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The Role of Clove Plantations in West Seram's Economy and Employment

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ABSTRACT

This study examines the effects of clove plantation area and production on gross regional domestic product (GRDP) and employment absorption in West Seram Regency, Indonesia. Annual secondary time-series data for 2003-2017 were obtained from Statistics Indonesia and include plantation area, production, GRDP at 2010 constant prices, and employment. Two multiple linear regression models were estimated using ordinary least squares. In the GRDP model, plantation area is statistically insignificant, while production has a positive and significant coefficient. The variables are jointly significant and the model yields $R^2 = 0.925375$. In the employment model, plantation area remains insignificant, whereas production is positive and significant; the model yields $R^2 = 0.516268$ and a significant F-test. The findings indicate that production growth is more consistently associated with regional output and employment than land expansion. However, possible positive serial correlation in the employment model warrants cautious interpretation and further robustness testing.

Keywords: *Clove, GRDP, employment absorption, multiple linear regression, West Seram Regency*

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1. Introduction

Plantation agriculture is an important economic activity in West Seram Regency, with cloves representing one of its key estate crops. The region's geographical conditions and land availability support clove cultivation and connect the commodity to production, processing, trade, and employment activities. The study data indicate that in 2017 the clove plantation area reached 407,479 ha and production amounted to 1,489,019 tons. In the same year, gross regional domestic product (GRDP) at 2010 constant prices reached IDR 22,996,276.91 million [1], [2].

From a theoretical perspective, the development of the plantation subsector can stimulate the regional economy by increasing production value and income, generating value added, and creating demand for labor. GRDP is commonly used to represent the value added generated by economic units within a region over a given period [3]. From the labor-market perspective, employment absorption reflects the number of working-age people engaged in economic activities in response to labor demand [4], [5].

Expansion of cultivated area and growth in production do not necessarily generate identical economic effects. A larger cultivated area may raise potential production capacity, but its effect on GRDP and employment depends on productivity, technology, ownership structure, investment, and the stage of crop development. In perennial crops such as cloves, production is also influenced by plant age, maintenance practices, input quality, and harvesting performance;

therefore, a large plantation area does not automatically translate into high output [6]. Empirical testing is consequently required to distinguish the effects of plantation area and realized production on regional economic performance.

Over 2003-2017, the main indicators followed markedly different trajectories. Plantation area increased from 338,661 ha to 407,479 ha, or by approximately 20.3%, whereas production rose from 412,627 tons to 1,489,019 tons, equivalent to about 260.9%. During the same period, GRDP increased by approximately 124.1%, while employment rose by only about 7.4%. These divergent patterns suggest that output growth was considerably faster than growth in cultivated area and labor absorption.

Against this background, this study aims to examine: (1) the effects of clove plantation area and production on GRDP in West Seram Regency; and (2) the effects of clove plantation area and production on employment absorption in West Seram Regency.

2. Theoretical Background and Hypothesis Development

2.1. Clove Plantations and the Regional Economy

Economic growth reflects an increase in an economy's capacity to produce goods and services. In the context of regional development, effective management of local resources is essential because expanding economic potential can increase value added and improve community welfare [7]. Plantation agriculture is part of the broader agricultural sector and contributes raw materials, household income, employment opportunities, and linkages to downstream economic activities.

Clove cultivation generates marketable agricultural output and may also support downstream processing industries. Its productivity is influenced by plant age, plantation management, input quality, climatic conditions, and technology. Higher production can increase the value of plantation output and stimulate processing and trading activities, thereby contributing to regional value added. By contrast, land expansion without adequate productivity does not necessarily increase value added proportionally. National plantation statistics also classify cloves as an economically important estate crop within Indonesia's plantation structure [8].

From a regional-economy perspective, clove plantations can affect local economic performance through several channels. First, cultivation generates primary agricultural output that contributes directly to agricultural value added. Second, plantation output becomes an input for processing, trade, transport, and supporting services. Third, income earned by farmers and workers can stimulate household consumption and create multiplier effects in the local economy. Consequently, plantation performance is shaped not only by the size of the cultivated area but also by productivity, management quality, marketing efficiency, and downstream linkages. Comparative evidence from Indonesia's plantation sector further shows that crop expansion is closely related to land-use dynamics, public policy, and local socioeconomic conditions [9].

