International Journal of Economics, Business and Innovation Research
https://e-journal.citakonsultindo.or.id/index.php/IJEBIR
E-ISSN : 2964-0865
IJEBIR

Analysis Of Income Inequality Reduction Through Agricultural Sector Development Performance In The Sulawesi Region

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Abstract

This study aims to analyze the reduction of income inequality through the development performance of the agricultural sector in the Sulawesi region. The focus of the study was directed to assess the influence of the agricultural subsector on the Gini Ratio as an indicator of income inequality in six provinces, namely South Sulawesi, West Sulawesi, Southeast Sulawesi, Central Sulawesi, Gorontalo, and North Sulawesi. The research uses a quantitative approach with secondary data sourced from the Central Statistics Agency. The data analyzed covers the period 2015–2025, resulting in 66 panel data observations. The analysis technique used is multiple regression of panel data, which combines time and region dimensions to test the simultaneous and partial influence of the performance of agricultural subsectors on income inequality more objectively. The results of the study show that the performance of the development of the agricultural sector simultaneously has a significant effect on the Gini Ratio in the Sulawesi Region, with the ability to explain the model of 81.0716%. Partially, the sub-sectors of food crops, plantation crops, and fisheries have a positive and significant effect, so that the increase tends to increase income inequality. On the other hand, the sub-sectors of livestock, agricultural and hunting services, as well as forestry and logging have a negative and significant effect, thus playing a role in reducing inequality. The horticulture subsector has a negative effect, but it is not significant. This study recommends that local governments prioritize investment, access to capital, technology, and capacity building in subsectors that reduce inequality, as well as ensure the development of the sub-sectors of food crops, plantations, and fisheries accompanied by equitable distribution of production

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access, institutional strengthening, downstreaming, education, infrastructure, and job creation in an inclusive and sustainable manner.

Keywords: Inequality; Income; Gini Ratio; Agriculture; Development

INTRODUCTION

Income inequality is still one of the regional development problems that requires serious attention, especially in archipelago areas that have diverse geographical characteristics, economic structures, and infrastructure capacities such as Sulawesi. Income inequality describes differences in people's ability to earn income, access economic resources, enjoy growth results, and build social mobility. In regional development, high economic growth does not always bring equity if the source of growth is only concentrated in certain regions, sectors, or community groups. Research on reducing income inequality needs to be directed at sectors that touch the livelihood base of the wider community, one of which is the agricultural sector.

The agricultural sector has a strategic position in the Sulawesi economy because it is a source of employment, a source of food, a support for the rural economy, and a leading commodity base in many districts. The Sulawesi region has a wealth of food commodities, horticulture, plantations, livestock, and fisheries spread from North Sulawesi, Gorontalo, Central Sulawesi, West Sulawesi, South Sulawesi, to Southeast Sulawesi. This power provides a great opportunity for more inclusive economic development. The study of Hermawan et al. (2023) emphasized that the price dynamics of staple foods, especially rice, can be related to income distribution in Indonesia, so the agricultural sector needs to be seen as an instrument of equity as well as a safeguard for household welfare.

The development of a well-performing agricultural sector can reduce inequality through several pathways. The first path is to increase farmers' direct income through higher productivity, production cost efficiency, and crop price stability. The second path is the expansion of employment opportunities in rural areas through planting, harvesting, processing, storage, distribution, and marketing activities. The third path is to strengthen linkages between agriculture and other sectors, especially trade, transportation, food processing industry, and village financial services. Liu et al. (2022) said increasing agricultural productivity supported by farmer education can narrow the rural-urban income gap, so agricultural development needs to move together to increase the capacity of human resources.

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In Sulawesi, agricultural development has a broader meaning because many regions still depend on primary activities as the main source of income. When agricultural productivity increases, farming households gain more room to save, improve consumption, send children to school, and develop side businesses. However, these benefits will be limited if access to land, water, capital, technology, and markets is uneven. Wudil et al. (2023) said that inequality of access to irrigation is related to rice production and water productivity. The findings are relevant for Sulawesi because some agricultural areas still face limited irrigation networks, variations in land quality, and long distribution distances from production villages to main markets.

Inclusive agricultural development also requires technological innovations that can be reached by smallholder farmers. Superior seed technology, appropriate mechanization, price information systems, simple precision agriculture, and digital extension services can encourage increased income if their use is not only enjoyed by farmers with large capital. Tang et al. (2022) said that technological innovation can increase inequality if it is not supported by public spending and equitable access policies. This means that agricultural development in Sulawesi requires policy design that pays attention to the capacity of smallholder farmers, farmer group institutions, technology adoption capabilities, and financing support that is in accordance with local conditions.

The transformation of agriculture towards added value is also an important key in reducing inequality. Many regions in Sulawesi produce primary commodities, but the greatest economic value often appears in the processing, packaging, inter-regional trade, and export stages. If farmers only act as suppliers of raw materials, the increase in production is not necessarily in line with a proportionate increase in income. Liao et al. (2025) show that agricultural innovation can narrow the income gap through improving production efficiency, strengthening factor allocation, and changing work structures. Thus, agricultural development strategies in Sulawesi need to be directed at the downstream of commodities, the development of local agro-industries, and the expansion of the role of farmers in the value chain. Zhang et al. (2025) found that the use of the internet is able to increase farmers' income and reduce inequality from several sources of income. The benefits of digitalization will be even more important because the geographical challenges between regions are quite large. Digital connectivity can shorten the information distance between farmers in production villages and municipal markets, wholesalers, cooperatives, and supporting institutions. Yang et al. (2026) explained that rural digital development can reduce farmers' income inequality through strengthening human capital, social capital, financial capital, and physical capital.

