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THE EFFECT OF LAND AREA AND ROAD INFRASTRUCTURE ON RICE PRODUCTION IN INCREASING GROSS REGIONAL DOMESTIC INCOME (GRDP) IN CENTRAL JAVA PROVINCE

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Abstract

The purpose of this research is as one of the efforts to realize the Spatial Plan for the Province of Central Java in terms of the development of food-agriculture-based rural areas that require the support of adequate facilities and infrastructure, including support for the feasibility of road infrastructure, irrigation, and so on. This type of research is quantitative, that is, this research method is used to examine certain populations or samples, and gathering power using research instruments, data analysis is quantitative/statistical, with the aim of testing the hypotheses that have been set. The research results which state that land area has a significant effect on rice production is in line with several opinions which state that the agricultural production function can function properly if there are factors that influence production. There are several factors that affect production in agriculture, especially for rice commodities, one of which is the area of agricultural land. Based on the previous explanation, the following conclusions can be drawn. First, land area has a significant influence on rice production in Central Java Province. Second, road infrastructure has no significant influence on rice production in Central Java Province. Third, land area has no significant effect on Gross Regional Domestic Product (GRDP) in Central Java Province. Fourth, road infrastructure also does not have a significant effect on GRDP in Central Java Province. Fifth, rice production does not have a significant effect on GRDP in Central Java Province. Sixth, rice production does not have a significant effect as a mediator between land area and GRDP in Central Java Province. Seventh, rice production also does not have a significant influence as a mediator between road infrastructure and GRDP in Central Java Province.

Keywords: Land Area, Road Infrastructure, Rice Production, Gross Regional Domestic Product (GRDP)

INTRODUCTION

Development is a multidimensional process that includes changes to various fundamental aspects of social structure, community attitudes, and national institutions, while continuing to pursue accelerated economic growth, overcoming inequality and alleviating poverty (Todaro, 2012). The main goal of development is to improve people's welfare. This objective is in accordance with the fourth paragraph of the Preamble to the 1945 Constitution, which is to promote public welfare. Welfare is a condition of fulfilling the material, spiritual and social needs of the country's population so that they can live properly and be able to develop themselves, so that they can carry out their social and economic functions (BPS, 2018).

Economic growth is a quantitative measure that describes the development of an economy in one year compared to the previous year. These developments are always obtained in the form of a percentage change and national income in a certain year compared to the previous year (Sukirno, 2019). Economic growth can be used as an economic indicator of a country's economic performance. If the growth of a country is positive, it can be said that the general

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state of the economy is good. The economic growth component consists of leading productive economic sectors which are used as a measure (Dewantoro, 2019). A positive economic growth is influenced by economic movements in each respective region. In order to increase the Gross Regional Domestic Product (GRDP), one of the efforts is to carry out development in the agricultural sector. Agricultural development is essentially the optimal utilization of agricultural resources in order to achieve development goals. Agricultural development is directed at the development of advanced, efficient and resilient agriculture. Furthermore, agricultural development aims to increase yields and quality of production, increase income and standard of living of farmers, breeders and fishermen, expand employment and business opportunities, support industrial development and increase exports (Mubyarto, 2008).

Agricultural development, especially rice production, is a staple food source for the people of Indonesia. Rice production is influenced by various factors, one of which is land area. Land area is the main capital for agricultural development. This is because land is one of the conditions for the ongoing process of agricultural production. Land area is one of the factors of rice production because land is the place where the production process occurs and grows.

Land area is the area of rice fields that will be planted with rice plants in a certain season. The area of a rice field is land that stretches wide and is in the form of plots with sides bounded by bunds or boundaries to hold water, usually the rice fields are not important where the land comes from or the status of the land (BPS, 2016). Agricultural land is a determinant of the influence of agricultural commodities. In general it is said, the wider the land planted, the greater the amount of production produced by the land (Rahim, 2007). In addition to land area, infrastructure also has a vital role in the success of agricultural development. Infrastructure is a system of public facilities, which are fundamentally aimed at the public/popular audience to serve and facilitate the community (Hudson, et al., 2007). Infrastructure is a physical system that provides transportation, irrigation, drainage, buildings and other public facilities, which are needed to meet basic human needs, both social and economic needs. This definition refers to infrastructure as a system. Where the infrastructure in a system are parts in the form of facilities and infrastructure (network) that are inseparable from one another (Grigg, 2008).

The availability of sufficient infrastructure and optimal conditions will make it easier for farmers to get maximum results from agricultural land (Pasandaran, 2017). Infrastructure is very important for economies, communities and businesses to achieve sustainable environmental conditions (Beeferman and Wain, 2013). The renewal process in various fields of development has carried out fundamental changes in terms of patterns and development of infrastructure, reforms have been carried out thoroughly in the provision of infrastructure at sectoral and cross-sectoral levels (Regulation of the President of the Republic of Indonesia No. 42 of 2005). Many economic benefits are obtained from infrastructure, including income, accessibility, and employment during road construction, reduction of transportation costs, cost and time savings, and increased industrial productivity (Weiss and Figura, 2003 in Kim, 2006). Infrastructure development is needed in economic activities, including activities related to agricultural production. The importance of good infrastructure in agricultural development is widely recognized worldwide. The World Food Summit technical document (FAO-UN, 2016)

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states that roads, electricity supply, telecommunications and other infrastructure services in agricultural areas are key in stimulating investment and agricultural growth.

Road infrastructure is one of the important infrastructures in the development of the economy and welfare of the people in a region. Because the existence of road infrastructure can facilitate the mobility of goods and people from one area to another. The availability of other infrastructure such as electricity, clean water and telecommunications can also improve the economy and welfare of the people of a region. Clean water and electricity infrastructure can influence directly or indirectly to increase household and industrial production in order to maximize the output produced (Winanda, 2016). The results of empirical studies show the influence of land area and agricultural infrastructure on agricultural production both in general and agricultural production in the form of rice commodities. Land area has a positive and significant effect on rice production (Andrias et al, 2017), agricultural land area has a positive and significant effect on rice production (Harini et al, 2019) and paddy field area has a positive and significant effect on rice production (Manggala and Boedi, 2018). Moreover, infrastructure development plays a role in explaining increased agricultural production and changes in land use in Vietnam's Mekong Delta Region. Improvements to roads and waterways have the effect of reducing transportation costs in explaining increased land use intensity and production levels (Edmonds, 2008).

Road, irrigation and market infrastructure together have a positive and significant effect on added value in the agricultural sector, while partially road and irrigation infrastructure have a positive and significant effect on added value in the agricultural sector (Purwansyah, et al., 2013). Road infrastructure has a positive but not significant effect on the agricultural sector, while the irrigation variable shows positive and significant results for the agricultural sector in Sumatra (Subroto, et al., 2016). The use of irrigation contributes significantly to increasing rice yields (Nonvide, 2017).

Rural infrastructure development in moderate conditions has an impact on moderate levels of rice productivity and rural infrastructure development with good conditions has an impact on high levels of rice productivity. Rural infrastructure has a significant positive impact on the productivity of rice cultivation land (Nayak, 2018). Rural infrastructure has a direct impact on rice productivity by providing viable options for rice production, milling, marketing and distribution (Tanko and Cheah, 2019).