Land expansion and production growth have different economic meanings. Plantation area represents physical capacity and the availability of land resources, whereas production represents realized output. A large cultivated area may generate limited value added when plants are immature, productivity is low, or post-harvest losses are substantial. Conversely, production can rise through productivity improvements without continuous land expansion. This distinction is important because a development strategy focused primarily on expanding land may entail higher investment and environmental costs than a strategy that raises productivity on existing plantations [10].

2.2. Gross Regional Domestic Product

GRDP measures the value added generated by all production units within a region. It can be estimated using the production, income, or expenditure approach [11]. This study uses GRDP at 2010 constant prices so that observed changes more closely represent changes in real economic activity rather than changes in prices.

The theoretical link between plantation activity and GRDP operates mainly through value-added creation. Constant-price GRDP captures changes in the volume of economic activity after the effects of price changes are controlled. A genuine increase in clove production may therefore raise agricultural value added and related economic activity, provided that higher output is followed by marketing and processing activities. In regional economic analysis, constant-price GRDP is also more suitable for tracking real changes over time than current-price GRDP [12].

From a regional policy perspective, the contribution of the plantation subsector to GRDP also depends on intersectoral linkages. Plantation activity requires production inputs, transport, maintenance services, marketing, and

processing. The stronger these linkages are within the same region, the larger the share of value added that can remain in the local economy. Conversely, when most inputs, services, and processing activities are sourced from outside the region, an increase in primary production may translate only partially into local value added. This framework explains why the effect of production on GRDP should be tested empirically rather than inferred solely from changes in cultivated area [13].

2.3. Employment Absorption

Labor comprises people who are able to perform work that produces goods and services, while employment absorption refers to the number of workers engaged in a particular economic activity. Labor-market literature also distinguishes the working-age population between the labor force and those outside the labor force, making labor-force participation and population structure relevant to employment analysis [14], [15]. In clove plantations, labor may be required for cultivation, maintenance, harvesting, transport, sorting, and processing. However, technological change and mechanization can cause output to increase without a proportional rise in employment.

Labor demand is derived from demand for output. When production increases and the production process requires more maintenance, harvesting, transport, sorting, and processing, demand for workers may also rise. Nevertheless, this relationship is not necessarily proportional because technology, mechanization, farm organization, worker productivity, wages, and ownership structures can alter the amount of labor required per unit of area or output [16].

Clove plantations may display different labor requirements across land preparation, immature-crop, mature-crop, harvesting, and processing stages. Maintenance and harvesting generally require recurring labor input, while some other activities can be replaced or assisted by machinery and specialized services. Accordingly, plantation area can be viewed as an indicator of potential employment capacity, whereas production is more closely related to the intensity of realized economic activity. This study therefore includes plantation area and production simultaneously to identify whether each variable has a distinct association with employment absorption [17], [18].

2.4. Previous Studies and Research Gap

Previous studies suggest that the economic effects of plantation development are not uniform across locations and institutional settings. Comparative evidence from Indonesia's oil-palm sector shows that smallholder livelihood gains depend on access to land, capital, institutions, and contractual arrangements [19], [20]. Household-level studies further report heterogeneous effects on consumption, welfare, nutrition, and livelihood outcomes [21], [22], while differences among smallholders influence both socioeconomic performance and the capacity to comply with production standards [23]. Other research emphasizes that economic benefits can coexist with ecological pressures and land-use trade-offs [24]. The studies cited in the source thesis also report links between plantation development, regional economic growth, and employment absorption [25]-[27]. Variations in empirical results may reflect differences in location, observation period, variable measurement, downstream industrial structure, and labor-market conditions.

The contribution of this study lies in examining two regional-development outcomes simultaneously - GRDP and employment absorption - using the same explanatory variables. This design makes it possible to assess whether plantation development is more strongly reflected in regional output or in employment creation. In addition, the 2003-2017 dataset covers a sufficiently long period to capture fluctuations in cultivated area, substantial production growth, and changes in employment absorption in West Seram Regency.