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From a regional perspective, Sulawesi has an important position in the development of Southeast Asian agriculture because this region is part of the production system of tropical commodities, food, and plantations. Wu et al. (2026) show that agricultural development in Southeast Asia is closely related to key commodities such as palm oil, rubber, and rice, and requires a cross-border comparative reading. Although Sulawesi has typical commodities such as cocoa, corn, coconut, cloves, nutmeg, coffee, rice, and livestock products, development challenges remain seen in the quality of infrastructure, access to financing, post-harvest processing, and price fluctuations. Therefore, the performance of agricultural development must be measured from production, added value, farmers' welfare, labor absorption, and its impact on income inequality.

Phenomena on the ground show that income inequality in Sulawesi is evident in the real difference between urban and rural areas, between production centers close to markets and agricultural villages far from distribution centers, as well as between farmers who have strong capital and small farmers who are highly dependent on the season. Some farmers are able to enjoy increased commodity prices when they have access to storage, merchant networks, transportation, and market information. Others sell their crops immediately after harvest due to the pressure of household needs and limited working capital. This condition makes the benefits of the growth of the agricultural sector not completely even. In some areas, the development of irrigation, farm roads, warehouses, cooperatives, and auction markets has not been balanced. As a result, agricultural household incomes are still vulnerable to crop failure, changes in input prices, extreme weather, and long marketing chains. This phenomenon is an important basis for analyzing how the development performance of the agricultural sector can play a role in reducing income inequality in the Sulawesi region. Data on inequality in the Sulawesi Region are presented as follows:

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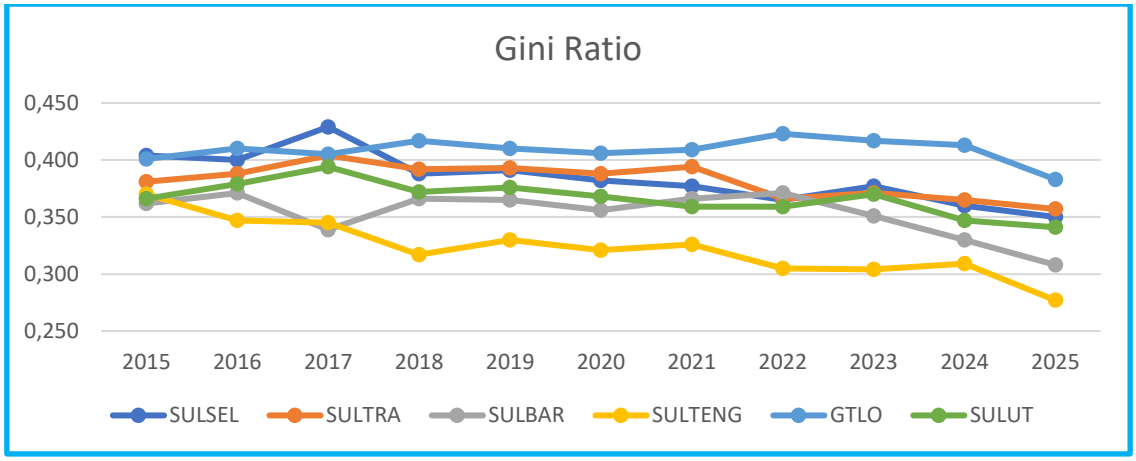


Figure 1: Income Inequality Trend (Gini Ratio) in the Sulawesi Region

Based on Figure 1 above, it can be seen that the Gini Ratio data for 2015–2025, income inequality in the Sulawesi Region shows a decreasing trend, but the decline is not completely evenly distributed between provinces. The average Gini Ratio of Sulawesi Regional moved from around 0.381 in 2015 to 0.336 in 2025. This decline signals an improvement in income distribution in general, but there is still a clear difference in the level of inequality between provinces. Gorontalo is the region with the highest relative inequality throughout the observation period, with an average of around 0.409 and had reached 0.423 in 2022. South Sulawesi and Southeast Sulawesi also showed relatively high levels of inequality in the early years, especially South Sulawesi which reached 0.429 in 2017 and Southeast Sulawesi which reached 0.404 in the same year. This condition shows that economic growth and productive activities in several provinces have not fully resulted in an equitable distribution of income for all community groups.

Another problem that can be seen from the data is the inequality between regions in the process of reducing the Gini Ratio. Central Sulawesi experienced the largest decline, from 0.370 in 2015 to 0.277, thus showing a stronger direction of equity than other provinces. West Sulawesi also fell quite sharply from 0.362 to 0.308, while South Sulawesi fell from 0.404 to 0.350. However, Gorontalo is still at 0.383 in 2025, higher than other provinces in Sulawesi, although it has decreased from 0.401 in 2015. This difference indicates that the economic structure, access to sources of income, quality of employment, control of productive assets, and people's connection to key economic sectors are still unbalanced. Thus, the issue of income inequality in the Sulawesi Region

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lies not only in the high and low Gini Ratio, but also in the inequality of each province's ability to create income equality in a sustainable manner.