Meanwhile, in relation to the Gross Regional Domestic Product (GRDP), the results of Witjaksono's research (2021) state that road infrastructure and land area each have a significant positive effect on rice production and rice production and Gross Regional Domestic Product (GDP). Furthermore, the results of this study found that rice production was able to mediate the respective effects of road infrastructure and land area on the Gross Regional Domestic Product (GRDP). The growth rate of Gross Regional Domestic Product (GRDP) in Central Java Province is a reflection of the ability to utilize the resources they have. Information on development results that have been achieved can be used as material for development planning. One of the indicators used refers to the results of regional income analysis. Based on the Gross Regional Domestic Product (GRDP) it can be seen the growth and development of the regional

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economy. Regional economic growth and development is determined by the potential sectors owned by the region. The output of the agricultural sector is the product of agricultural goods and services produced during a year, which is the national income from the agricultural sector. The output of the agricultural sector is the efficiency of existing resources in the economy (labor, capital goods, money, and entrepreneurial skills) used to produce goods and services in the agricultural sector. The greater the national income or GRDP, the more efficient the allocation of economic resources. As one of the efforts to realize the Spatial Plan for the Province of Central Java in terms of developing food-agriculture-based rural areas, it requires the support of adequate facilities and infrastructure, including support for the feasibility of road infrastructure, irrigation, and so on. The fact shows that the development of rural agriculture in Central Java Province is not without problems, one of which is the existence of agricultural infrastructure in rural areas which is suspected to still not support agricultural production. These infrastructures include the availability of markets, transportation facilities and feasibility of village roads, irrigation development, and so on.

METHOD

This type of research is quantitative, that is, this research method is used to examine certain populations or samples, and gathering power using research instruments, data analysis is quantitative/statistical in nature, with the aim of testing established hypotheses (Sugiyono, 2016). Quantitative data is in the form of numbers or numerical information and is usually associated with statistical analyses. The techniques used for data collection in this study are documentation and literature study Based on the level of explanation, this research is classified as associative research. Associative research is research that seeks the influence or relationship of two or more variables. This research was conducted to determine the effect of Land Area and Road Infrastructure on Rice Production and Gross Regional Domestic Product (GRDP) in Central Java Province in 2019 - 2021. This research is at the level of explanation, namely how the variables studied will explain the object under study through the collected data. All data obtained will be processed and processed with a quantitative analysis.

Strengthening the study results in this study was carried out through econometric analysis in the form of estimating the panel data model regression. The panel data referred to includes data on land area, length of road infrastructure, total rice production, and data on the Gross Regional Domestic Product (GRDP) of each district in Central Java Province for a period of 3 (three) years, namely in the period between 2019 - 2021. This research was carried out with a district area coverage of 35 (thirty five) districts in Central Java Province. The research was conducted between April - June 2022. The data used in this research is secondary data. Secondary data is data that has undergone processing and was previously available. The secondary data used in this study includes data on land area, data on the length of road infrastructure, data on the amount of rice production, and data on the Gross Regional Domestic Product (GDP) for each district in Central Java Province in 2019 – 2021. This secondary data source was obtained from Central Java provincial government agencies or agencies such as the Central Statistics Agency, Bappeda, and other related agencies.

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RESULTS AND DISCUSSION

This study combines cross sections (cross data) with time series (time series). In analyzing the data using panel data regression analysis method and then proceed with path analysis.

Results of the Analysis of the Sub-Structure Regression Model I

The sub-structural regression model I is intended to predict the effect of the independent variable Land Area (LogLAHAN) and Road Infrastructure (LogJALAN) on the dependent variable Rice Production (LogPADI). The sub-structural regression equation model I in this study was PADI = β0 + β1LAND + β2JALAN + ε1 which was then converted into a Logarithmic equation LogPADI = β0 + β1LogLAND + β2LogJALAN + ε1.

Test Results of the Sub-Structure Regression Model I

Determination of the best model of the regression equation for Sub Structure I was carried out by analyzing the panel data model through three models, namely the Common Effect (CE) model, Fixed Effect (FE) model, and Random Effect (RE) model.

a. Common Effects Model (CE)

The first step is to process the data using the Common Effects (CE) model approach. The processing results use the Eviews 9.0 program as shown in Table 5.2.

Table 5.2: Regression Results of Sub Structure I Common Effect Model (CE)

Dependent Variable: LOG (PADI)

Method: Panel Least Squares

Variables	coefficient	std. Error	t-Statistics	Prob.
C	1.660551	0.144070	11.52597	0.0000
LOG(LAND)	1.002093	0.010090	99.31498	0.0000
LOG(ROAD)	0.004888	0.032433	0.150699	0.8805
R-squared	0.996748	Mean dependent var		11.72389
Adjusted R-squared	0.996684	SD dependent var		1.939432
SE of regression	0.111686	Akaike info criterion		-1.518097
Sum squared residue	1.272322	Schwarz criterion		-1.442269
*Logs*likelihood	82.70008	Hannan-Quinn criter.		-1.487370
F-statistics	15629.35	Durbin-Watson stat		0.837995
Prob(F-statistic)	0.000000			

Source: Eviews 10 data processed, 2023.

b. Fixed Effects (FE) Model

The second step is data processing using the Fixed Effect (FE) model approach. The processing results use the Eviews 9.0 program as shown in the following table.

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Table 5.3: Regression Results of Sub Structure I Model Fixed Effect (FE)

Dependent Variable: LOG (PADI)				
Method: Panel Least Squares				
Variables	**coefficient**	**std. Error**	**t-Statistics**	**Prob.**
C	-1.811872	2.299496	-0.787943	0.4335
LOG(LAND)	1.263392	0.140677	8.980779	0.0000
LOG(ROAD)	0.133868	0.289944	0.461702	0.6458
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.999265	Mean dependent var	11.72389	
Adjusted R-squared	0.998876	SD dependent var	1.939432	
SE of regression	0.065011	Akaike info criterion	-2.358214	
Sum squared residue	0.287396	Schwarz criterion	-1.423009	
*Log*slikelihood	160.8062	Hannan-Quinn criter.	-1.979251	
F-statistics	2569.144	Durbin-Watson stat	3.605372	
Prob(F-statistic)	0.000000			

Source: Eviews 9 data processed, 2023.

c. Random Effects Model (RE)

The final step in processing panel data regression is carried out using the Random Effects (RE) model approach. The processing results from the Eviews 9.0 program obtained the results as in the following table.

Table 5.4: Regression Results of Sub Structure I Random Effect Model (RE)

Dependent Variable: LOG (PADI)
Method: Panel EGLS (Cross-section random effects) Total panel
(balanced) observations: 105
Swamy and Arora estimator of component variances

Variables	**coefficient**	**std. Error**	**t-Statistics**	**Prob.**
C	1.663999	0.221842	7.500824	0.0000
LOG(LAND)	1.003787	0.015515	64.69592	0.0000
LOG(ROAD)	0.001816	0.049751	0.036512	0.9709

Effects Specification

	SD	**Rho**
Random cross-sections	0.093187	0.6726
Idiosyncratic random	0.065011	0.3274

Weighted Statistics

R-squared	0.992047	Mean dependent var	4.380228
Adjusted R-squared	0.991891	SD dependent var	0.728211
SE of regression	0.065575	Sum squared residue	0.438612
F-statistics	6361652	Durbin-Watson stat	2.430121
Prob(F-statistic)	0.000000		
Unweighted Statistics			
R-squared	0.996746	Means dependent var	11.72389
Sum squared residue	1.272750	Durbin-Watson stat	0.837462

Source: Eviews 9 data processed, 2023.

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Results of the Selection Test for the Sub-Structure Regression Model I

The selection of the panel data regression model for Sub Structure I was carried out by the Chow test, Hausman test, and Lagrange Multiplier (LM) test. Each of these tests is intended to determine the most appropriate panel data regression model to be used to predict the effect of the independent variables Log(LAND) and Log(LAND) on the dependent variable Log(PADI). The following are the results of tests to determine the most appropriate type of panel data regression model in this study.

Chow test

Chow's test was used to make a choice between the panel data regression technique with the Fixed Effect (FE) method and the panel data model regression without dummy variables or the Common Effect (CE) method. Decision making is done by looking at the results of the statistical F test, namely by comparing the probability value with α (5%). If the probability value > α then H0 is accepted or the model used is the Common Effect model. If the probability value < α is rejected, it means that the right panel data regression model to use is Fixed Effect. However, if it is rejected, the Fixed Effect model must be tested again to choose whether to use the Fixed Effect or Random Effect model (Ghozali, 2013). The processing results of the Chow Test can be seen in the following table.