2.5. Hypothesis Development

Regional economic growth can be explained by the productive capacity of key economic sectors, particularly agriculture in regions where agricultural activities constitute an important source of local income. In the context of clove cultivation, an expansion of plantation area increases the availability of productive agricultural resources, while higher production reflects greater utilization of these resources and generates additional economic value through farm income, trade, transportation, processing, and other related activities. From the perspective of the agricultural-led growth theory, improvements in agricultural productivity and output can stimulate regional economic activity through income generation, market linkages, and multiplier effects. Therefore, variations in clove plantation area and

production are expected to contribute to changes in the Gross Regional Domestic Product (GRDP) of West Seram Regency. Accordingly, the following hypothesis is proposed:

H1: Clove plantation area and production significantly affect GRDP in West Seram Regency.

Agricultural expansion is also closely associated with regional employment creation because agricultural production requires labor for land preparation, planting, cultivation, harvesting, post-harvest activities, and distribution. An increase in clove plantation area may consequently expand the demand for agricultural labor, while higher production can intensify labor requirements throughout the production and value-chain processes. This relationship is consistent with the structural transformation perspective, which recognizes agriculture as an important source of employment and income, particularly in rural and resource-based economies. In addition, the development of an agricultural commodity can generate indirect employment through upstream inputs and downstream activities such as transportation, trading, and processing. Hence, greater clove plantation area and production are expected to increase employment absorption in West Seram Regency. Accordingly, the following hypothesis is proposed

H2: Clove plantation area and production significantly affect employment absorption in West Seram Regency.

3. Research Method

This study was conducted in West Seram Regency using a quantitative approach. The analysis uses annual secondary time-series data for 2003-2017, yielding 15 observations. The data were obtained from Statistics Indonesia (BPS) and relevant regional statistical publications. The independent variables are clove plantation area (X_1, hectares) and clove production (X_2, tons). The first dependent variable is GRDP at 2010 constant prices (Y_1, IDR million), while the second dependent variable is employment absorption (Y_2, persons).

Data were collected through documentation of official statistical publications and related reports. The empirical analysis employs multiple linear regression estimated by ordinary least squares (OLS). Two regression equations are specified as follows:

$$Y_1 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon \quad (1)$$

$$Y_2 = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \varepsilon \quad (2)$$

Partial significance is assessed using t-tests at the 5% significance level, while joint significance is evaluated using the F-test. The coefficient of determination (R^2) is used to measure the proportion of variation in the dependent variable explained by the independent variables. Diagnostic tests include multicollinearity using the variance inflation factor (VIF), heteroskedasticity using the Breusch-Pagan-Godfrey test, residual normality using the Jarque-Bera test, and autocorrelation using the Durbin-Watson statistic.

3.1. Operational Definition of Variables

The study comprises two independent and two dependent variables estimated in two separate regression equations. Clove plantation area (X_1) is measured in hectares and represents the total cultivated clove area in West Seram Regency. Clove production (X_2) is measured in tons per year. GRDP (Y_1) is measured at 2010 constant prices in IDR million to represent real changes in regional economic activity. Employment absorption (Y_2) is measured as the number of workers covered by the study data.

Table 1. Operational definitions of research variables

Variable	Symbol	Operational definition	Unit	Source
Plantation area	X_1	Total clove plantation area in West Seram Regency	Hectares	BPS Maluku
Production	X_2	Annual clove plantation production	Tons	BPS Maluku
GRDP	Y_1	West Seram Regency GRDP at 2010 constant prices	IDR million	BPS West Seram
Employment	Y_2	Number of workers absorbed in the study data	Persons	BPS/relevant agencies

Source: *Compiled from variable definitions and data sources* .

3.2. Model Specification and Analytical Procedure

The equations are estimated using ordinary least squares (OLS). The first model specifies GRDP as the dependent variable, whereas the second model specifies employment absorption as the dependent variable. In each equation, the coefficient on plantation area captures the average change in the dependent variable associated with a one-hectare increase in cultivated area, holding production constant. The coefficient on production captures the average change in the dependent variable associated with a one-ton increase in production, holding plantation area constant. Coefficients are interpreted with explicit attention to their measurement units and statistical significance.