Based on this description, income inequality in the Sulawesi Region is an important issue to be studied through its relationship with the development performance of the agricultural sector. The agricultural sector has a strategic position because it is a source of livelihood for the community, a source of labor, a driver of the rural economy, as well as a support for various production activities in the Sulawesi region. However, the characteristics of each agricultural subsector can contribute differently to the dynamics of people's incomes, especially due to differences in access to land, capital, technology, labor, infrastructure, and markets. Therefore, this study needs to be directed at several main subsectors, namely food crops, horticulture, plantation crops, livestock, agricultural and hunting services, forestry and logging, and fisheries, to see how the performance of each subsector is related to the level of income inequality reflected through the Gini Ratio. Thus, this study aims to analyze the reduction of income inequality through the development performance of the agricultural sector in the Sulawesi Region, so as to provide a more comprehensive understanding of the role of the agricultural sector in supporting regional economic equity.

LITERATURE REVIEW

Income Inequality (Gini Ratio)

Income inequality describes the difference in income distribution between individuals or households within a region, and the Gini Ratio is one of the most commonly used measures because it is able to summarize the degree of inequality into a single index between 0 and 1. A value closer to 0 indicates a more even distribution of income, while a value closer to 1 indicates a stronger concentration of income in a particular group. In development studies, the Gini Ratio is important because high economic growth can produce different quality of welfare if access to jobs, land, capital, education, markets, and technology is not distributed in a balanced manner. Chisadza et al. (2023) show that changes in environmental and economic conditions can affect income distribution, so measures of inequality need to be placed in a broader socio-economic context. Zheng and Li (2024) also emphasize that the income dynamics of farmers can change when agricultural economic strategies, such as product brand strengthening, change income opportunities between farmers. Dasgupta et al. (2023) show that agricultural households are more vulnerable to climate pressures because their income is highly dependent on natural productivity. Moyer et al. (2023) reinforce the view that income inequality is closely

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related to long-term development vulnerabilities, especially when poor households face greater economic risks. Thus, the Gini Ratio can be understood as an indicator of equitable distribution of development outcomes that is sensitive to economic structure, sectoral transformation, and community capacity to access productive sources of income.

Development of the Agricultural Sector

The development of the agricultural sector is a process of increasing economic, social, technological, and institutional capacity that enables agricultural activities to produce higher productivity, more stable incomes, and stronger food security. Agricultural development includes improving access to production inputs, extension, infrastructure, market information, digital technology, financing, yield processing, and value chain relationships that benefit farmers. Marion et al. (2024) show that agricultural product market access interventions can increase market participation, production, farm investment, selling prices, sales volume, and farmers' income. Ongachi and Belinder (2025) affirm the role of agricultural extension as an important pathway for livelihood diversification and sustainable development in rural communities. Smidt and Jokonya (2022) explained that the adoption of digital technology in the agricultural value chain is influenced by economic, social, political, and institutional factors, so agricultural development requires comprehensive system support. Ouko et al. (2022) place the involvement of young generations in agripreneurship as an important element for strengthening rural employment and poverty reduction. Yaohong et al. (2025) show that rural revitalization policies oriented towards food security, poverty alleviation, and sustainable development can strengthen the position of agriculture in the regional development agenda.

GDP in the Agricultural Sector

The GDP of the agricultural sector is the gross added value generated by all agricultural economic activities in a region during a certain period, so this indicator is often used to read the contribution of agriculture to the economic structure of the region. In the context of Indonesia's regional statistics, this sector includes several main subsectors. The food crop subsector includes commodities such as rice, corn, soybeans, tubers, and palawija which play an important role in food security. The horticultural crop subsector includes vegetables, fruits, medicinal plants, and ornamental plants that have high economic value and fresh and processed market opportunities. The plantation crop subsector includes commodities such as oil palm, rubber, coffee, cocoa, tea, sugarcane,

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and coconut, which are often sources of export and industrial raw materials. The livestock sub-sector includes the production of large livestock, small livestock, poultry, eggs, milk, and their by-products. The agricultural and hunting services sub-sector includes land processing services, crop maintenance, harvesting, nurseries, insemination, and production support activities. The forestry and logging sub-sectors include forest management, timber forest products, non-timber forest products, and legal logging activities. The fisheries subsector includes capture and aquaculture fisheries, both marine and inland waters. Sharmiladevi (2023) emphasized that the added value of agriculture, forestry, and fisheries has a relationship with economic growth and trade openness. Chowdhury et al. (2022) show that the contribution of agriculture to the economy needs to be read together with the aspect of ecological sustainability. Nugroho and Lakner (2022) emphasize that economic globalization affects products, supply chains, trade, technology, and food security in developing countries. Thus, the GDP of the agricultural sector reflects the performance of primary production as well as the capacity of the region in managing natural resources, labor, technology, markets, and subsectoral added value.

METHODOLOGY

This study applies a quantitative approach, which is an approach that focuses on objective measurements and numerical data analysis to understand a certain phenomenon (Borgstede & Scholz, 2021; Barroga et al., 2023; Lim, 2024). The population in this study is 6 provinces in Pulawu Sulawesi consisting of South Sulawesi, West Sulawesi, Southeast Sulawesi, Central Sulawesi, Gorontalo, and North Sulawesi. The sampling method in this study is a saturated sample which is sampling where all populations are the research sample. This study uses secondary data accessed through https://www.bps.go.id/id. The data that will be used is 2015-2025 data, so that the number of panel data is 66 research data.