Table 5.5: Chow Test Results of Regression Model Sub Structure I

Redundant Fixed Effects Tests Equation: Untitled Test cross-section fixed effects			
Effect Test	**Statistics**	**df**	**Prob.**
Cross-section F	6.854126	(34,68)	0.0000
Chi-square cross-sections	156.212320	34	0.0000

Source: Eviews 9 data processed 2023.

Processing results The Chow test above shows that the probability value of the F test and Chi-square is significant (0.0000 <5%), which means that H0 is rejected and Ha is accepted. Thus it can be concluded that the Fixed Effects (FE) model is better than the Common Effects (CE) model in estimating the selection of panel data regression to measure the effect of Land Area (LogLAHAN) and Road Infrastructure (LogJALAN) on the dependent variable Rice Production (LogPADI) in the Province Central Java. The test will be continued with the Hausman Test to select panel data regression estimates between the Fixed Effect (FE) and Random Effect (RE) models.

Hausman test

The Hausman test is used to determine the choice of the best model between the Fixed Effect (FE) or Random Effect (RE) models. Decision making is done if the Hausman statistical value is greater than the critical value (5%) then rejecting the null hypothesis and the correct model is the Fixed Effect (FE) model. Conversely, when the Hausman value is less than the critical value, it fails to reject the null hypothesis and the right model is Random Effect (RE). The processing results of the Hausman Test are as shown in the following table.

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Table 5.6: Results of Hasuman Test Regression Model Sub Structure I

Correlated Random Effects - Hausman Test			
Equation: Untitled			
Test cross-section random effects			
Test Summary Chi-Sq.			
	Statistics	Chi-Sq. df	Prob.
Random cross-sections	3.778673	2	0.1512

Source: Eviews 9 data processed, 2023.

The test results show that the Prob. Random cross-section of 0.1512. This means rejecting the null hypothesis because the Hausman statistical value is greater than the critical value (5%). Thus it can be concluded that the Random Effects (CE) model is more appropriate than the Fixed Effects (FE) model. The results of the two model selection tests, namely the Chow Test and the Hausman Test, show that there are differences in the results, so the test is continued with the Lagrange Multiplier (LM) test as a determinant. The Lagrange Multiplier (LM) test was performed to make a comparison in determining the best regression model between the Random Effects (CE) and Common Effects (CE) models. The method used is the Breusch Pagan method with the criteria if the Breusch-Pagan probability value (P Value) is less than alpha (5%) then it accepts H1 which means the best estimation method is Random Effect (RE). Conversely, if the p value is greater than alpha (5%) then accept H0, which means that the best estimation method is Common Effect (CE). The results of the Lagrange Multiplier (LM) test can be seen in the following table.

Table 5.7. Results of Lagrange Multiplier Test for Regression Model Sub Structure I

Lagrange multiplier (LM) test for panel data Sample: 2019 2021

Total panel observations: 105 Probability in ()

Null (no rand. effect) Alternative	Cross-section One-sided	Period One-sided	Both
Breusch-Pagan	43.31461	0.151219	43.46583
	(0.0000)	(0.6974)	(0.0000)
Honda	6.581384	-0.388869	4.378769
	(0.0000)	(0.6513)	(0.0000)
King-Wu	6.581384	-0.388869	1.173334
	(0.0000)	(0.6513)	(0.1203)
GM	--	--	43.31461
	--	--	(0.0000)

Source: Eviews 9 data processed, 2023.

The output results above show the probability value of Breush-Pagan (BP) in the sub-cross section of 0.000. The hypothesis is that if the Breush-Pagan (BP) probability is smaller than Alpha (0.0000 <0.05) then H0 is rejected and H1 is accepted. Thus the correct regression model for the results above is the Random Effect (RE) model. On this basis, the best sub-structure I regression model for research is the Random Effect (RE) model.

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Results of Determination of Regression Model Sub Structure I

The best sub-structure I regression model for research is the Random Effect (RE) model.

Table 5.8. Results of Sub Structure Model I Selected Random Effect (FE)

Dependent Variable: LOG (PADI)
Method: Panel EGLS (Cross-section random effects) Sample: 2019 2021
Period included: 3
Cross-sections included: 35
Total panel (balanced) observations: 105
Swamy and Arora estimator of component variances

Variables	coefficient	std. Error	t-Statistics	Prob.
C	1.663999	0.221842	7.500824	0.0000
LOG(LAND)	1.003787	0.015515	64.69592	0.0000
LOG(ROAD)	0.001816	0.049751	0.036512	0.9709

Source: Eviews 9 data processed, 2023.

The multiple linear regression equation built from the selected model is as follows:

***LOGS*(RICE) = 1.663999 + 1.003787*LOG(LAND) + 0.001816*LOG(JALAN)**

The multiple linear regression equation above explains the following:

1) A constant of 1.663999 indicates that if there are no LAND and ROAD variables or the independent variable is zero, then rice production is 1.663999.
2) The regression coefficient of the variable Land Area (LOGLAND) is 1.003787. This means that every increase of one unit of land area will affect the increase in rice production by 1.003787 assuming the variable Road Infrastructure (LogJALAN) is constant (zero).
3) Regression coefficientvariable Road Infrastructure (LogJALAN) is 0.001816.

This means that every increase of one unit of Road Infrastructure will affect the increase in Rice Production by 0.001816 assuming the variable Land Area (LogLAHAN) is constant (zero).

Result of Feasibility Test of Regression Model of Sub Structure I

Testing the Sub Structure I regression model that has been carried out previously shows that the Random Effects (RE) model is the selected panel data regression model and at the same time meets the requirements of the classical assumption test. Furthermore, this sub-structural model I will undergo a feasibility test which is carried out using the F-test with the criteria if the probability value of the F-statistic is smaller than the 5% significance level, then reject H0 or the Random Effect (RE) model. The results of the F-test can be seen below.

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Table 5.9. Results of the F-test Regression Model Sub-Structure I

Weighted Statistics

R-squared	0.992047	Mean dependent var	4.380228
Adjusted R-squared	0.991891	SD dependent var	0.728211
SE of regression	0.065575	Sum squared residue	0.438612
F-statistics	6361652	Durbin-Watson stat	2.430121
Prob(F-statistic)	0.000000		

Source: Eviews 9 data processed, 2023.

The feasibility test of the panel data regression model of the Sub Structure I model is reflected in the results of the F-test which shows that the probability value of the F-statistic is smaller than the significance level (0.0000 <0.05). This gives an understanding that rejecting H0 or the Random Effect (RE) model is quite feasible to use to measure the effect of Land Area and Road Infrastructure on Rice Production in Central Java Province.

Test Results for the Coefficient of Determination (R2) Regression Model Sub Structure I

The coefficient of determination (R square) in multiple linear regression analysis has meaning as the influence contribution given by the independent variable to the dependent variable. The coefficient of determination (R2) in this study is useful for predicting the contribution of the joint effect of Land Area (LAN) and Road Infrastructure (JALAN) variables to Rice Production (PADI) in Central Java Province. The results of calculating the Coefficient of Determination (R2) can be seen in Table 5.11.

Table 5.10: Test Results for the Coefficient of Determination (R2) Regression Model Sub Structure I

Weighted Statistics

R-squared	0.992047	Mean dependent var	4.380228
Adjusted R-squared	0.991891	SD dependent var	0.728211
SE of regression	0.065575	Sum squared residue	0.438612
F-statistics	6361652	Durbin-Watson stat	2.430121
Prob(F-statistic)	0.000000		

Source: Eviews 9 data processed, 2023.

