overall. They found that agricultural sector growth accounts for about 66% of national poverty reduction, and its effect on rural poverty is even greater. At the provincial level, the study "Analysis of Poverty and Agricultural Sector Growth in North Sumatra Province" conducted by Harahap, Rahmanta, and Lindawati showed a strong relationship between agricultural sector growth and the level of poverty in North Sumatra. The agricultural sector has significant potential to increase farmers' household income and stimulate non-agricultural activities in villages.

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agricultural sector contributes the most to poverty reduction in Indonesia compared to other sectors, as most poor people live in rural areas and depend on agriculture. Therefore, inclusive agricultural sector growth that empowers small farmers can be the key to sustainably reducing poverty levels.

Agricultural labor also plays an important role in reducing poverty. The greater the number of workers absorbed and the higher their productivity, the more positive the effect on community welfare. Tambunan (2014) emphasized that employment absorption in the agricultural sector is closely related to poverty reduction since the majority of the poor work in this sector. However, an increase in the number of agricultural workers alone is not sufficient it must be accompanied by improvements in skills, access to production facilities, and technological support to enhance productivity and prevent structural poverty. Therefore, efforts to improve the quality of human resources in agriculture through training and extension programs are essential.

Investment in the agricultural sector is also a key factor in strengthening the rural economy. Investment can take the form of infrastructure development such as irrigation, village roads, crop storage facilities, as well as financial support and technological research. According to the World Bank (2023), public investment in the agricultural sector has the most significant effect on poverty reduction, particularly in areas where communities are highly dependent on agriculture. Such investments not only increase productivity and farming efficiency but also create new job opportunities and expand market access for farmers. In other words, the greater the investment directed toward the agricultural sector, the greater the potential for improving rural welfare.

According to Suparmoko (2002), regional economic development will be effective only if it identifies the basic sectors with potential for development, one of which is the agricultural sector. This sector makes a major contribution to the Gross Regional Domestic Product (GRDP), but its growth is often constrained by various factors, including low investment levels and the declining number of agricultural workers. Masru'ah and Soejoto (2013) emphasized that sustainable development must begin with the agricultural sector and rural areas, as this sector plays a strategic role in accelerating equitable welfare distribution. However, data indicate that the economic structure's transformation toward the secondary and tertiary sectors has led to a yearly decline in the number of agricultural workers. This condition indicates a labor shift from the traditional productive sector to the industrial and service sectors, which are considered more economically promising.

Previous studies also reinforce this perspective. Harahap, Rahmanta, and Lindawati (2020) found that in North Sumatra Province, growth in the agricultural sector has a significant effect on poverty reduction. They argue that increased productivity, labor efficiency, and the use of modern technology are key to improving rural welfare. Arifin (2019) also emphasized that agricultural investment, particularly in infrastructure and technology, plays an important role in accelerating rural economic transformation and increasing small farmers' income. Based on theory and previous research findings, it can be concluded that the three main variables agricultural output growth, agricultural labor, and agricultural investment are interrelated in affecting the level of poverty in rural areas. Increased agricultural output is expected to raise farmers' income, broad labor absorption can strengthen community welfare, and adequate investment can create a foundation for long-term economic growth. Therefore, this study assumes that improving the performance of the agricultural sector through productivity, employment opportunities, and optimal investment will contribute significantly to reducing poverty levels in rural North Sumatra.

3. Method

This study was conducted to examine the role of the agricultural sector in reducing the level of poverty in rural areas of North Sumatra Province. The data used are time series data covering a ten-year period, from 2015 to 2024. The data were obtained from the Central Bureau of Statistics (BPS) of North Sumatra, the Investment Coordinating Board (BKPM), and several official publications such as Indonesian Agricultural Statistics.

This research employs a quantitative approach using numerical data to describe the relationship between agriculture and poverty. The analysis focuses on the effect of several agricultural factors on the poverty level in the province.

The variables used consist of:

- a. Poverty Rate (%) as the dependent variable
- b. Agricultural Output Growth (%), Agricultural Labor (%), and Agricultural Investment (billion rupiah) the independent variables.