The data analysis in this research uses multiple regression analysis of panel data. Multiple regression analysis of panel data is a multiple regression method that uses combined data, namely time series and cross section data (Ratnasari et al., 2023; Putria et al., 2023; Choudhury & Sahu, 2023). The equation for the regression of the data panel is as follows:

$$GR_{it} = \alpha_{it} + \beta_1 FC_{it} + \beta_2 HC_{it} + \beta_3 PC_{it} + \beta_4 LS_{it} + \beta_5 ASH_{it} + \beta_6 FL_{it} + \beta_7 FS_{it} + \varepsilon$$

Description:

GR= Income Inequality; FC= Food Crops; HC= Horticultural Crops; PC= Plantation Crops

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LS= Livestock; ASH= Agricultural and Hunting Services; FL= Forestry and Logging; FS= Fisheries; α=Kontansta; β=Regression coefficient; ε=Epsilon

RESULTS AND DISCUSSION

Research Results

Classic Assumption Testing

Residual Normality

The results of normality testing using the *help of the E-Views 9* Program are as follows:

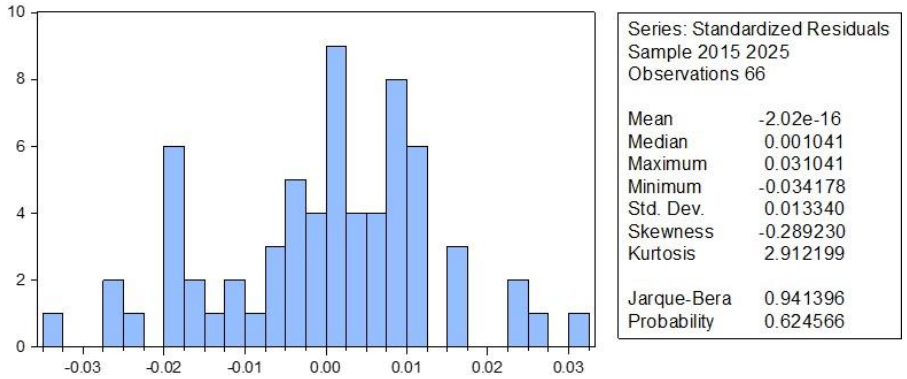


Figure 2: Normality Test Results

Source: *E-Views Data Processing Version 9, 2026*

Based on the image above, it can be seen that the value *of Jarque Bera* (JB) is 0.941 with a probability value of 0.624. The probability or significance value is greater than 0.05 so that Ho is accepted, the data in this study meets the normality test.

Autocorrelation Testing

The results of the Durbin Watson *method autocorrelation test* are shown in the following table 1:

Table 1: Autocorrelation Test Results

Variable Dependent: GR			
Method: Panel Least Squares			
F-statistic	40.77126	Durbin-Watson stat	**1.455513**
Prob(F-statistic)	0.000000		

Source: *E-Views Data Processing Version 9, 2026*

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Based on the table above, the *Durbin Watson* value is 1.455513. The *Durbin Watson* value is located between the values of -2 to +2 (**-2 < 1,455 < +2**). So that it can be concluded that the data is in a state of meeting the autocorrelation test.

Data Multicollinearity Testing

Based on the data processing that has been carried out previously, the *Variance Inflation Factor* (VIF) of each variable is as follows:

Table 2: Multicollinearity Test Results

Variable	VIF	Conclusion
FC= Food Crops	1.107	Meets the Multicollinearity test
HC= Horticultural Crops	1.045	
PC= Plantation Crops	1.269	
LS= Livestock	1.237	
ASH= Agricultural and Hunting Services	1.294	
FL= Forestry and Logging	1.028	
FS= Fisheries	1.230	

Source: *E-Views Data Processing Version 9, 2026*

Based on the results of the above data processing, it was found that the VIF value for the variable food crop sub-sector was 1,107, the VIF value of the horticultural crop sub-sector was 1,045, the VIF value of the plantation crops sub-sector was 1,269, the VIF value of the livestock sub-sector was 1,237, the VIF value of the agricultural and hunting services sub-sector was 1,294, the VIF value of the forestry and logging sub-sector was 1,028, and for the fisheries sub-sector by 1,230. The VIF value is lower than the standard of 10, so it is concluded that the regression model does not have a multicollinearity problem.

Data Heterokedasticity Testing

The following data processing results test heterokedasticity using the Glejser heterokedasticity method:

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Table 3: Heterokedasticity Test Results

Variable	Prob. Value	Conclusion
FC= Food Crops	0.6951	Meets the Heterokedasticity test
HC= Horticultural Crops	0.6064	
PC= Plantation Crops	0.7804	
LS= Livestock	0.2580	
ASH= Agricultural and Hunting Services	0.7746	
FL= Forestry and Logging	0.1574	
FS= Fisheries	0.2849	

Source: *E-Views Data Processing Version 9, 2026*

Based on the results of the output above, it can be seen that *the probability* value of the food crop sub-sector is 0.6951, the *probability* value of the horticultural crop sub-sector is 0.6064, the *probability* value of the plantation crop sub-sector is 0.7804, the *probability* value of the livestock sub-sector is 0.2580, the *probability value* of the agricultural and hunting services sub-sector is 0.7746, and the value of the *The probability* of the forestry and logging sub-sector is 0.1574 and the *probability* value of the fisheries sub-sector is 0.2849. Based on these results, the *probability value of* the glycer *test* is greater than alpha 0.05 so that the regression model in this study is not affected by heterokedasticity symptoms.

Multiple Regression Equations

The results of the analysis with the help of the E-Views 9 program are shown in table 4 as follows:

Table 4: Multiple Regression Analysis Results

Variable Dependent: GR				
Method: Panel Least Squares				
Date: 06/06/26 Time: 12:07				
Sample: 2015 2025				
Periods included: 11				
Cross-sections included: 6				
Total panel (balanced) observations: 66				
Variable	Coefficient	Std. Error	t-Statistic	Prob.