The results of calculating the Coefficient of Determination (R2) as shown in the table above shows that the value of R-squared (R2) is 0.992047 while the Adjusted R-squared is 0.991891. This gives an understanding that the contribution of the variable Land Area (LAHAN) and Road Infrastructure (JALAN) to Rice Production (PADI) in Central Java Province is 99.1%, while the remaining 0.9% is influenced by other variables not measured in this research model.

Results of Hypothesis Testing of the Sub-Structure Regression Model I

The hypothesis in this study states that there is an influence of each independent variable Land Area (LAHAN) and Road Infrastructure (JALAN) on Rice Production (PADI) in Central Java Province. Hypothesis testing is done by using the t-test with the criteria for decision making

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by comparing the probability value of t (prob.) with the level of significance (α = 5%). If the probability value t (prob.) is smaller than the level of significance (α) then each independent variable has a significant effect on the dependent variable. Conversely, if the probability value t (prob.) is greater than the level of significance (α) then each independent variable has no significant effect on the dependent variable. The results of testing the hypothesis with this t-test can then be seen in the following table.

Table 5.11. Hypothesis Test Results t-test Regression Model Sub Structure I

Dependent Variable: LOG(PADI)
Method: Panel EGLS (Cross-section random effects) Sample: 2019 2021
Period included: 3
Cross-sections included: 35
Total panel (balanced) observations: 105
Swamy and Arora estimator of component variances

Variables	coefficient	std. Error	t-Statistics	Prob.
C	1.663999	0.221842	7.500824	0.0000
LOG(LAND)	1.003787	0.015515	64.69592	0.0000
LOG(ROAD)	0.001816	0.049751	0.036512	0.9709

Source: Eviews 9 data processed, 2023.

The results of the t-test above show that the variable Land Area (LogLAHAN) has a t-Statistic value of 64.69592 with a probability of 0.0000. Meanwhile for the Road Infrastructure variable (LogJALAN) it has a t-Statistic value of 0.036512 with a probability of 0.9709. This gives an understanding that land area has a significant effect on rice production (0.0000 <0.05), while road infrastructure has no significant effect on rice production (0.9709 > 0.05) in Central Java Province.

Results of Analysis of the Sub-Structure Regression Model II

This sub-structure II regression model is intended to predict the effect of the independent variables Land Area (LAHAN), Road Infrastructure (JALAN), and Rice Production (PADI) on the dependent variable GRDP (GRDP). The second sub-structure regression equation model in this study is GRDP = β0 + β3LAND + β4JALAN + β5PADI + ε2. This equation is then converted into a logarithmic equation as follows: LogPDRB = β0 + β3LogLAND + β4LogJALAN + β5LogPADI + ε2

Test Results of the Sub-Structure Regression Model II

Determination of the best model of the Sub Structure II regression equation was first carried out by analyzing the panel data model through three models, namely, the Common Effect (CE) model, Fixed Effect (FE) model, and Random Effect (RE) model.

1. Common Effects Model (CE)

The first step is to process the data using the Common Effects (CE) model approach. The processing results use the Eviews 10 program as shown in the following table.

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Table 5.15. Regression Results of Sub Structure II Common Effect Model (CE)

Dependent Variable: LOG (PDRB) Method: Panel Least Squares

Variables	coefficient	std. Error	t-Statistics	Prob.
C	9.978850	0.984307	10.13794	0.0000
LOG(LAND)	-1.645697	0.449061	-3.664754	0.0004
LOG(ROAD)	0.847071	0.146048	5.799952	0.0000
LOG(PADDY)	1.517130	0.445823	3.402984	0.0010
R-squared	0.370603	Mean dependent var		16.91956
Adjusted R-squared	0.351908	SD dependent var		0.624659
SE of regression	0.502876	Akaike info criterion		1.500406
Sum squared residue	25.54135	Schwarz criterion		1.601509
*Logs*likelihood	-74.77132	Hannan-Quinn criter.		1.541375
F-statistics	19.82368	Durbin-Watson stat		0.095425
Prob(F-statistic)	0.000000			

Source: Eviews 10 data processed, 2023.

2. Fixed Effects (FE) Model

The second step is data processing using the Fixed Effect (FE) model approach. The processing results use the Eviews 9.0 program as shown in the following table.

Table 5.16. Regression Results of Sub Structure II Fixed Effect (FE) Model

Dependent Variable: LOG(PDRB)

Method: Panel Least Squares

Variables	coefficient	std. Error	t-Statistics	Prob.
C	16.73206	0.759323	22.03548	0.0000
LOG(LAND)	-0.034006	0.068372	-0.497374	0.6206
LOG(ROAD)	0.000988	0.095458	0.010353	0.9918
LOG(PADDY)	0.044468	0.039863	1.115527	0.2686
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.999246	Mean dependent var		16.91956
Adjusted R-squared	0.998830	SD dependent var		0.624659
SE of regression	0.021370	Akaike info criterion		-4.579105
Sum squared residue	0.030598	Schwarz criterion		-3.618624
*Logs*likelihood	278.4030	Hannan-Quinn criter.		-4.189899
F-statistics	2399,806	Durbin-Watson stat		3.188436
Prob(F-statistic)	0.000000			

Source: Eviews 10 data processed, 2023.

3. Random Effects Model (RE)

The final step in processing panel data regression is the Random Effects (RE) model approach. The processing results from the Eviews 9.0 program obtained the following results.

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Table 5.17. Regression Results of Sub Structure II Random Effect Model (RE)

Dependent Variable: LOG(GRDP)

Method: Panel EGLS (Cross-section random effects)

Swamy and Arora estimator of component variances

Variables	coefficient	std. Error	t-Statistics	Prob.
C	15.66029	0.553824	28.27668	0.0000
LOG(LAND)	-0.004958	0.056402	-0.087904	0.9301
LOG(ROAD)	0.126634	0.085546	1.480309	0.1419
LOG(PADDY)	0.039887	0.039244	1.016386	0.3119
Effects Specification				
	SD		Rho	
Random cross-sections	0.514261		0.9983	
Idiosyncratic random	0.021370		0.0017	
Weighted Statistics				
R-squared	0.055008	Mean dependent var	0.405814	
Adjusted R-squared	0.026939	SD dependent var	0.022914	
SE of regression	0.022603	Sum squared residue	0.051600	
F-statistics	1.959755	Durbin-Watson stat	1.912361	
Prob(F-statistic)	0.124830			
Unweighted Statistics				
R-squared	0.140615	Means dependent var	16.91956	
Sum squared residue	34.87443	Durbin-Watson stat	0.002830	

Source: Eviews 9 data processed, 2023.

Results of the Sub-Structure Regression Model Selection Test II

The selection of the sub-structure II panel data regression model was carried out by the Chow test, Hausman test, and Lagrange Multiplier (LM) test. Each of these tests is intended to determine the most appropriate panel data regression model to be used to predict the effect of the independent variables Land Area (LogLAHAN), Road Infrastructure (LogJALAN), and Rice Production (LogPADI) on the dependent variable GRDP (LogPDRB) in Java Province Middle. The following are the results of tests to determine the most appropriate type of panel data regression model in this study.

1. Chow test

Chow's test was usedto make a choice between the panel data regression technique with the Fixed Effect (FE) method and the panel data model regression without dummy variables or the Common Effect (CE) method. Decision making is done by looking at the results of the statistical F test, namely by comparing the probability value with α (5%). If the probability value > α then H0 is accepted or the model used is the Common Effect model. If the probability value < α is rejected, it means that the right panel data regression model to use is Fixed Effect. However, if it is rejected, the Fixed Effect model must be tested again to choose whether to use the Fixed Effect or Random Effect model (Ghozali, 2013). The processing results of the Chow Test can be seen in the following table.

