THE EFFECT OF ROAD AND IRRIGATION INFRASTRUCTURE DEVELOPMENT ON AGRICULTURAL GROSS DOMESTIC PRODUCT IN THE PROVINCE OF WEST JAVA

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ABSTRACT
This study is to determine the effect of infrastructure such as roads and irrigation on agricultural sector GRDP in West Java Province. The data used in this research is secondary data. The method used is classical assumption test and multiple linear regression. The results of this study indicate that the road variable has a positive and significant effect on agricultural sector GRDP, while the irrigation variable does not show significant results and has no positive effect on agricultural sector GRDP in West Java Province. Based on the results of the study in the context of economic development in the agricultural sector of West Java Province, it is directed to spur equitable distribution of irrigation development so that agricultural production increases and road infrastructure as a basis for distributing agricultural production and increasing the optimal utilization of regional potential, especially in the agricultural sub-sector in West Java Province. Thus, the government is expected to maintain the climate and build infrastructure in a sustainable manner to keep the agricultural sector growing better..
Keywords : *Road, Irrigation, GRDP of Agricultural Sector, Classical Assumption Test and Multiple Linear Regression)*

INTRODUCTION

West Java Province is known as one of the largest agricultural suppliers in Indonesia, meaning that West Java Province relies on the agricultural sector as a source of livelihood for its people and as a support for economic development. Existing agricultural productivity is still unable to meet the needs of the community at large. One of the factors causing low agricultural productivity is the large amount of land conversion in West Java, so that it has not been able to utilize existing natural resources effectively and efficiently.

Table 1 : Gross Regional Domestic Product at constant prices of Agriculture Sector in West Java Province (In Billion Rupiah)

| Year	Agriculture	Year	Agriculture
2010	89.088,26	2017	99.669,37
2011	88.386,51	2018	101.752,20
2012	88.409,46	2019	104.596,75
2013	92.390,13	2020	107.000,79
2014	92.653,58	2021	108.406,55
2015	92.802,80	2022	113.186,39
2016	98 096,58		

Source: Central Bureau of Statistics of West Java Province 2022 (Processed).

The table above shows the contribution of the agricultural sector to GDP in West Java Province. It can be seen that, every year the contribution of the agricultural sector continues to increase, seen from the last 13 years 2010 to 2022 shows the development of GRDP at constant prices of the positive agricultural sector in West Java Province which continues to increase. The GRDP of the agricultural sector in 2010 reached 89 088.26 billion and continued to grow to 113 186.39 billion in 2022, this positive trend continues because West Java Province is very close to the capital city of Jakarta.

The GRDP of the agricultural sector annually reaches 7% every year until the GRDP of the agricultural sector is in the top 4 positions, it shows the strong potential of the agricultural sector in West Java Province. Infrastructure development is an important part of driving economic growth. Thus, infrastructure development is believed to have an important role in economic growth, especially in the agricultural sector. Various efforts have been made by the government to provide quality infrastructure facilities and services, both in the form of rehabilitation or capacity building of damaged infrastructure facilities, as well as new development. Based on Figure 2, the government allocates a economic growth increases. From year to year, it can be seen that Public Works is dominated by a large budget and continues to increase as the APBN in 2010 amounted to Rp 86 Trillion and in 2022 it rise to Rp 372.8 Trillion. Infrastructure is the most influential thing to be addressed and is useful for future investment. Infrastructure is needed to strengthen the manufacturing base so that logistics costs can be lowered and is expected to improve inter-regional and inter-island connectivity, accelerate equitable development in poor and underdeveloped areas, increase competitiveness, and production capacity budget for infrastructure spending in Indonesia for development, which fluctuates annually as
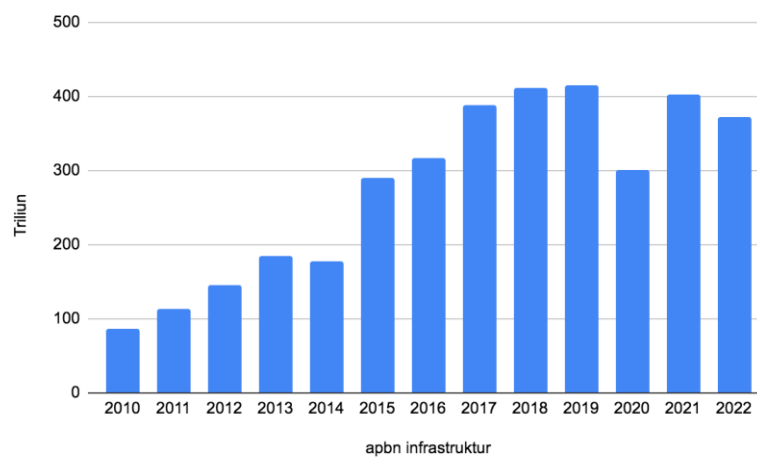
Source: Bureau of Budget Analysis and APBN Implementation - SETJEN DPR RI, 2022 (Processed).
Figure 1: Indonesia's Infrastructure Budget (In Trillion Rupiah)