The analysis begins by examining the time-series development of the variables and then estimating the two regression equations. The t-test evaluates the partial significance of each regression coefficient at the 5% level. The F-test assesses whether the independent variables jointly explain variation in the dependent variable. R^2 measures the model's explanatory power; however, a high R^2 by itself does not establish a causal relationship.

Diagnostic testing covers multicollinearity, heteroskedasticity, residual normality, and autocorrelation. Multicollinearity is assessed using centered VIF values, with values well below 10 interpreted as evidence against severe multicollinearity. Heteroskedasticity is examined using the Breusch-Pagan-Godfrey test; a probability above 0.05 indicates insufficient evidence to reject homoskedasticity. Residual normality is evaluated using the Jarque-Bera probability. Autocorrelation is examined using the Durbin-Watson statistic, which is particularly relevant because the dataset is a time series.

The study uses only 15 annual observations, and this relatively small sample should be considered when interpreting the strength of the statistical tests. The models are intentionally parsimonious in order to evaluate the direct associations of two plantation indicators with GRDP and employment. Other potentially relevant factors - including clove prices, investment, wages, technology, crop age, the number of firms, and processing capacity - are excluded because consistent data are not available for the entire period. The estimated coefficients should therefore be interpreted as conditional associations within the specified models rather than as fully identified causal effects.

4. Results and Discussion

4.1. Development of the Research Variables

Before discussing the regression results, it is useful to examine the development of all variables over 2003-2017 because their time-series patterns provide important context for the estimates. Plantation area fluctuated considerably in the early part of the period. It declined from 338,661 ha in 2003 to 203,217 ha in 2005, then increased to approximately 423,000 ha in 2013 and remained relatively stable through 2016 before falling to 407,479 ha in 2017. This pattern differs from production, which increased strongly over the longer term.

Table 2. Plantation area, production, GRDP, and employment, 2003-2017

Year	Plantation area (ha)	Production (tons)	GRDP, 2010 constant prices (IDR million)	Employment (persons)
2003	338,661	412,627	10263241.45	50,162
2004	259,626	536,415	10990566.21	43,705
2005	203,217	447,227	11744878.43	33,700
2006	253,757	787,528	12552021.53	42,082
2007	275,609	907,424	13370677.54	45,705
2008	259,798	871,111	14279904.81	43,084
2009	320,281	916,084	15208390.66	49,114
2010	422,743	989,041	15930239.18	70,064
2011	413,933	1,036,646	17026716.57	70,316
2012	414,352	1,075,505	18069053.50	70,064
2013	423,545	1,172,003	19150561.51	67,175
2014	422,850	1,173,743	20396303.11	69,225
2015	422,861	1,538,092	20800664.35	69,235
2016	422,985	1,556,595	21785244.96	69,359
2017	407,479	1,489,019	22996276.91	53,850

Source: *Statistics Indonesia (BPS), Maluku Province and West Seram Regency*

Production increased from 412,627 tons in 2003 to 1,489,019 tons in 2017, reaching a period peak of 1,556,595 tons in 2016. Cumulatively, production growth was substantially greater than the growth of plantation area. This difference suggests that output growth may have been related not only to land expansion but also to changes in crop maturity, productivity, maintenance intensity, and management practices. The pattern supports the decision to include plantation area and production as separate explanatory variables.

GRDP at 2010 constant prices increased consistently from IDR 10,263,241.45 million in 2003 to IDR 22,996,276.91 million in 2017. Employment absorption, by contrast, fluctuated. The number of workers declined early in the period, rose sharply during 2010-2012 to around 70,000 persons, and then fell to 53,850 persons in 2017. These different trajectories indicate that regional output growth did not translate one-for-one into employment growth. Labor productivity, technological change, organizational restructuring, and firm-level conditions may allow output to expand without employment increasing at the same pace.