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Table 5.18: Chow Test Results of Sub-Structure Regression Model II

Redundant Fixed Effects Tests Equation: Untitled Test cross-section fixed effects			
Effect Test	**Statistics**	**df**	**Prob.**
Cross-section F	1642.974024	(34,67)	0.0000
Chi-square cross-sections	706.348639	34	0.0000

Source: Eviews 9 data processed, 2023.

The processing results of the Chow test above show that the probability value of the F test and Chi-square is significant (0.0000 <5%), which means rejecting H0 and accepting Ha. Thus it can be concluded that the Fixed Effects (FE) model is better than the Common Effects (CE) model in estimating panel data regression selection to measure the effect of Land Area (LogLAHAN), Road Infrastructure (LogJALAN), and Rice Production (LogPADI) on the dependent variable GRDP (LogPDRB) in Central Java Province The test will be continued with the Hausman Test to select panel data regression estimates between Fixed Effect (FE) and Random Effect (RE) models.

2. Hausman test

The Hausman test is used to determine the choice of the best model between the Fixed Effect (FE) or Random Effect (RE) models. Decision making is done if the Hausman statistical value is greater than the critical value (5%) then rejecting the null hypothesis and the correct model is the Fixed Effect (FE) model. Conversely, when the Hausman value is less than the critical value, it fails to reject the null hypothesis and the right model is Random Effect (RE). The processing results of the Hausman Test can be seen in the following table.

The test results show that the Prob. The random cross-section of 0.0018 is smaller than the critical value (5%) so that it rejects the null hypothesis which means that the Fixed Effects (FE) model is more appropriate than the Random Effects (CE) model. The results of the Chow test and the Hausman test show that there are similarities in the results which refer to the best regression model, which is the Fixed Effects (FE) model, so there is no need for further testing using the Lagrange Multiplier (LM) Test.

Results of Determination of the Sub-Structure Regression Model II

The results of the Chow test and the Hausman test show that there are similarities in the results which refer to the best regression model, which is the Fixed Effects (FE) model. The sub-structure II regression model can be explained as follows.

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Table 5.20: Results of Regression Model Sub Structure II Selected Fixed Effect (FE)

Dependent Variable: LOG(PDRB) Method: Panel Least Squares Sample: 2019 2021
Period included: 3
Cross-sections included: 35
Total panel (balanced) observations: 105

Variables	coefficient	std. Error	t-Statistics	Prob.
C	16.73206	0.759323	22.03548	0.0000
LOG(LAND)	-0.034006	0.068372	-0.497374	0.6206
LOG(ROAD)	0.000988	0.095458	0.010353	0.9918
LOG(PADDY)	0.044468	0.039863	1.115527	0.2686

Source: Eviews 9 data processed, 2023.

The multiple linear regression equation built from the selected model is as follows: LogPDRB = 16.73206 - 0.034006*LogLAND + 0.000988*LogROAD + 0.044468*LogPADI. The multiple linear regression equation above explains the following:

1 A constant of 16.73206 indicates that if there are no LAN, ROAD, and PADI variables or the independent variable is zero, then the GRDP is 16.73206.

2 The regression coefficient of the variable Land Area is -0.034006. This means that every reduction of one unit of land area will affect GRDP by 0.034006 assuming the variables of Road Infrastructure and Rice Production are constant (zero).

3 The regression coefficient of the Road Infrastructure variable is 0.000988. This means that every increase of one unit of Road Infrastructure will affect the increase in GRDP by 0.000988 assuming the variables of Land Area and Rice Production are constant (zero).

4 The regression coefficient of the Rice Production variable is 0.044468. This means that every increase of one unit of rice production will affect the increase in GRDP by 0.044468 assuming the variables of Land Area and Road Infrastructure are constant (zero).

Feasibility Test Results of Regression Model Sub Structure II

Testing of the Sub Structure II model that has been carried out previously shows that the Fixed Effects (FE) model is the selected panel data regression model and at the same time meets the requirements of the classical assumption test. Furthermore, this sub-structural model II will be tested for feasibility by using the F-test with the criteria that if the probability value of the F-statistic is less than the 5% significance level, then rejecting H0 or the Fixed Effects (FE) model is feasible to use to predict the independent variable of the variable bound. The results of the F-test can be seen below.

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Table 5.21: Results of F-test Regression Model Sub Structure II

Dependent Variable: LOG(PDRB) Method:
Panel Least Squares Sample: 2019 2021
Period included: 3
Cross-sections included: 35
Total panel (balanced) observations: 105

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.999246	Mean dependent var	16.91956
Adjusted R-squared	0.998830	SD dependent var	0.624659
SE of regression	0.021370	Akaike info criterion	-4.579105
Sum squared residue	0.030598	Schwarz criterion	-3.618624
*Logs*likelihood	278.4030	Hannan-Quinn criter.	-4.189899
F-statistics	2399,806	Durbin-Watson stat	3.188436
Prob(F-statistic)	0.000000		

Source: Eviews 9 data processed, 2023.

The feasibility test of the panel data regression model of the Sub Structure II model is reflected in the results of the F-test which shows that the probability value of the F-statistic is smaller than the significance level (0.0000 <0.05). This provides an understanding that rejecting H0 or the Fixed Effect (FE) model is appropriate to use to measure the effect of the independent variables Land Area (LogLAHAN), Road Infrastructure (LogJALAN), and Rice Production (LogPADI) on the dependent variable GRDP (LogPDRB) in Central Java Province .

Test Results for the Coefficient of Determination (R2) Regression Model Sub Structure II

The coefficient of determination (R square) in multiple linear regression analysis has meaning as the influence contribution given by the independent variable to the dependent variable. The value of the coefficient of determination (R2) in this study is useful for predicting the contribution of the joint effect of the variables Land Area (LAND), Road Infrastructure (JALAN), and Rice Production (PADI) to Gross Regional Domestic Income (GRDP) in Central Java Province. The results of calculating the Coefficient of Determination (R2) can be seen in the following table.

Table 5.22. Test Results for the Coefficient of Determination (R2) Regression Model Sub Structure II

Cross-section fixed (dummy variables)

R-squared	0.999246	Mean dependent var	16.91956
Adjusted R-squared	0.998830	SD dependent var	0.624659
SE of regression	0.021370	Akaike info criterion	-4.579105
Sum squared residue	0.030598	Schwarz criterion	-3.618624
*Logs*likelihood	278.4030	Hannan-Quinn criter.	-4.189899
F-statistics	2399,806	Durbin-Watson stat	3.188436
Prob(F-statistic)	0.000000		

Source: Eviews 9 data processed, 2023.

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The results of calculating the Coefficient of Determination (R2) as shown in the table above show that the value of R-squared (R2) is 0.999246 while the Adjusted R-squared is 0.998830. This gives an understanding that the variable contribution of Land Area (LAHAN), Road Infrastructure (JALAN), and Rice Production (PADI) to the Gross Regional Domestic Product (GRDP) in Central Java Province is 99.8%, while the remaining is 0.2 % is influenced by other variables not measured in this research model.

Results of Hypothesis Testing of the Sub-Structure Regression Model II

The research hypothesis states that there is an influence of each independent variable Land Area (LAHAN) and Road Infrastructure (JALAN) on the dependent variable Rice Production (PADI) in Central Java Province. Hypothesis testing is done by using the t-test with the criteria for decision making by comparing the probability value of t (prob.) with the level of significance (α = 5%). If the probability value t (prob.) is smaller than the level of significance (α) then each independent variable has a significant effect on the dependent variable. Conversely, if the probability value t (prob.) is greater than the level of significance (α) then each independent variable has no significant effect on the dependent variable. The results of testing the hypothesis with this t-test can then be seen in the following table.