The data used are in an aggregated provincial form. Since the majority of North Sumatra's population resides in rural areas and relies on the agricultural sector for their livelihoods, this data is considered to represent rural conditions in general.

Data analysis was carried out using multiple linear regression with the assistance of the SPSS program to determine the extent of the effect of agricultural output growth, agricultural labor, and agricultural investment on the poverty rate. The results of this analysis are expected to explain the role of the agricultural sector in reducing the level of poverty in rural areas of North Sumatra.

4. Result and Discussion

4.1 Research Result

4.1.1 Classical Assumption Test Results

The classical assumption test was conducted to ensure that the linear regression model used met the basic requirements so that the results of the analysis could be considered valid, consistent, and unbiased. This testing is essential, especially when using the Ordinary Least Square (OLS) method. Several tests that need to be performed include the normality test, multicollinearity test, heteroscedasticity test, and autocorrelation test.

4.1.2 Normality Test

The normality test aims to determine whether the data of the research variables are normally distributed or not. Before conducting further analysis, the data must first be examined to meet the normality requirement. In this study, the researcher used the One Sample Kolmogorov-Smirnov Test method. The data are considered normally distributed if the significance value is greater than 0.05, while if the value is less than 0.05, the data are considered not normally distributed. The results of the normality test can be seen in Table 1 below.

Table 2. One Sample Kolmogorov-Smirnov Test.

		Unstandardized Residual
N		10
Normal Parameters.a,b	Mean	.0000000
	Standard Deviation	2,272,076,662
Most Extreme Differences	Absolute	.285
	Positive	.218
	Negative	-.285
Test Statistics		.285
Asymp. Sig. (2-tailed)		.020 cd
a. Test distribution is Normal		
b. Calculated from data		
c. Lilliefors Significance Correction		

Source: Processed Data (SPSS 25) 2025

Based on the results of the normality test in Table 1 using the One Sample Kolmogorov-Smirnov method, the residual value obtained is 0.020 from a total sample of 10. Since this value is smaller than 0.05, it can be concluded that the data in this study are not normally distributed.

4.1.3 Multicollinearity Test

The multicollinearity test is conducted in regression analysis to detect the presence of a high correlation among independent variables in the model. The purpose of performing this test is to ensure that multicollinearity does not occur namely, a condition in which

independent variables are strongly correlated with one another, making it difficult to determine the individual influence of each variable on the dependent variable. Detection of multicollinearity typically uses indicators such as the Variance Inflation Factor (VIF) and Tolerance values. The common standard for testing multicollinearity is that if the VIF value exceeds 10 or the Tolerance value is below 0.1, symptoms of multicollinearity may exist. Conversely, if the VIF value is below 10 and the Tolerance value is greater than 0.1, the regression model is considered free from multicollinearity.

Table 3. Multicollinearity Test Results.

Model	Coefficients ^a							
	Unstandardized		Standardized		Collinearity Statistics			
	Coefficients		Coefficients		Tolerance	VIF		
Model	B	Std. Error	Beta	t	Sig.			
1	(Constant)	1,149,755	528,794		2,174	.073		
	Agricultural							
	Output							
	Growth	-13,782	12,921	-521	-1,067	.327	.544	1,837
	Agricultural							
	Labor	-1,407	1,277	-516	-1.101	.313	.592	1,691
	Agricultural							
	Investment	.282	.486	.299	.580	.583	.488	2,048

Source: Processed Data (SPSS 25) 2025

Based on the results of the multicollinearity test in Table 2 above, the VIF values for agricultural output growth (X_1) are 1.837, for agricultural labor (X_2) are 1.691, and for agricultural investment (X_3) are 2.048—all of which are below 10 (<10). Meanwhile, the Tolerance values for agricultural output growth (X_1) are 0.544, for agricultural labor (X_2) are 0.592, and for agricultural investment (X_3) are 0.488—all greater than 0.1 (>0.1). Thus, it can be concluded that there are no symptoms of multicollinearity in the regression model used in this study. In other words, the three independent variables are relatively free from the influence of one another.