The 2015-2016 period is particularly noteworthy because production rose sharply while plantation area remained almost unchanged. Production increased from 1,173,743 tons in 2014 to 1,538,092 tons in 2015 and 1,556,595 tons in 2016, while the cultivated area remained at approximately 422,000-423,000 ha. Descriptively, this reinforces the argument that land area is not the sole determinant of output. From a policy perspective, productivity gains on existing plantations may be more efficient than further land expansion when output can be increased through crop renewal, improved planting material, better maintenance, and more efficient harvesting and post-harvest management.

4.2. Effects of Clove Plantations on GRDP

The GRDP model exhibits strong explanatory power. An R^2 of 0.925375 indicates that approximately 92.54% of the observed variation in GRDP is explained by plantation area and clove production within the model, while the remainder is associated with factors not included in the specification. The F-test yields a probability of 0.000000, indicating that plantation area and production are jointly significant in explaining GRDP.

Table 3. Regression results for plantation area and production on GRDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	6,046,254	1,138,940	5.308667	0.0002
Plantation area (X_1)	-3.002235	3.262121	-0.920332	0.3755
Production (X_2)	11.31726	0.995556	11.36778	0.0000

Source: Author's calculations based on the study data SPSS 22.

Individually, the plantation-area coefficient is -3.002235 with $p = 0.3755$, indicating no statistically significant relationship with GRDP. Because the coefficient is not significant, its negative sign should not be interpreted as evidence of a stable negative economic effect. The result suggests that land expansion alone is insufficient to raise regional value added; productivity, crop maturity, management quality, and processing capacity may be more important channels.

By contrast, the production coefficient is 11.31726 with $p < 0.001$, indicating a positive and statistically significant association with GRDP. With GRDP measured in IDR million, a one-ton increase in production is associated with an increase of approximately IDR 11.31726 million in GRDP, ceteris paribus. This finding is consistent with the argument that higher plantation output can expand the value of primary production and stimulate downstream economic activity.

Over 2003-2017, clove production increased much faster than plantation area. Production rose by more than two and a half times, whereas plantation area increased by only about one-fifth. This pattern suggests that changes in productivity and production intensity may have played an important role. Accordingly, policies aimed at raising production through crop renewal, good agricultural practices, stronger supply chains, and more efficient processing may be more effective than strategies centered solely on land expansion.

4.3. Effects of Clove Plantations on Employment Absorption

The employment model produces an R^2 of 0.516268, meaning that approximately 51.63% of the variation in employment absorption is explained by plantation area and clove production. The reported regression output gives a Prob(F-statistic) of 0.012812, indicating that the model is jointly significant at the 5% level. This value should be distinguished from R^2; the source thesis contains a narrative section that appears to report 0.516268 as the F-test probability. The present article follows the value reported in the regression output.

Table 4. Regression results for plantation area and production on employment absorption

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	26,632.20	9,277.695	2.870562	0.0141
Plantation area (X1)	0.023907	0.026573	0.899682	0.3860
Production (X2)	0.022182	0.008110	2.735217	0.0181

Source: Author's calculations based on the study data SPSS 22.

Plantation area has a coefficient of 0.023907 with p = 0.3860, indicating no statistically significant association with employment absorption. This outcome may arise when land expansion is accompanied by technology, mechanization, contractual labor arrangements, or management systems that do not require proportional increases in labor. Labor demand may also vary according to crop age and the stage of plantation operations.

Production has a coefficient of 0.022182 with p = 0.0181, indicating a positive and statistically significant association with employment absorption. In the model, an additional ton of production is associated with an increase of approximately 0.022182 workers, holding other factors constant. Substantively, higher output can increase labor requirements for harvesting, collection, transport, sorting, marketing, and processing.

Although the model is jointly significant, its R^2 is markedly lower than that of the GRDP model. This suggests that employment absorption is likely influenced by additional factors such as wages, investment, the number of firms or processing facilities, technology, crop-age structure, education, and local labor-market conditions. Moreover, the Durbin-Watson statistic of 0.870845 indicates possible positive serial correlation under conventional interpretation. The inferential results for the employment model should therefore be interpreted cautiously and re-examined using methods that correct for serial correlation.