Table 5.23. Results of Hypothesis Testing of the Sub-Structure Regression Model II

Dependent Variable: LOG(PDRB) Method: Panel Least Squares Sample: 2019 2021
Period included: 3
Cross-sections included: 35
Total panel (balanced) observations: 105

Variables	coefficient	std. Error	t-Statistics	Prob.
C	16.73206	0.759323	22.03548	0.0000
LOG(LAND)	-0.034006	0.068372	-0.497374	0.6206
LOG(ROAD)	0.000988	0.095458	0.010353	0.9918
LOG(PADDY)	0.044468	0.039863	1.115527	0.2686

Source: Eviews 9 data processed, 2023.

The results of the t-test above show that the variable Land Area (LogLAHAN) has a t-Statistic value of -0.497374 with a probability of 0.6206, the Road Infrastructure variable (LogLAHAN) has a t-Statistic value of 0.000988 with a probability of 0.9918, while Rice Production (LogPADI) has a t-Statistic value of 0.044468 with a probability of 0.2686. The three results of the t-test show that the probability value of t (prob.) is greater than the level of significance (5%), which means that the independent variables namely Land Area, Road Infrastructure, and Rice Production each have no significant effect on Domestic Income Gross Regional (GRDP) in Central Java Province.

Path Analysis Test Results (Path Analysis)

Path analysis (path analysis) is the development of a regression model that is used to test the suitability (fit) of the correlation matrix of two or more models being compared. The path analysis model in this study was used to analyze the relationship between variables with the

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aim of knowing the direct and indirect effect of a set of variables Land Area (LAND) and Road Infrastructure (JALAN) on the variable Gross Regional Domestic Income (LogPDRB) mediated by Rice Production (PADI) in Central Java Province.

Results of the Path Diagram Model

The path diagram model describes the path analysis in a path diagram so that the paradigm that represents the research hypothesis is seen. The path diagram in this study is shown in the following figure. Based on the calculation of multiple linear regression as described above, an overview of the results of the path coefficients can be presented as follows.

Table 5.27: Summary of Path Coefficient Test Results

Variable	Coefficient	SE	t-count	Prob.	Decision
LAND - RICE	1.003787	0.015515	64.69592	0.0000	Significant
ROAD - PADI	0.001816	0.049751	0.036512	0.9709	Not significant
LAND - GRDP	-0.034006	0.068372	-0.497374	0.6206	Not significant
ROADS - GRDP	0.000988	0.095458	0.010353	0.9918	Not significant
RICE - GRDP	0.044468	0.039863	1.115527	0.2686	Not significant

Source: Eviews 9 data processed, 2023.

Furthermore, the path diagram of the two structural models can be presented as follows.

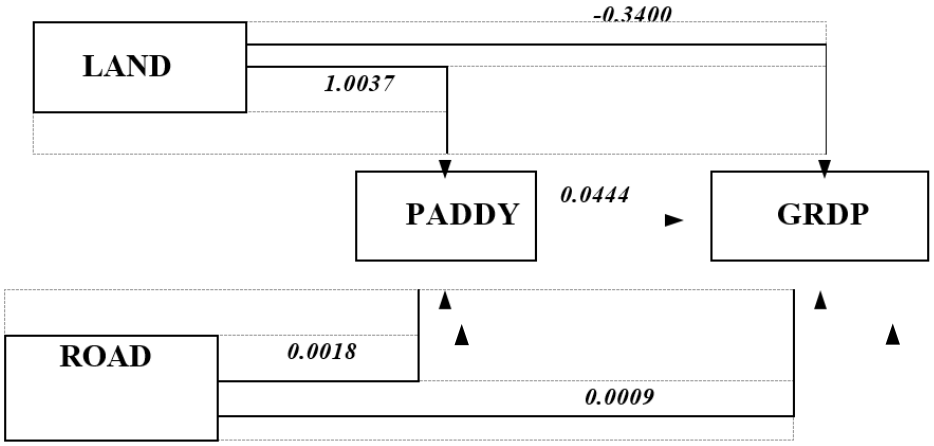

Figure 5.7 Path Diagram of Path Analysis Test Results

Source: Eviews 9 data processed, 2023.

Sobel test results

Sobel test (Sobel Test) was conducted to test the hypothesis of the variable Rice Production (LogPADI) in mediating the effect of the independent variable Land Area (LAHAN) and Road Infrastructure (JALAN) on the dependent variable Gross Regional Domestic Income (LogPDRB) by mediating Rice Production (PADI) in Province of Central Java. The Sobel test is carried out with the help of the Sobel Test Calculator for the Significance of Mediation application.

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Summary of Hypothesis Test Results

On the basis of the calculations as explained above, an overview of the results of the hypothesis testing in this study can be presented as follows.

1. Land area has a significant effect on rice production

The research hypothesis states that land area has a significant effect on rice production in Central Java Province. Testing the hypothesis with the t-test shows that the t-statistic value of the variable Land Area (LOGLAND) is 64.69592 and the probability is 0.0000. The probability value t (Prob.) is smaller than the level of significance (0.0000 <5%), then H0 is rejected and H1 is accepted or Land Area (LAHAN) has a significant effect on Rice Production (PADI). Thus, the research hypothesis which reads Land Area has a significant effect on Rice Production in Central Java Province can be accepted or tested for truth.

2 Road infrastructure has no significant effect on rice production

The hypothesis of this study states that road infrastructure has a significant effect on rice production in Central Java Province. Testing the hypothesis with the t-test shows that the t-Statistic value of the Road Infrastructure (LogJALAN) variable is 0.036512 and the probability is 0.9709. The probability value t (Prob.) is greater than the level of significance (0.9709 > 5%), then H0 is accepted and H1 is rejected or Road Infrastructure (JALAN) has no significant effect on Rice Production (PADI). Thus, the research hypothesis which reads Road Infrastructure has a significant effect on Rice Production in Central Java Province is unacceptable or untested the truth.

3. Wide Land influential not significant to Income Gross Regional Domestic (GDP)

The hypothesis of this study states that land area has a significant effect on Gross Regional Domestic Income (GRDP) in Central Java Province. Testing the hypothesis with the t-test shows that the t-statistic value of the variable Land Area (LOGLAND) is -0.497374 and the probability is 0.6206. The probability value of t (Prob.) is greater than the level of significance (0.6206 > 5%), then H0 is accepted and H1 is rejected or Land Area (LOGLAHAN) has no significant effect on Gross Regional Domestic Product (GRDP). Thus, the research hypothesis which reads Land Area to Gross Regional Domestic Product (GRDP) in Central Java Province cannot be accepted or has not been tested for truth.

4. Road Infrastructure has no significant effect on Gross Regional Domestic Product (GRDP)

The hypothesis of this study states that road infrastructure has a significant effect on the Gross Regional Domestic Product (GRDP) in Central Java Province. Testing the hypothesis with the t-test shows that the t-Statistic value of the Road Infrastructure (LogWAY) variable is 0.000988 and the probability value is 0.9918. The probability value t (Prob.) is greater than the level of significance (0.9918 > 5%), then H0 is accepted and H1 is rejected or the Road Infrastructure (LogWAY) has no significant effect on the Gross Regional Domestic Product (GDP). Thus, the research hypothesis which reads Road Infrastructure has a significant effect on the Gross Regional Domestic Product (GDP) in Central Java Province cannot be accepted or has not been

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tested for truth.

5. **Paddy Production has no significant effect on Gross Regional Domestic Product (GDP)**

The hypothesis of this study states that rice production has a significant effect on the Gross Regional Domestic Product (GRDP) in Central Java Province. Testing the hypothesis with the t-test shows that the t-Statistic value of the Rice Production variable (LogPADI) is 0.000988 and the probability value is 0.2686. The probability value t (Prob.) is greater than the level of significance (0.9918 > 5%), then H0 is accepted and H1 is rejected or Rice Production (LogPADI) has no significant effect on Gross Regional Domestic Product (GDP). Thus, the research hypothesis which reads Rice Production has a significant effect on Gross Regional Domestic Product (GDP) in Central Java Province cannot be accepted or has not been tested for truth.