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C	0.497009	0.173344	2.867178	0.0058
FC	0.094072	0.017155	5.483533	0.0000
HC	-0.003310	0.012657	-0.261478	0.7947
PC	0.079532	0.018272	4.352699	0.0001
LS	-0.090614	0.025528	-3.549535	0.0008
ASH	-0.167420	0.033370	-5.017072	0.0000
FL	-0.013069	0.005209	-2.508939	0.0149
FS	0.074918	0.021084	3.553309	0.0008
R-squared	0.831100	Mean dependent var		0.369439
Adjusted R-squared	0.810716	S.D. dependent var		0.032460
S.E. of regression	0.014122	Akaike info criterion		-5.568925
Sum squared resid	0.011567	Schwarz criterion		-5.303513
Log likelihood	191.7745	Hannan-Quinn crister.		-5.464048
F-statistic	40.77126	Durbin-Watson stat		1.455513
Prob(F-statistic)	0.000000			

Source: E-Views version 9, 2026

Based on the numbers in the *Unstandardized Coefficients* column, the multiple regression equation is as follows:

$\hat{Y}$ = 0.497 + 0.094FC - 0.003HC + 0.079PC - 0.091LS - 0.167ASH - 0.013FL + 0.075FS + e

Based on the regression equation model above, it can be interpreted that the constant value of 0.497 indicates that if there is no influence of the variables of the food crop sub-sector, horticultural crop sub-sector, plantation crop sub-sector, livestock sub-sector, agricultural and hunting services sub-sector, forestry and logging sub-sector, and fisheries sub-sector, then income inequality (Gini Ratio) in the Sulawesi Region is 0.497.

The value of the regression coefficient of the food crop sub-sector (FC) of 0.094 indicates that every increase in the food crop sub-sector by 1 unit will increase income inequality (Gini Ratio) in the Sulawesi Region by 0.094, assuming that other variables are ceteris paribus or considered fixed. The value of the regression coefficient of the

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horticultural crop subsector (HC) of -0.003 indicates that every increase in the horticultural crop sub-sector by 1 unit will reduce income inequality (Gini Ratio) in the Sulawesi Region by 0.003, assuming other variables ceteris paribus. The regression coefficient value of the plantation crop sub-sector (PC) of 0.079 indicates that every increase in the plantation crop sub-sector by 1 unit will increase income inequality (Gini Ratio) in the Sulawesi Region by 0.079, assuming other variables are ceteris paribus. The value of the regression coefficient of the livestock sub-sector (LS) of -0.091 indicates that every increase in the livestock sub-sector by 1 unit will reduce income inequality (Gini Ratio) in the Sulawesi Region by 0.091, assuming other variables are ceteris paribus.

The regression coefficient value of the agricultural and hunting services sub-sector (ASH) of -0.167 indicates that every increase in the agricultural and hunting services sub-sector by 1 unit will reduce income inequality (Gini Ratio) in the Sulawesi Region by 0.167, assuming other variables are ceteris paribus. The regression coefficient value of the forestry and logging sub-sector (FL) of -0.013 indicates that any increase in the forestry and logging sub-sector by 1 unit will reduce income inequality (Gini Ratio) in the Sulawesi Region by 0.013, assuming other variables are ceteris paribus. The value of the fisheries sub-sector regression coefficient (FS) of 0.075 indicates that every increase in the fisheries sub-sector by 1 unit will increase income inequality (Gini Ratio) in the Sulawesi Region by 0.075, assuming other variables are ceteris paribus.

The test was then followed by the determination coefficient and hypothesis testing as follows:

Simultaneous Test Results

Based on table 4, the F-calculation value is 40.77126 and the significance value is 0.000000. The significance value is less than 0.05 so the hypothesis is accepted. This means that the development performance of the agricultural sector consisting of the food crop sub-sector, horticultural crop sub-sector, plantation crop sub-sector, livestock sub-sector, agricultural and hunting services sub-sector, forestry and logging sub-sector, and fisheries sub-sector together have a significant effect on income inequality (Gini Ratio) in the Sulawesi Region. The results of this simultaneous influence mean that the agricultural sector has an important role in influencing the level of income equity, so strengthening development in various agricultural sub-sectors needs to be considered as one of the efforts to reduce income inequality in the Sulawesi Region.

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Coefficient of Determination

Based on the results of the analysis of the determination coefficient in table 4, it shows that the magnitude of the determination coefficient or *Adjusted R Square* number is 0.810716. This value shows that 81.0716% of income inequality variability (Gini Ratio) in the Sulawesi Region can be explained by the development performance of the agricultural sector consisting of the food crops sub-sector, horticultural crop sub-sector, plantation crop sub-sector, livestock sub-sector, agricultural and hunting services sub-sector, forestry and logging sub-sector, and fisheries sub-sector. While the remaining 18.9284% is explained by other variables that are not studied in this study such as poverty rate, unemployment rate, economic growth, education level, population, investment, government spending, infrastructure development, and the contribution of other sectors outside the agricultural sector.