The presence of infrastructure increases productivity, facilitates the movement of people, goods and services, and facilitates regional trade. Structures in this type of economic structure are considered capable of influencing investment. The most affected structures are road infrastructure, national roads, and rural roads. Sumatra Island has many resources that can be utilized ranging from natural resources to human resources.

Road infrastructure development in West Java Province has always increased from 2018 where the length of roads in West Java Province reached 8016,5 kilometers, the West Java Provincial Government focused on improvement and development in the following year, until the length of the road increased by 28.462 kilometers in 2022, this increase in road infrastructure development reflects the positive dynamics of road infrastructure development over a five-year period. Irrigation development in West Java province from 2010-2022 seen from the total area of irrigation development measured in hectares shows a stable figure of 8.240,03 hectares in 2010 and 42.966 in 2022 this shows that the area of irrigation development has always increased from year to year and shows a continuous effort to improve irrigation infrastructure in the region. Year-on-year changes reflect a response to the needs and challenges that may be faced, as well as efforts to optimize the utilization of irrigation resources to support the agricultural sector and environmental sustainability. Road and irrigation infrastructure development has been a major focus of the government in an effort to improve accessibility and efficiency in the agricultural sector. Good infrastructure can improve market access, reduce transportation costs and improve access to water sources that are important for agriculture in West Java Province. In the context of the regional economy, the growth of the agricultural sector has a significant impact on GRDP at constant prices in West Java Province.

Although many studies have examined the effect of infrastructure on economic growth, there are not many studies that focus on the agricultural

sector at the regional level. Therefore, it is important to provide empirical evidence on the importance of road and irrigation infrastructure development to the agricultural sector in a region-specific context, and the dynamics of road and irrigation infrastructure development continue to change over time.

Based on the background that has been stated above, the problem formulation in this study is how does the influence of the road and irrigation factor to the GRDP of the agricultural sector in West Java Province?

RESEARCH OBJECTIVES

In accordance with the formulation of the problem stated, the purpose of this study is to determine the magnitude of the influence of road and irrigation factors on agricultural sector GRDP in West Java Province.

Literatur Review

Infrastructure

Places that are considered public spaces such as hospitals, roads, bridges, sanitation facilities (thinking behavior by cultivating clean living with the aim that people do not come into contact with soil and other hazardous waste, with the hope that these activities will continue and improve human health) and others. In economics, infrastructure is a form of public capital that includes government investment. The structures in this study include roads, bridges and canals (Mankiw, 2003: 38).

Road Infrastructure

Roads are land transportation infrastructure that includes all parts of the road, including complementary buildings and equipment intended for traffic, which are on the surface of the land, above the surface of the land, below the surface of the land and / or water, and above the surface of the water, except for railways, lorry roads, and cable roads (Law No.38 of 2004). Roads are classified into several types, namely:

1. Public roads, which are roads intended for public traffic.
2. Special roads, which are roads built by agencies, business entities, individuals, or community groups for their own interests.
3. Toll roads, which are public roads that are part of the road network system and as national roads whose users are required to pay tolls.

Irrigation

Irrigation comes from the term irrigation in Dutch or irrigation in English. The purpose of irrigation, which is to meet the needs of water in the rainy season for agricultural purposes, such as wetting the soil, drunkenness, regulating soil temperature, avoiding pest problems in the soil and so on (Mawardi, 2007).

Gross Regional Domestic Revenue (GRDP)

In general, economic growth is defined as an increase in an economy in producing goods and services. In other words, the direction of economic growth is more to do with quantitative change and is usually calculated using Gross Domestic Product (GDP) data or revenue or the total market value of final goods and services produced from an economy over a certain period of time and usually one year. To calculate economic growth in nominal terms, GDP (Gross Domestic Product) can be used.

Agriculture

In general, the definition of agriculture is a human activity that includes farming, animal husbandry, fisheries and forestry. As well as the use of animals that can help the tasks of farmers, this activity is a scope in agriculture (Bukhori, 2014).