4.4. Discussion of the GRDP Model

The GRDP model indicates that production has the strongest statistical relationship with regional output. The production coefficient of 11.31726 and a probability of 0.0000 imply a positive and statistically significant association at the 5% level. Given that GRDP is measured in IDR million, an additional ton of production is associated with approximately IDR 11.31726 million higher GRDP, holding plantation area constant. The magnitude should be interpreted in the context of the aggregate annual data: the coefficient does not represent direct farmer income, but rather the conditional change in regional output associated with production in the regression model.

The insignificant effect of plantation area on GRDP has an important policy implication. Physical land expansion does not automatically generate additional economic value when it is not accompanied by higher productivity and realized production. Some plantation areas may contain immature or aging crops, face low yields, or require additional investment before generating substantial output. The evidence therefore provides stronger support for policies emphasizing intensification, crop renewal, productivity, and downstream processing than for policies that rely primarily on land expansion.

The R^2 of 0.925375 indicates that plantation area and production together explain approximately 92.54% of the variation in GRDP within the sample. This high value, however, does not imply that clove plantations causally determine 92.54% of the regional economy. GRDP aggregates all sectors of economic activity and also exhibits a strong time trend. Given the small time-series sample, the possibility of common trends should be considered. The most defensible interpretation is that plantation indicators - particularly production - are strongly associated with changes in GRDP over the study period.

4.5. Discussion of the Employment Model

In the employment model, production also has a positive and statistically significant coefficient. The coefficient of 0.022182 with p = 0.0181 indicates that higher production is associated with greater employment after controlling for plantation area. This relationship is economically plausible because larger harvest volumes can increase labor requirements for harvesting, collection, transport, administration, marketing, and processing. Nevertheless, labor requirements per unit of output may decline over time as productivity, organization, and technology improve.

Plantation area has a positive coefficient of 0.023907 but is not statistically significant at the 5% level. This result reinforces the point that hectares of land do not necessarily translate directly into jobs. Plantations of identical size can employ different numbers of workers because of crop age, topography, management systems, mechanization, outsourcing, and maintenance intensity. Employment creation is therefore more likely to arise when plantation

development generates additional production activity rather than merely increasing the administratively recorded land area.

The employment model has an R^2 of 0.516268, substantially below that of the GRDP model. Thus, almost half of the variation in employment is associated with factors outside plantation area and production. Wage levels, migration, education and skills, the number of firms, investment in processing, commodity-market conditions, labor regulations, and technological change may affect labor-use decisions [28]. The more moderate R^2 highlights the importance of viewing plantation development as part of a broader regional labor-market system.

4.6. Diagnostic Tests and Model Consistency

Table 6. Summary of diagnostic tests

Test	GRDP model	Employment model	Interpretation
Centered VIF, X_1/X_2	1.229445	1.229445	No evidence of severe multicollinearity
Breusch-Pagan, Prob. Chi-square	0.4755	0.1536	No evidence of heteroskedasticity
Jarque-Bera probability	0.575166	0.659561	Residuals are consistent with normality at $\alpha = 5\%$
Durbin-Watson	1.409571	0.870845	GRDP: inconclusive range; employment: possible positive autocorrelation

Source: Author's calculations based on the study data SPSS 22.

The centered VIF of 1.229445 in both models is well below 10, indicating no evidence of severe multicollinearity. The Breusch-Pagan-Godfrey probabilities are also above 0.05, providing no evidence of heteroskedasticity at the 5% level. The Jarque-Bera probabilities of 0.575166 and 0.659561 exceed 0.05, so the residuals are consistent with normality at the 5% level. A narrative statement in the source thesis that interpreted these probabilities as evidence of non-normal residuals is corrected in the present article.

4.7. Economic and Policy Implications

Overall, production shows a more consistent relationship with regional economic outcomes than plantation area in both the GRDP and employment models. The first implication is that regional plantation policy should prioritize productivity improvement. Agricultural development fundamentally seeks to enhance productivity and the sector's capacity to generate income and employment [29]. Relevant measures include crop renewal, improved planting material, appropriate fertilization, pest and disease management, farm-road improvement, extension services, and stronger farmer capacity. A productivity-oriented strategy is also consistent with the finding that plantation area is not statistically significant in either model.