Partial Testing

The Effect of the Food Crop Sub-Sector on Income Inequality (Gini Ratio)

Based on the results of the analysis, the t-calculated value of the food crop sub-sector was 5.483533 with a significance value smaller than 0.05 (0.0000 < 0.05), so the food crop sub-sector had a positive and significant effect on income inequality (Gini Ratio) in the Sulawesi Region. The results of the positive coefficient are significant that the improvement in the performance of the food crop sub-sector tends to increase the Gini Ratio value, thereby potentially increasing income inequality in the Sulawesi Region. In other words, the increase in the food crop sub-sector has not been fully able to encourage income equity, but the benefits may still be concentrated in certain groups.

The Effect of Horticultural Crop Sub-Sector on Income Inequality (Gini Ratio)

Based on the results of the analysis, the t-calculated value of the horticultural crop sub-sector was -0.261478 with a significance value greater than 0.05 (0.7947 > 0.05), so the horticultural crop sub-sector had a negative but insignificant effect on income inequality (Gini Ratio) in the Sulawesi Region. The negative coefficient results are not significant, meaning that improving the performance of the horticultural crop sub-sector has the potential to reduce income inequality, but this influence has not been the main factor in this research model. This shows that the role of the horticulture sub-sector in reducing income inequality in the Sulawesi Region is still relatively limited.

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The Effect of the Plantation Crop Sub-Sector on Income Inequality (Gini Ratio)

Based on the results of the analysis, the t-calculated value of the plantation crop sub-sector was obtained of 4.352699 with a significance value smaller than 0.05 (0.0001 < 0.05), so the plantation crop sub-sector had a positive and significant effect on income inequality (Gini Ratio) in the Sulawesi Region. The results of the positive coefficient are significant means that the more the performance of the plantation crop sub-sector improves, the Gini Ratio value also tends to increase. Because the Gini Ratio is an indicator of income inequality, this increase shows that the growth of the plantation sub-sector has the potential to widen income inequality in the Sulawesi Region because the economic benefits have not been evenly distributed.

The Influence of the Livestock Sub-Sector on Income Inequality (Gini Ratio)

Based on the results of the analysis, the t-calculated value of the livestock sub-sector was -3.549535 with a significance value smaller than 0.05 (0.0008 < 0.05), the livestock sub-sector had a negative and significant effect on income inequality (Gini Ratio) in the Sulawesi Region. The results of the negative coefficient are significant that the improvement in the performance of the livestock sub-sector is able to significantly reduce the Gini Ratio value. This means that the development of the livestock sub-sector plays a good role in reducing income inequality and encouraging income equity in the Sulawesi Region.

The Effect of the Sub-Sector of Agricultural Services and Hunting on Income Inequality (Gini Ratio)

Based on the results of the analysis, the t-calculated value of the agricultural and hunting services sub-sector was -5.017072 with a significance value of less than 0.05 (0.0000 < 0.05), then the agricultural and hunting services sub-sector had a negative and significant effect on income inequality (Gini Ratio) in the Sulawesi Region. The negative coefficient results are significant means that improving the performance of the agricultural and hunting services sub-sector can significantly reduce income inequality. This shows that this sub-sector has an important role in improving income equity in the Sulawesi Region.

The Effect of Forestry and Logging Sub-Sectors on Income Inequality (Gini Ratio)

Based on the results of the analysis, the t-calculated value of the forestry and logging sub-sector was -2.508939 with a significance value of less than 0.05 (0.0149 <

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0.05), so the forestry and logging sub-sectors had a negative and significant effect on income inequality (Gini Ratio) in the Sulawesi Region. The result of a significant negative coefficient means that the improvement in the performance of the forestry and logging sub-sectors tends to significantly reduce the Gini Ratio value. Thus, this sub-sector has the potential to contribute to reducing income inequality in the Sulawesi Region.

The Influence of the Fisheries Sub-Sector on Income Inequality (Gini Ratio)

Based on the results of the analysis, the t-calculation value of the fisheries sub-sector was obtained of 3.553309 with a significance value of less than 0.05 (0.0008 < 0.05), so the fisheries sub-sector has a positive and significant effect on income inequality (Gini Ratio) in the Sulawesi Region. The results of the positive coefficient are significant means that the improvement in the performance of the fisheries sub-sector tends to increase the Gini Ratio value. Because the higher the Gini Ratio, the higher the income inequality, the increase in the fisheries sub-sector in this study has the potential to increase income inequality in the Sulawesi Region.

DISCUSSION

The development performance of the agricultural sector has a very strategic position in an effort to reduce income inequality in the Sulawesi Region because this sector is still the main source of livelihood for most rural populations. When agricultural development is able to increase productivity, expand employment opportunities, and strengthen farmers' access to markets and technology, the resulting economic benefits can be enjoyed by a wider group of communities. On the other hand, if the growth of the agricultural sector is only concentrated in certain business actors who have greater capital and access, then the income gap can widen further. This condition is relevant to the characteristics of Sulawesi's economy which is still supported by primary activities based on agriculture, plantations, livestock, forestry, and fisheries. Therefore, the quality of agricultural development is not only measured by the increase in output, but also by its ability to create a more even distribution of income. This view is in line with the findings of Khan et al. (2022) and Ndlovu et al. (2023) who affirm that the inclusive transformation of the agricultural sector plays an important role in reducing economic inequality and improving the welfare of rural communities.

The urgency of developing the agricultural sector in reducing income inequality is also increasingly important because this sector has a strong relationship with various other economic activities. Improving agricultural performance not only creates income for

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farmers, but also encourages the development of the trade, transportation, agricultural product processing, and various supporting services in rural areas. In the context of Sulawesi, equity-oriented agricultural development can be an effective instrument to reduce the gap between urban and rural areas and expand economic opportunities for low-income households. Phenomena in the field show that areas that have productive agricultural activities and are supported by a good marketing network tend to have a more even level of community welfare than areas where agriculture is still subsistence. This argument is supported by the results of research by Ogutu et al. (2021) and Rahman et al. (2024) which show that increased productivity and agricultural market integration contribute to reducing income inequality through expanding economic access for low-income groups.