The Effect of Infrastructure on Economic Growth

The study of development economic theory according to Marsuki (2005) and Sjafrizal (2006), cited by Setiadi (2006), says that to create and improve economic activities, adequate infrastructure facilities are needed. Based on research conducted by Tunjung Hapsari (2011) in his research conducted in Indonesia explains that infrastructure shows a significant influence on economic growth in Indonesia.

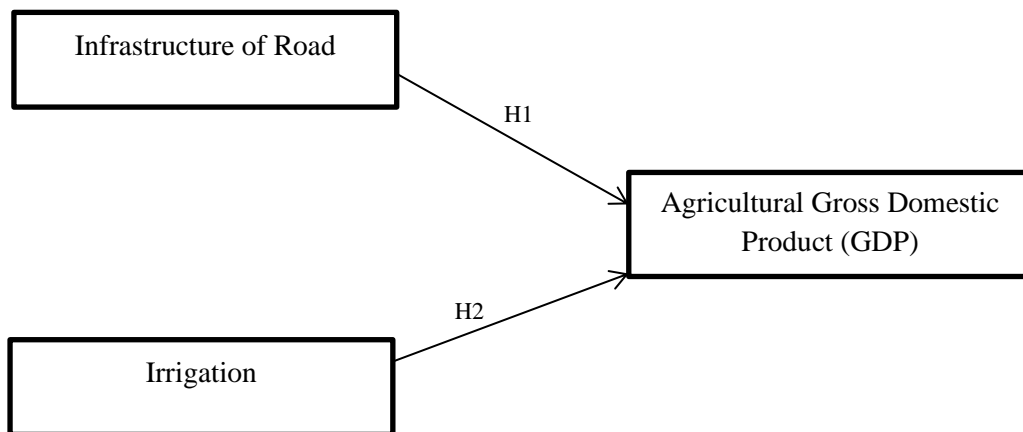### Effect of Infrastructure on Agriculture

Agricultural infrastructure, especially agricultural roads and irrigation, is one of the components in the upstream subsystem which is expected to support the farming subsystem, processing subsystem and marketing subsystem, especially in the production centers of horticulture, plantations and smallholder livestock. Based on research conducted by Sitti Aisyah (2011) in her research conducted in Baebunta District, it is explained that infrastructure, especially irrigation, has a positive and significant influence on the income of rice farmers in Baebunta District.

Previous Research

Based on the results of research conducted by Kamaruddin et al (2021) states that infrastructure has a positive role in economic growth. Based on the results of data analysis, it shows that variable X has a significant effect on variable Y, this is based on the t value of 6.318 and t table of 2.776 which states that every 1% increase in infrastructure value, the economic value will increase by 0.046, the regression coefficient is positive, so it can be said that the direction of the influence of variable X on Y is positive. This type of research is associated with quantitative methods. The technique used to collect data in this study is through observation, interviews and documentation with data analysis using simple linear regression with the Eviews 13 version 16.00 program.

Framework of Thought

Based on the theoretical basis that has been stated, the framework in this study is:

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┌─────────────────────────┐
│   Infrastructure of Road │
└─────────────────────────┘
              \  H1
               \
                ┌──────────────────────────┐
                │ Agricultural Gross Domestic│
                │      Product (GDP)         │
                └──────────────────────────┘
               /
              /  H2
┌─────────────────────────┐
│        Irrigation        │
└─────────────────────────┘
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Research Hypothesis :

The hypothesis in this study is used to determine the relationship between the independent variable and the dependent variable. Based on the theory listed in the introduction section, several hypotheses are drawn which assume that:

1. The Road Infrastructure has a positive and significant effect on the GRDP of the agricultural sector.
2. Irrigation has a positive and significant effect on GRDP in the agricultural sector

RESEARCH METHODS

Type of Research

The research conducted in this study is association research. Association study is a type of research that aims to determine the influence between two or more variables (Umar, 2013). This study aims to determine the effect of road and irrigation infrastructure development on agricultural sector GRDP in West Java Province.

Type and Source of Data

The data used in this study are quantitative. According to Sugiyono (2017), quantitative data is a type of data that can be measured (measured) or calculated directly as a variable or numerical number. The quantitative data of this study are road and irrigation infrastructure development data and agricultural sector GRDP data of West Java Province in 2018-2022.

The information used in this study was obtained from secondary sources. According to Hasan (2002), secondary data is information obtained or collected by people who research from existing sources. Road and irrigation infrastructure development data and agricultural sector GRDP data of West Java Province, Sumbawa Regency in 2018-2022 were collected from existing documents obtained from the Central Bureau of Statistics of West Java Province.