The second implication concerns downstream development. Increases in primary production are more likely to generate substantial local economic effects when processing, transport, technical services, and trading activities are developed within West Seram Regency. Stronger processing industries and supply-chain integration can retain a larger share of value added within the region and create a wider range of jobs than cultivation alone. Regional policy can strengthen linkages among farmers, cooperatives, private firms, processors, and service providers so that production growth generates broader multiplier effects.

The third implication is the need to improve workforce quality. The positive association between production and employment indicates that output growth remains relevant to local job creation, but required skills may change as production becomes more efficient. Training in harvesting, occupational safety, equipment maintenance, production administration, quality control, post-harvest handling, and processing can help local workers participate in higher-value activities. Employment policy should therefore consider job quality, productivity, and income sustainability in addition to the number of workers employed.

The fourth implication is the need to balance economic benefits with environmental sustainability. Plantation expansion can generate social and environmental costs when governance is weak. Because plantation area is not statistically significant in either model, the results provide an additional rationale for prioritizing productivity gains on existing land. Stronger licensing governance, fire prevention, protection of high-conservation-value areas, and effective

land-conflict resolution remain important so that economic gains are not accompanied by rising environmental and social costs. Decentralization and intergovernmental fiscal arrangements also place regional governments in an important position to manage local economic resources responsibly.

4.8. Research Limitations

This study has several limitations. First, the sample contains only 15 annual observations, resulting in relatively few degrees of freedom. Second, the models include only two main explanatory variables and therefore do not capture all determinants of GRDP and employment. Third, the time-series data indicate possible autocorrelation, particularly in the employment model, requiring caution in coefficient inference. Fourth, the analysis uses aggregate regency-level data and cannot distinguish between smallholder plantations, large private estates, and other organizational forms.

Future research should extend the observation period, use more recent data, and incorporate variables such as clove prices, yield per hectare, crop age, investment, wages, the number of firms, processing capacity, and relevant policy variables. Time-series properties such as stationarity and cointegration should also be examined to reduce the risk of spurious regression. Where data are available, panel analysis across districts or regencies could increase the number of observations while capturing spatial heterogeneity.

5. Conclusion

The results show that clove production is the variable most consistently associated with economic performance in West Seram Regency. In the GRDP model, production has a positive and statistically significant coefficient, whereas plantation area is not significant. Jointly, plantation area and production explain approximately 92.54% of the variation in GRDP. In the employment model, production is also positive and significant while plantation area remains insignificant; the model is jointly significant and explains approximately 51.63% of the variation in employment absorption.

These findings indicate that clove-development policy should not focus exclusively on land expansion. Higher productivity and value added through crop renewal, appropriate technology, improved plantation management, more efficient harvesting and post-harvest practices, and stronger downstream industries are likely to generate stronger economic effects. Controlling land expansion is also important for reducing environmental risks and land-use conflicts.

For employment policy, production growth should be linked to skills development so that local workers can participate in both cultivation and higher-value processing activities. Future studies should include investment, trade, wages, technology, the number of processing firms, crop-age structure, and other relevant determinants. Because the employment model shows possible positive autocorrelation, subsequent research should also apply serial-correlation corrections or standard errors that are robust to serial dependence.

In summary, the evidence suggests that productivity- and value-added-oriented clove development is more relevant to regional economic performance than land expansion alone. Production is positively associated with both GRDP and employment absorption, whereas plantation area is not statistically significant in either model. Regional policy should therefore connect production growth with crop renewal, cultivation efficiency, downstream processing, workforce upgrading, and environmental governance. These conclusions apply to the study period and model specification; further research using longer datasets and stronger time-series methods remains necessary.

Author Contributions Statement

Abdul Malik Balami was responsible for conceptualization, data collection, methodology, formal analysis, interpretation of results, Rizki Fitriani Muin preparation of the original draft, and review and editing of the manuscript.

Conflict of Interest Statement

The author declares no financial, personal, professional, academic, or intellectual conflicts of interest that could have influenced this study.

Data Availability

The data supporting the findings of this study were obtained from publications of Statistics Indonesia (BPS), Maluku Province and West Seram Regency. Derived data used in the analysis are reported in the article and may be requested from the corresponding author upon reasonable request.

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