The results of the simultaneous testing show that all sub-sectors that together shape the development performance of the agricultural sector have a significant influence on income inequality in the Sulawesi Region. These findings indicate that changes in the distribution of people's income cannot be explained by just one specific agricultural activity, but are the result of the interaction of various interrelated sub-sectors in the regional economic system. In practice, the development of food crops, plantations, livestock, agricultural services, forestry, and fisheries creates a chain effect on employment opportunities, household incomes, and local economic activities. Phenomena in the field show that regions that are able to develop various agricultural activities in an integrated manner tend to have better economic resilience than regions that depend on only one superior commodity. This condition is in line with the results of research by Mardones and del Río (2022) and Mzyece et al. (2023) who emphasized that integrated agricultural development is able to influence income distribution through increasing economic opportunities for various community groups.

The results of the determination coefficient show that the development performance of the agricultural sector is able to explain the variation in income inequality in the Sulawesi Region with an Adjusted R Square value of 0.810716. This value indicates that the agricultural sector is the dominant factor related to changes in the level of income inequality in the study area. However, there are still other factors outside the model that also determine the level of income equity, such as the quality of human resources, infrastructure conditions, access to financing, the development of the processing industry, and local government policies. In the field, differences in access to education and economic facilities between regions often cause the benefits of economic growth not to be enjoyed equally by the entire community. Therefore, agricultural development needs

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to be supported by cross-sectoral policies so that its impact on income equality is more optimal. These findings are in line with the research of Hidayat et al. (2024) and Binswanger-Mkhize and Savastano (2022) which emphasized that reducing inequality requires synergy between agricultural development and broader socio-economic development.

The food crop sub-sector has a positive and significant effect on income inequality in the Sulawesi Region. These findings indicate that improving the performance of food crops has not fully resulted in an equitable distribution of economic benefits among agricultural business actors. Phenomena in the field show that the benefits of increasing food crop production are often enjoyed more by farmers who have large land, access to modern technology, and better capital capabilities than small farmers. In addition, differences in access to production facilities, irrigation, and marketing networks can cause the results of food crop development to be concentrated in certain groups. This condition has the potential to increase the income gap even though in aggregate the food crop sector is growing. This result is in line with the research of Muyanga et al. (2022) which found that an increase in agricultural productivity is not always followed by income equity if there is a gap in productive asset ownership. Similar findings were also put forward by Nchare and Badmus (2024) who explained that the benefits of agricultural growth tend to be greater felt by groups of farmers who have stronger economic access.

The horticulture sub-sector has a negative influence on income inequality, but this influence is not significant. This condition indicates that the development of horticulture has the potential to support income equity, but its contribution is not strong enough to be the main factor in explaining changes in income inequality in the Sulawesi Region. Phenomena in the field show that horticultural businesses still face various obstacles, such as price fluctuations, limited post-harvest storage facilities, and dependence on relatively unstable market conditions. As a result, increasing horticultural production has not been able to consistently improve the welfare of farmers on a large scale. Despite this, horticulture still has good prospects because it generally involves more labor-intensive and provides business opportunities for small-scale farming households. These findings are supported by research by Suroso et al. (2023) which shows that horticultural development can expand the economic opportunities of rural communities, as well as research by Adewuyi et al. (2021) which confirms that the contribution of horticulture to income equity is highly dependent on the efficiency of supply chains and market access owned by farmers.

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The plantation crop sub-sector has a positive and significant effect on income inequality in the Sulawesi Region. These findings indicate that the growth of plantation activities has not fully resulted in an equitable distribution of economic benefits to all business actors. In reality, most of the profits from export value plantation commodities are often more enjoyed by business actors who have a large land scale, access to large capital, and better connectivity to national and international markets. Meanwhile, smallholders often face limitations in access to financing, technology, and bargaining positions in the marketing chain. This condition causes an increase in plantation performance that can encourage economic growth without being followed by a balanced income distribution. This phenomenon is often found in areas that rely on superior plantation commodities as the engine of the regional economy. These findings are in line with the research of Krishna et al. (2023) which states that the expansion of plantation commodities has the potential to increase the gap if the distribution of productive assets is uneven. Similar results were also reported by Sari and Dharmawan (2022) who found that the development of commercial plantations often creates a difference in income levels between small-scale farmers and business actors with greater resources.

The livestock sub-sector has a negative and significant effect on income inequality in the Sulawesi Region. These findings show that the development of livestock is able to provide more inclusive economic benefits and reach a wider group of people. In the field, livestock businesses can be run relatively by households with a small business scale so that the opportunity for community participation becomes greater than some other agribusiness activities. In addition to serving as a primary source of income, livestock farms are also often a source of additional income and productive savings for rural households. Increasing livestock productivity can strengthen family economic resilience while expanding job opportunities in cultivation, processing, and marketing of livestock products. Therefore, the development of this sub-sector has the potential to improve the distribution of people's income. The findings are supported by research by Ahmed et al. (2024) which shows that the development of smallholder farms contributes to improving the welfare of low-income groups. In addition, research by Wahyuni et al. (2021) explains that livestock activities have a relatively strong equitable effect because they involve many rural households in the local economic value chain.