Data Collection Technique

The research collected data using documentary techniques. According to Sugiyono (2017), the documentation technique is a technique for obtaining ready-made information collected by other parties. The data includes road and irrigation infrastructure development data and agricultural sector GRDP data for West Java Province from 2018 to 2022 obtained from records and archives of the Central Bureau of Statistics of West Java Province.

Variables and Operational Definition of Variables

A variable is an attribute, characteristic or value of a person, object or activity that has certain variations that researchers identify to study and then draw conclusions (Sugiyono, 2017). The variables of this study are as follows:

1) Independent variables are variables that cause changes or the emergence of dependent variables (Sugiyono, 2017). In this study, the independent variable is road infrastructure development (X1) and irrigation infrastructure development (X2). The indicators used to measure this variable are the total length of roads built in 2018-2022 according to road conditions in km, total irrigation in 2018-2022 according to irrigation conditions in West Java Province.

2) Dependent variable is a variable that is influenced or is the result of the existence of an independent variable (Sugiyono, 2017). The dependent variable in this study is the economic growth of Sumbawa Regency represented by the agricultural sector GRDP (Y). The indicator used to measure this variable is the Gross Regional Domestic Product (GRDP) of the agricultural sector based on 2018-2022. year at constant prices in rupiah units.

Data Analysis Technique

The data analysis technique used in this study uses quantitative data analysis with statistical tests. The statistical tests used include classical assumption tests and multiple linear regression.

Classical Assumption Tests

1) **Normality Test**

The intended normality test is to test whether the residual value in the regression model has a normal distribution or not. According to Ghozali (2017: 127).

2) **Multicollinearity Test**
Multicollinearity is a linear relationship between independent variables. Ghozali (2017: 71) states that the multicollinearity test aims to test whether in the regression model there is a high or perfect correlation between the independent variables.

3) **Hetero Test**
According to Ghozali (2021: 178), the heteroscedasticity test is to find out or test whether in the regression model there is or is an inequality of variance from the residuals of one observation to another, which means heteroscedasticity occurs.

4) **AutoCorrelation Test**
According to Ghozali (2018: 111) The autocorrelation test aims to test whether in the linear regression model there is a correlation between confounding errors in period t and confounding errors in period t-1 (previous)

Multiple Linear Regression

1) **F-test**
According to Imam Ghozali (2018: 98) the F-test aims to determine the effect of independent variables together (simultaneously) on the dependent variable.

2) **T-Test**
According to Ghozali (2018: 152) says that the t-test is used to determine each independent variable on the dependent variable.

3) **R-Square Test**
The coefficient of determination (R^2) is used to predict how much influence the independent variable has on the dependent variable. The coefficient of determination is between zero and one. A value close to one means that the independent variables provide almost all the information needed to predict the variations in the dependent variables. Conversely, a small coefficient of determination indicates that the ability of the independent variables to explain variations in the dependent variable is very limited (Ghozali, 2018: 97)
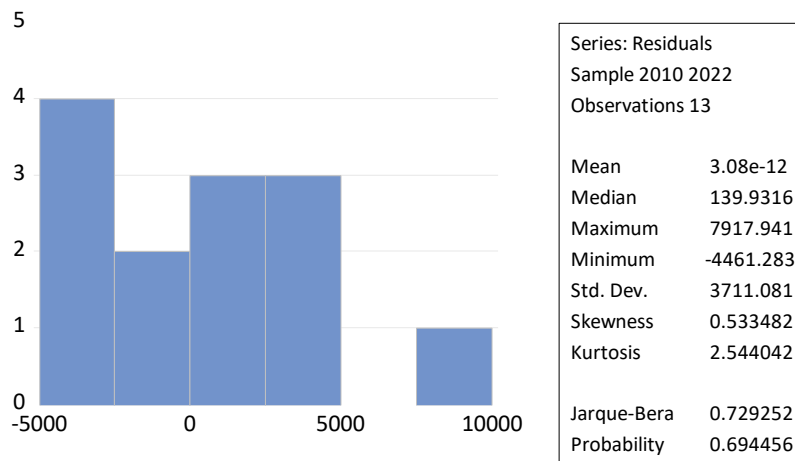
RESULTS AND DISCUSSION
Data Analysis Results
Classical Assumption Test
Normality Test

The normality test is used to determine whether the data is normally distributed or not. In this study, the Jarque-Bera test was used with the help of Eviews 6.0 software to see whether the data was normally distributed or not.