6. **Rice production has no significant effect in mediating the effect of land area on Gross Regional Domestic Product (GRDP)**

The hypothesis of this study states that land area has a significant effect on Gross Regional Domestic Income (GRDP) through the mediation of rice production in Central Java Province. Testing the hypothesis with the Sobel Test shows that the Sobel Test statistical value is smaller than the z-score (1.1152 <1.96) which means that Rice Production (LogPADI) is not able to mediate the effect of Land Area (LogLAHAN) on Gross Regional Domestic Product (LogPDRB) . Thus the research hypothesis which reads Land Area has a significant effect on Gross Regional Domestic Income (GRDP) through the mediation of Rice Production in Central Java Province cannot be accepted or has not been tested for truth.

7. **Rice production has no significant effect in mediating the effect of road infrastructure on Gross Regional Domestic Product (GRDP)**

The hypothesis of this study states that road infrastructure has a significant effect on Gross Regional Domestic Product (GRDP) through the mediation of rice production in Central Java Province. Testing the hypothesis with the Sobel Test shows that the Sobel Test statistical value is smaller than the z-score (0.0363 <1.96) which means that Rice Production (LogPADI) is not able to mediate the effect of Road Infrastructure (LogJALAN) on Gross Regional Domestic Product (LogPDRB). Thus the research hypothesis which reads Road Infrastructure has a significant effect on Gross Regional Domestic Income (GRDP) through the mediation of Rice Production in Central Java Province is unacceptable or has not been tested for truth.

DISCUSSION

Discussion of the Effect of Land Area on Rice Production

Land area is the area of rice fields that will be planted with rice in a certain season. The area of a rice field is land that stretches wide and is in the form of plots with sides bounded by bunds or boundaries to hold water, usually the rice fields are not important where the land comes from or the status of the land (BPS, 2016). Agricultural land is a determinant of the influence of agricultural commodities. In general, it can be said that the wider the land planted with rice, of

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course, the greater the amount of rice production produced by that land.

The results of this study found that land area has a significant effect on rice production in Central Java Province. The results of this study are consistent with the results of a study conducted by Andrias et al (2017) which concluded that land area has a positive and significant effect on rice production. In line with this, several other research results also state that the area of agricultural land has a significant positive effect on rice production (Harini et al, 2019; Witjaksono, et al., 2021), and the area of paddy fields has a positive and significant effect on rice production (Manggala and Boedi , 2018).

The research results which state that land area has a significant effect on rice production is in line with several opinions which state that the agricultural production function can function properly if there are factors that influence production. There are several factors that affect production in agriculture, especially for rice commodities, one of which is the area of agricultural land (Soekartawati, 2013). Land area is the main capital for agricultural development. This is because land is one of the conditions for the ongoing process of agricultural production. Land area is one of the factors of rice production because land is where the growth and production processes occur (Fitri, 2015). Agricultural production is influenced by various factors such as land area, seeds, fertilizers, pesticides (pesticides), irrigation systems,

Discussion of the Effect of Road Infrastructure on Rice Production

The availability of infrastructure increases people's access to resources so as to increase efficiency and productivity leading to the economic development of an area or region. Grigg (2008) explains that infrastructure is a physical system that provides transportation, irrigation, drainage, buildings and other public facilities, which are needed to meet basic human needs, both social needs and economic needs.

The results of this study found that road infrastructure has no significant effect on rice production in Central Java Province. The results of this study are consistent with the results of research by Subroto, et al. (2016) who conducted research on the effect of infrastructure on the agricultural sector on the island of Sumatra which concluded in their research that road infrastructure had a positive but not significant effect on the growth of the agricultural sector. The results of this study are also in line with the results of research by Ekawati et al. (2018) who found that infrastructure did not support the availability of sustainable rice in Kalimantan, where it was stated that the dominant infrastructure factors included support for road infrastructure and facilities, as well as the availability of agricultural tools and machinery.

However, the results of these studies are inconsistent with the results of studies which state that road infrastructure has a significant positive effect on rice production (Witjaksono, et al., 2021) and road infrastructure has a significant positive effect on the added value of the agricultural sector (Purwansyah, et al. al., 2013). The results of the study which found that road infrastructure had no significant effect on rice production were also inconsistent with the results of Nayak's research, Chittaranjan (2018) which stated the results of his research that the development of rural infrastructure in good condition had an impact on high levels of rice

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productivity. Likewise with several research results which stated that road repairs had an effect on reducing transportation costs. Transportation costs supported by easy access to road infrastructure have a significant effect on the use of agricultural land and rice production (Edmonds, 2008). National competitiveness is affected by the level of institutional development and other factors, including road infrastructure. In this case, road infrastructure has an influence on increasing production capacity, including agricultural production (Palei, 2015). Physical and institutional infrastructure in the form of improved rice seeds and climate change awareness will increase rice productivity. Rural infrastructure will connect farmers and buyers so that they can increase access to inputs and outputs, increase production yields, reduce price distortions, and make the domestic market function properly.

The research results which state that road infrastructure has a significant effect on rice production mentioned above are in line with the opinion of Pasandaran (2017) which explains that the availability of sufficient infrastructure and optimal conditions will make it easier for farmers to get maximum results from agricultural land. Farmers will find it easier in terms of the cultivation process, access to production facilities, to marketing their agricultural products. If all of these things are fulfilled, there will be no less prosperous farmers and this will later encourage the development of the country's economy as a whole.

Infrastructure has a vital role in the success of agricultural development. Infrastructure such as roads, PDAM, Telkom, and others have positive externalities that can increase the productivity of all inputs in the production process. Positive externalities in infrastructure are in the form of a spiller effect in the form of an increase in the agricultural sector without having to increase capital and labor inputs or also increase the level of technology. With the development of infrastructure, productivity levels, companies and the agricultural sector will increase. One of the most visible is road construction (Caning and Pedroni, 2004).

Discussion of the Effect of Land Area on Gross Regional Domestic Product (GRDP)

The process of regional economic growth is shown by using the rate of increase in the Gross Regional Domestic Product (GDP), so that the level of development of per capita GRDP achieved by the community is often used as a measure of the success of a region in achieving its goals of creating economic development. Gross Regional Domestic Product (GDP), is one of the important indicators to determine the economic condition of a region in a certain period. The agricultural sector has an important role in the economy of Langkat Regency, this can be seen from its contribution to GRDP and its role in creating community jobs. As is known agricultural resources consisting of land, labor, water,

The results of this study found that land area has no significant effect on Gross Regional Domestic Income (GRDP) in Central Java Province. The results of this study are not consistent with those of Witjaksono, et al. (2021) who conducted research on the effect of road infrastructure and land area on rice production in increasing GRDP which stated that land area had a significant positive effect on GRDP. The results of this study are also not in line with the results of the respective studies of Arotaa et al., (2016) and Reavindo (2020) which state that there is a relationship between the area of agricultural land and the Gross Regional Domestic

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Product (GRDP) of the agricultural sector, when the area of land increases or decreased gross regional domestic product continues to increase.

Discussion of the Effect of Road Infrastructure on Gross Regional Domestic Product (GRDP)

Infrastructure development is one of the important components that will determine the success of the development of a nation. Infrastructure is an economic fundamental and in the development period the availability of infrastructure is a separate demand. Its role as a driver of the economic sector will be able to drive the development of related sectors and will eventually create new business fields and provide production output as input for consumption. In addition, apart from playing a role as a driving force for the development of economic sectors, infrastructure makes a significant contribution to the Gross Regional Domestic Product (GDP).

The results of this study found that road infrastructure has no significant effect on the Gross Regional Domestic Product (GRDP) in Central Java Province. The results of this study are in line with the results of research by Fisu et. al., (2022) who conducted research on economic growth in Palopo City. The results of the study concluded that long road infrastructure had a negative and insignificant effect on economic growth as a proxy for GRDP in Palopo City.