4.1.4 Heteroscedasticity Test

The heteroskedasticity test is conducted to determine whether there are differences in the variance of residuals between one observation and another. A good regression model should not experience heteroskedasticity. To identify this, the scatterplot pattern is typically examined. If the model is free from heteroskedasticity, the data points will be randomly distributed above and below the zero line on the Y-axis, rather than clustering on one side. Additionally, the distribution of points should not form a particular pattern such as waves or a funnel shape that widens and then narrows. In other words, the data points should appear random without any clear pattern.

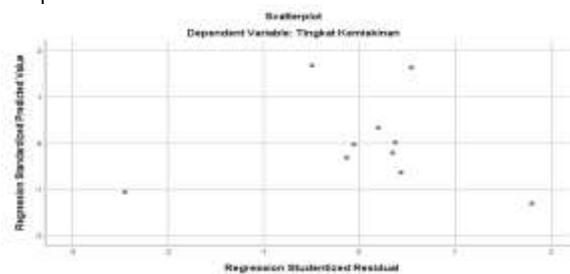


Figure 1. Heteroscedasticity Test Results

Source: Processed Data (SPSS 25) 2025

Based on the observation results from the heteroskedasticity test displayed through the scatterplot, it can be seen that the data points (residuals) are randomly scattered around the zero line of the standardized regression values. This distribution pattern indicates no particular trend, such as clustering on one side or forming a specific pattern. Therefore, it can

be concluded that the regression model does not experience heteroskedasticity, meaning that H_0 is accepted and the model meets the homoskedasticity assumption.

4.1.5 Multiple Linear Regression Analysis

Table 4. Multiple Linear Regression Analysis.

Model		Coefficients ^a		Standardized Coefficients		
		Unstandardized Coefficients		Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1,149,755	528,794		2,174	.073
	Agricultural Output Growth	-13,782	12,921	-521	-1,067	.327
	Agricultural Labor	-1,407	1,277	-516	-1.101	.313
	Agricultural Investment	.282	.486	.299	.580	.583

a. Dependent Variable: Poverty Level

Source: Processed Data (SPSS 25) 2025

Based on the results of the multiple linear regression test presented in Table 3, the regression equation can be formulated as follows: $Y = 1,149,755 - 13.782X_1 - 1.407X_2 + 0.282X_3$, where: Y = Poverty Rate. X_1 = Agricultural Output Growth. X_2 = Agricultural Labor. X_3 = Agricultural Investment. The interpretation of the results is as follows:

- Constant (a) of 1,149,755 with a significance value of 0.073 indicates that when agricultural output growth, agricultural labor, and agricultural investment are not considered, the poverty rate remains at 1,149,755.
- Agricultural Output Growth (X_1) has a regression coefficient of -13.782 with a significance value of 0.327 (> 0.05). This indicates that agricultural output growth has a negative and insignificant effect on the poverty rate.
- Agricultural Labor (X_2) has a regression coefficient of -1.407 with a significance value of 0.313 (> 0.05). This means agricultural labor has a negative and insignificant effect on the poverty rate.
- Agricultural Investment (X_3) has a regression coefficient of 0.282 with a significance value of 0.583 (> 0.05). This indicates that agricultural investment has a positive and insignificant effect on the poverty rate.

4.2 Hypothesis Testing

4.2.1 Partial T Test

The partial t-test in regression analysis aims to examine the effect of each independent variable individually on the dependent variable. The partial t-test method is typically applied in multiple linear regression, where two or more independent variables are involved. In this test, the calculated t value (t-count) for each coefficient is compared with the t-table value based on a predetermined significance level, usually 0.05, and a specific degree of freedom. If the significance value (p-value) is smaller than 0.05, or if the t-count is greater than the t-table value, the independent variable is considered to have a significant effect on the dependent variable. Conversely, if these conditions are not met, the independent variable does not have a significant effect

Table 5. Partial t-Test Results.