Series: Residuals	
Sample 2010 2022	
Observations 13	
Mean	3.08e-12
Median	139.9316
Maximum	7917.941
Minimum	-4461.283
Std. Dev.	3711.081
Skewness	0.533482
Kurtosis	2.544042
Jarque-Bera	0.729252
Probability	0.694456

Source: Processed Data Results using Eviews

Figure 2 Normality Test Results

The test criterion is if the probability > Alpha value, then H0 which states that the residuals are normally distributed is accepted. Conversely, if the Probability value < Alpha value, then H0 which states that the residuals are normally distributed is rejected. From the figure above, it can be seen that the Jarque-Bera value is 0.729252. While the probability is 0.694, it can be concluded that the Probability value of 0.694> 0.05, so the data is normally distributed (passes Normality).

Multicollinearity Test

The multicollinearity test aims to test whether the regression model finds a correlation between independent variables. A good regression model should not have a high correlation between the independent variables. You do this by calculating the correlation coefficient between the independent variables.

Variance Inflation Factors

Sample: 2010 2022

Included observations: 13

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	15294275	12.03068	NA
Irrigation	0.005486	9.157487	1.119261
Road	0.023656	9.456032	1.119261

Source: Processed Data Results using Eviews

Figure 6 Regression Analysis Results for the Effect of Roads and Irrigation on Agricultural GRDP

Based on Figure 6 shows that:

1. The constant of 81814.86 explains that if the road and irrigation variables are assumed to be zero or constant, the growth of the agricultural sector will increase by 81.82 percent.
2. The coefficient of road estimation is 0.967991, meaning that if there is an increase in road infrastructure by 1 percent, the growth of the agricultural sector will increase by 0.967991 percent, assuming other variables are considered constant.
3. The irrigation estimation coefficient is 0.095372, meaning that if there is an increase in irrigation infrastructure by 1 percent, the growth of the agricultural sector will increase by 0.095372 percent, assuming other variables are considered constant.

The t-test shows the significant level of influence of the road and irrigation variables on agricultural GRDP.

1. The road variable has a t-statistic value of 6.293633. At a significant level of $\alpha = 0.05$ percent and the number of n - k = 10, the t table value is 2.228141. The absolute value of t-statistic > t-table (6.293633 > 2.228141), means that H0 is rejected. Indicates that the road variable has a significant and positive effect on the growth of GRDP in the agricultural sector in West Java Province.
2. The irrigation variable has a t-statistic value of 1.287623. At a significant level of $\alpha = 0.05$ percent and the number of n - k = 10, the t table value is 2.228141. The absolute value of t statistic < t table (1.2876233 < 2.28141), means that H0 is accepted. Indicates that the irrigation variable has no significant and positive effect on the growth of GRDP in the agricultural sector in West Java Province.

CONCLUSIONS

Based on the discussion and analysis conducted in this study, several conclusions can be drawn regarding the impact of infrastructure, specifically road and irrigation variables, on the Gross Regional Domestic Product (GRDP) in the agricultural sector of West Java Province. First, the findings indicate that the road infrastructure variable has a positive and significant effect on the GRDP in the agricultural sector. Well-maintained and accessible roads play a crucial role in facilitating the transportation of agricultural goods, reducing distribution costs, and improving market access for farmers. The availability of reliable roads ensures that agricultural products can be transported efficiently from farms to markets, processing facilities, and export hubs. This leads to increased economic activity and revenue generation within the agricultural sector, ultimately contributing to the GRDP. Improved road infrastructure also supports the movement of agricultural inputs such as fertilizers, seeds, and equipment, further enhancing productivity and agricultural output.

On the other hand, the study found that the irrigation variable does not have a positive and significant effect on the GRDP of the agricultural sector in West Java Province. This result suggests that, despite the importance of irrigation systems in agriculture, current irrigation infrastructure in the region may not be adequately contributing to economic growth in this sector. There are several potential reasons for this finding. First, irrigation infrastructure in certain areas might be outdated, poorly maintained, or inefficient, leading to suboptimal water distribution and usage. Secondly, water management practices or institutional inefficiencies could be affecting the performance of irrigation systems, limiting their impact on agricultural productivity. It is also possible that the type of crops grown in the region is not heavily reliant on irrigation systems, or that rainfall patterns in West Java reduce the dependency on artificial irrigation, lessening its impact on GRDP.

In conclusion, while road infrastructure has proven to be a key factor in enhancing agricultural sector performance and contributing to GRDP, there is a need for further investigation and improvement of irrigation systems to better support agricultural development in West Java. Policymakers should prioritize infrastructure investment in roads while also addressing the challenges associated with irrigation to ensure a more comprehensive and sustainable agricultural growth.

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