The agricultural and hunting services sub-sector has a negative and significant effect on income inequality in the Sulawesi Region. These findings indicate that increasing agricultural and hunting service activities is able to encourage a more equitable distribution of income in the community. Empirically, agricultural services have labor-

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intensive characteristics because they involve various activities such as land cultivation, planting, plant maintenance, harvesting, and services for the use of agricultural tools and machinery. The existence of these various types of services opens up job opportunities for people who do not own agricultural land so that economic benefits can be felt by a wider group. Phenomena in the field show that the development of agricultural services often increases the income of rural workers while strengthening economic relations between agricultural business actors. Thus, improving the performance of this sub-sector can be an important instrument in encouraging inclusivity in agricultural development. The findings are in line with the results of research by Mottaleb et al. (2022) which affirmed that access to modern agricultural services contributes to improving the welfare of rural farmers and workers. In addition, research by Prasetyo and Supriyati (2024) shows that the development of agricultural services is able to expand economic opportunities and improve income distribution in agrarian-based areas.

The forestry and logging sub-sectors have a negative and significant effect on income inequality in the Sulawesi Region. These findings show that improving the performance of the forestry sub-sector has the potential to provide relatively equitable economic benefits to communities, especially for groups living around forest areas. In practice, forestry activities are not only related to the use of timber products, but also include various other forest products that can be a source of income for local communities. In various regions of Sulawesi, the use of sustainably managed forest products is often an alternative livelihood that can improve the welfare of rural households. In addition, the social forestry program that has developed in recent years has also opened up wider economic access for communities around the forest. This condition causes the economic benefits of the forestry sector to reach low-income groups, thus contributing to reducing inequality. These results are consistent with the research of Gritten et al. (2022) which explains that community-based forest management is able to increase the equitable distribution of economic benefits. Similar findings were also presented by Maryudi et al. (2023) which showed that community access to forestry resources plays an important role in strengthening welfare and reducing economic disparities in rural areas.

The fisheries sub-sector has a positive and significant effect on income inequality in the Sulawesi Region. These findings indicate that improving fisheries performance has not been fully followed by an equitable distribution of economic benefits among fishery business actors. Phenomena on the ground show that the profits obtained from fishing activities are often greater enjoyed by business actors who have more modern fishing

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fleets, strong capital, access to technology, and extensive marketing networks. On the other hand, small-scale fishermen generally still face limited production facilities, dependence on middlemen, and high business risks due to weather conditions and price fluctuations. As a result, the growth of the fisheries sector has the potential to increase income disparities between groups of business actors. This condition is quite relevant to the characteristics of the Sulawesi region which has the potential for large marine resources but has not been fully balanced by equal economic access for all coastal communities. These findings are in line with research by Belton et al. (2021) which explains that modernization of the fisheries sector can increase disparities if access to capital and technology is uneven. In addition, research by Purcell et al. (2023) shows that inequality in asset ownership and market access are the main factors that cause the benefits of fisheries development to not be distributed in a balanced manner.

The relationship between agricultural sector development and income inequality in the Sulawesi Region is complex because each sub-sector shows different influence characteristics. This condition shows that the success of agricultural development is not only determined by increased production and economic growth, but also by the ability to create a more inclusive distribution of benefits for all levels of society. Phenomena in the field show that sub-sectors that have broad involvement of rural households tend to have a better impact on income equality than sub-sectors whose economic benefits are concentrated in certain groups. Therefore, the direction of agricultural development in the future needs to place the aspect of inclusivity as an important part of the regional development strategy. This approach is in line with the views of Barrett et al. (2022) who emphasize the importance of agricultural development that favors vulnerable groups to achieve quality growth. Furthermore, the results of Kurniawan and Widyastuti (2025) research also emphasized that the integration of agricultural policies, community empowerment, and strengthening economic access are important factors in realizing more equitable and sustainable development.

CONCLUSION AND RECOMMENDATIONS

Based on the results of the study, it can be concluded that the simultaneous development performance of the agricultural sector has a significant effect on income inequality (Gini Ratio) in the Sulawesi Region. In addition, the variables of the agricultural sector were able to explain the variation in income inequality of 81.0716%, while the rest was influenced by other factors outside the model. Partially, the sub-sectors of food crops, plantation crops, and fisheries have a positive and significant effect on the Gini Ratio,

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which shows that improved performance in these sub-sectors tends to increase income inequality. In contrast, the sub-sectors of livestock, agricultural and hunting services, and forestry and logging have a negative and significant effect on the Gini Ratio, thereby contributing to reducing income inequality and promoting economic equity. Meanwhile, the horticulture sub-sector has a negative but not significant effect, so its role in reducing income inequality is still relatively limited. Thus, the development of the agricultural sector has a strategic role in influencing the level of income equality in the Sulawesi Region.

Based on the conclusions of the study, local governments in the Sulawesi Region need to direct agricultural development policies to sub-sectors that have been proven to be able to reduce income inequality, namely livestock, agricultural services and hunting, as well as forestry and logging through increased investment, access to capital, technology, and strengthening the capacity of business actors. On the other hand, the development of the sub-sectors of food crops, plantations, and fisheries needs to be accompanied by an equitable distribution strategy of economic benefits, such as strengthening the institutions of farmers and fishermen, distributing more equitable access to production, and increasing added value through downstreaming. In addition, the government needs to strengthen synergy with other supporting factors, such as education, infrastructure, and job creation, so that efforts to reduce income inequality can run more effectively and sustainably in the Sulawesi Region.

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