Model	Coefficients ^a		Unstandardized Coefficients		Standardized Coefficients		
		B	Coefficients		Coefficients		
			Std. Error	Beta	t	Sig.	
1	(Constant)	1,149,755	528,794		2,174	.073	

Agricultural						
Output Growth	-13,782	12,921	-521	-1,067	.327	
Agricultural						
Labor	-1,407	1,277	-516	-1.101	.313	
Agricultural						
Investment	.282	.486	.299	.580	.583	

a. Dependent Variable: Poverty Level

Source: Processed Data (SPSS 25) 2025

Based on the partial (t-test) analysis results shown in the table above, it can be explained that the t-test aims to determine whether the independent variables Agricultural Output Growth (X1), Agricultural Labor (X2), and Agricultural Investment (X3) have a significant effect on the dependent variable, Poverty Rate. The calculated t value for Agricultural Output Growth is -1.067 with a significance value of 0.327, which is greater than 0.05; for Agricultural Labor, the t value is -1.101 with a significance of 0.313, also greater than 0.05; and for Agricultural Investment, the t value is 0.580 with a significance of 0.583, also greater than 0.05. These results indicate that all independent variables have a negative and insignificant effect on the dependent variable (Poverty Rate). To determine the t-table value, the degree of freedom (df) is calculated using the formula $df = n - k = 10 - 4 = 6$. With a significance level (α) of 0.05 and $df = 6$, the t-table value obtained is 2.44691. Since the t-count for Agricultural Output Growth (-1.067) is smaller than the t-table (2.44691), it can be concluded that Agricultural Output Growth has a negative and insignificant effect on the Poverty Rate in North Sumatra during the 2015–2024 period.

4.2.2 Simultaneous Significance Test F

The F-test aims to evaluate the combined effect of the independent variables Agricultural Output Growth (X1), Agricultural Labor (X2), and Agricultural Investment (X3) on the dependent variable, Poverty Rate (Y). In this study, the comparison between the calculated F-value (F-count) and the critical F-value (F-table) was used, with the numerator ($m-1$) and the denominator ($N-m$), where N is the total number of samples and m is the number of independent variables. The results of the F-test are presented in the following table, based on calculations performed using SPSS version 25.

Table 6. Simultaneous Significance Test Results.

ANOVA ^a						
Model		Sum Of Squares	df	Mean Squares	F	Sig
1	Regression	132,062,988	3	44,020,996	.568	.656b
	Residual	464,609,912	6	77,434,985		
	Total	596,672,900	9			

a. Dependent Variable: Poverty Level

b. Predictors: (Constant), Agricultural Investment, Agricultural Labor, Agricultural Output Growth

Source: Processed Data (SPSS 25) 2025

Based on the analysis results, the calculated F-value (F-count) is 0.568, which is lower than the F-table value of 4.757 ($0.568 < 4.757$), with a significance value of 0.656. Because the significance value exceeds 0.05, it can be concluded that the applied regression model is not significant overall. This indicates that the independent variables Agricultural Output Growth (X1), Agricultural Labor (X2), and Agricultural Investment (X3) collectively do not have a significant effect on the dependent variable, Poverty Rate (Y). Thus, the combination of these three independent variables is unable to explain the variation in the Poverty Rate in North Sumatra.

4.3 The Coefficient of Determination Test

Table 7. The Result of Coefficient of Determination Test.

Model Summary				
Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	.470b	.221	-.168	27,827,142

Source: Processed Data (SPSS 25) 2025

Based on the analysis results in Table 6, it is known that the correlation coefficient (R) value is 0.470, while the adjusted R Square value is 0.168 or equivalent to 16.8%. This means that 16.8% of the variation in variable Y is affected by variables X1, X2, and X3. Meanwhile, the remaining 83.2% is influenced by other factors outside those three variables that also affect the poverty level in North Sumatra.

4.4 Discussion

The research results indicate that the agricultural sector still plays an important role in the rural economy of North Sumatra, although its effect on poverty reduction has not shown statistically significant results. This condition reflects the reality in the field that agriculture remains the main source of livelihood for most rural communities; however, improvements in productivity and added value have not been evenly distributed. Based on the regression analysis results, it is known that agricultural output growth and agricultural labor have a negative effect on the poverty rate, although the effect is not significant. Meanwhile, the agricultural investment variable shows a positive direction but has not yet had a real impact on poverty reduction.