The research results which state that road infrastructure has an insignificant effect on Gross Regional Domestic Product (GRDP) are certainly not in accordance with Philip's Big Push Theory (2019) which states that there is a link between road infrastructure and

Gross Regional Domestic Product (GRDP). The economic growth model of the Strong Push Theory (Big Push Theory) according to Rosenstein-Rodan states that if developing countries want to break the cycle of poverty then there needs to be "large-scale investment" in the industrial sector (big push). This large-scale investment will create synergistic interactions between various sectors with the support of social infrastructure such as roads, bridges, ports, communication systems, hospitals, schools, irrigation, and so on.

Prapti et al. (2015) explains the big push theory states that infrastructure needs to be built first, everything else develops then flows, (trickledown effect). Overcoming the obstacles to economic development in underdeveloped countries as well as to push the economy towards progress requires a "strong impetus" or a large overall program in the form of a minimum amount of investment. There are a minimum number of resources that must be provided if a development program is to be successful. The “piecemeal” way of working will not propel the economy successfully along the development trajectory, but a large amount of infrastructure investment is an absolute requirement in this regard.

Infrastructure developmentis one of the important and vital aspects to accelerate the process of national and regional development. Infrastructure also plays an important role as one of the driving wheels of economic growth. The rate of economic growth cannot be separated from the availability of infrastructure such as transportation, telecommunication, sanitation and energy. This is why infrastructure development is the foundation for sustainable economic

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development.

Discussion of the Effect of Rice Production on Gross Regional Domestic Product (GRDP)

Regional economic development is inseparable from the value of the Gross Regional Domestic Product (GRDP). The value of a region's GRDP describes regional economic development and the role of each sector in the economy. In order to increase the role of the agricultural sector in the economy, the most important thing that needs attention is how the role of the agricultural sector is in the GRDP of a region.

The results of this study found that rice production had no significant effect on the Gross Regional Domestic Product (GRDP) in Central Java Province. The results of this study are not consistent with the results of research by Witjaksono, et al. (2021) who stated in his research conclusions that rice production had a significant positive effect on GRDP. Also inconsistent with the results of Muliati et al. (2022) which states that rice production has a negative effect on the Gross Regional Domestic Product (GRDP) in 34 Indonesian provinces. This means that if rice production increases, the Gross Regional Domestic Product (GRDP) will decrease. This is inversely proportional to economic theory where an increase in production should be able to support an increase in GRDP, not make GRDP decrease.

The role of the agricultural sector, including rice production in the economy of a country or a region, can be seen from several aspects, one of which is the contribution of the agricultural sector to the Gross Domestic Product (GDP) or to the Gross Regional Domestic Product (GDP). The agricultural sector is a very strategic factor, is the basis of the people's economy in rural areas, dominates the lives of the majority of the population, absorbs more than half of the total workforce and even becomes a safety valve during the Indonesian economic crisis (Arifin, 2004). An increase in the purchasing power of rural areas, as a result of an increase in the agricultural surplus, was a strong stimulus for industrial development. In other words, expanding output and increasing agricultural productivity will increase the demand for manufactured goods, which in turn will expand the industrial sector. If this condition can be realized then the service sector will increase to serve the needs of the agricultural sector and industrial sector. This will have a huge impact on the economy because GDP requires the role of these sectors (Jhingan, 2004).

Agriculture in developing countries can be seen as an economic sector with great potential in terms of contribution to regional economic growth and development, namely product contribution, market contribution, production factors contribution, and foreign exchange contribution. The product contribution explains that the expansion of other economic sectors is highly dependent on output growth in the agricultural sector. Market contribution, in agrarian countries like Indonesia, agriculture plays a role as an important source for the growth of domestic demand for products from other economic sectors. Meanwhile, the contribution of factors of production, as a source of capital for investment in other sectors. That in the process of economic development there is a transfer of surplus labor (L) from agriculture (rural) to industry and other urban sectors. Finally, the contribution of foreign exchange, as an important source of surplus in the trade balance (source of foreign exchange), both through exports of

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agricultural products and by increasing domestic agricultural production to replace imports (import substitution) (Kuznets, 1946 in Sukirno, 2019).

Discussion of the Effect of Land Area on Gross Regional Domestic Income (GRDP) through the mediation of Rice Production

The agricultural sector has played a role in the national economy through the formation of GRDP, earning foreign exchange, supplying food and industrial materials, alleviating poverty, creating jobs, and increasing people's income. The results of this study found that rice production had a non-significant effect in mediating the effect of land area on gross regional domestic income (GRDP) in Central Java province. The results of this study are not consistent with those of Witjaksono, et al. (2021) who concluded in his research that rice production is able to mediate the significant effect of land area on GRDP.

Land area in the agricultural sector has an important role in agricultural business and production processes. This is because the land has productivity in producing vegetable and animal materials, as a raw material for making various goods, has the ability to absorb liquids, distributes some rainwater to fill land water, and others (Rusdiah, 2008). Agricultural production is influenced by various factors such as land area, seeds, fertilizers, pesticides (pesticides), irrigation systems, labor, climate and so on (Utami, et al., 2011).

The agricultural sector has a large forward multiplier effect through input-output-outcom linkages between industry, consumption, and investment. This happens nationally and regionally because the comparative advantage of most of Indonesia's territory is the agricultural sector. Related to this, the area of agricultural land is certainly one of the determining factors for agricultural production results. The wider the agricultural land planted, the greater the amount of production produced by the land, including rice production which will ultimately be able to contribute to the agricultural sector's Gross Regional Domestic Product (GDP) (Laoh, 2008).

Discussion of the Effect of Road Infrastructure on Gross Regional Domestic Product (GDP) through the mediation of Rice Production

Road infrastructure has an important role in agricultural development in relation to achieving optimal results of agricultural production in Indonesia. Means in the form of road infrastructure is a form of support for the smooth running of farming activities, from obtaining seeds to marketing agricultural products which in the end will be able to increase the income of a region. The results of this study found that rice production had a non-significant effect in mediating the effect of road infrastructure on gross regional domestic income (GRDP) in Central Java province. The results of this study are not consistent with those of Witjaksono, et al. (2021) who stated in their conclusion that rice production is able to mediate the significant effect of road infrastructure on GRDP.

Infrastructure such as roads, PDAM, Telkom, and others have positive externalities that can increase the productivity of all inputs in the production process, including agricultural production. Positive externalities in infrastructure are in the form of spillover effects in the

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form of increased production by companies and the agricultural sector without having to increase capital and labor inputs or also increase the level of technology. With the construction of infrastructure, the level of productivity of the agricultural sector will increase. One of the most visible is road construction. This is where infrastructure can play a role in poverty alleviation, namely by increasing access for both the poor and access for government intervention to be more effective in overcoming poverty.

Palei (2015) explains that infrastructure factors are determined mainly by the quality of roads, rail infrastructure, air transportation and electricity supply. The influence of road infrastructure on economic growth (GRDP) includes infrastructure having an influence on increasing additional production capacity, reducing input costs in production costs, and transactions. Tanko and Cheah (2019) in identifying the impact of rural infrastructure on rice productivity and the level of rice productivity explained that rural infrastructure plays an important role in increasing agricultural productivity. Rural infrastructure is conceptualized by proxy for physical infrastructure such as roads and institutions.

CONCLUSION

Based on the previous explanation, the following conclusions can be drawn. First, land area has a significant influence on rice production in Central Java Province. Second, road infrastructure has no significant influence on rice production in Central Java Province. Third, land area has no significant effect on Gross Regional Domestic Product (GRDP) in Central Java Province. Fourth, road infrastructure also does not have a significant effect on GRDP in Central Java Province. Fifth, rice production does not have a significant effect on GRDP in Central Java Province. Sixth, rice production does not have a significant effect as a mediator between land area and GRDP in Central Java Province. Seventh,

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