The increase in agricultural production in North Sumatra has not been fully able to reduce poverty because the growth that occurs has not reached all levels of farmers. The existing growth tends to be enjoyed by large farmers who have access to capital, land, and better technology, while small farmers still face limited resources. Thus, although agriculture acts as the main support for the rural economy, its role in reducing poverty has not been maximized because the benefits of growth have not been evenly distributed across all groups in rural communities.

From the labor perspective, the research results show that the increase in the number of agricultural workers does not necessarily reduce the poverty rate. Most workers in the agricultural sector still work traditionally, with low skills and limited productivity. Many farmers rely only on simple tools and lack access to modern technology or adequate agricultural training. As a result, even though the agricultural sector can absorb a large number of workers, its impact on improving welfare has not been felt significantly. Therefore, the role of agriculture in reducing poverty needs to be strengthened through improving human resource quality, training, and technological innovation that suits local conditions.

The research results also show that investment in the agricultural sector has a positive effect on the poverty rate, although it is not significant. This means that the increase in investment has not yet had a direct impact on rural welfare. This may occur because most investments in North Sumatra are still focused on large-scale agricultural sectors, such as palm oil plantations, which do not always provide direct benefits to small farmers. In order for investment to truly play a role in reducing poverty, a more inclusive policy direction is needed namely, investment that supports smallholder agriculture, expands access to small business capital, builds agricultural infrastructure such as irrigation and village roads, and strengthens farmer institutions.

Overall, the F-test results show that the three variables agricultural output growth, agricultural labor, and agricultural investment do not have a significant effect on the poverty rate. However, this does not mean that the agricultural sector has no role. On the contrary, these results indicate that the agricultural sector still has great potential but has not been utilized optimally. Many obstacles hinder the role of this sector, such as limited infrastructure, restricted market access, fluctuating agricultural product prices, and the lack of appropriate technology applications that could help increase production efficiency.

These findings are consistent with the opinion of Suryahadi and Sumarto (2003), who stated that agricultural sector growth can reduce poverty if it is inclusive and involves small farmers. Similarly, research by Harahap, Rahmanta, and Lindawati (2020) shows that the agricultural sector has a significant effect on improving community welfare when supported

by good labor productivity, modern technology application, and investment directed toward the interests of farmers.

The role of agriculture in reducing poverty levels in rural North Sumatra remains potential. This sector has great capacity to drive the rural economy but requires stronger policy support so that its benefits can be felt by all communities. Efforts that can be made include strengthening the agricultural extension system, facilitating access to financing for farmers, expanding investment opportunities for small and medium-scale farms, and improving production and distribution infrastructure for agricultural products.

In addition, local governments also need to create synergy between the agricultural sector and the processing and trade industries. Increasing the added value of agricultural products through post-harvest activities and household industries in rural areas can strengthen local economic chains. With an integrated development approach that favors small farmers, the agricultural sector can become a key pillar in alleviating poverty and promoting sustainable economic growth in North Sumatra.

5. Conclusion and Suggestions

The agricultural sector plays an important role in the rural economy of North Sumatra as the main source of livelihood for the majority of rural communities. However, the research results indicate that the effect of agricultural output growth, agricultural labor, and agricultural investment on reducing the poverty rate is not yet statistically significant. This is due to uneven growth in the agricultural sector, where most benefits are enjoyed by large farmers, while small farmers still face limited resources and low productivity. The increase in agricultural labor has not been able to significantly reduce poverty because many workers still use traditional methods with low skills. Agricultural investment is still largely focused on large-scale farming, and therefore has not provided tangible benefits for small farmers.

To strengthen the role of agriculture in poverty reduction, it is necessary to improve the quality of human resources through training, the application of appropriate technology, and inclusive investment that supports smallholder agriculture. More concrete policy support in infrastructure improvement, access to financing, and the development of added value for agricultural products is also essential to enhance the welfare of rural communities comprehensively.

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