

## The Role of Infrastructure in the Province's Gross Regional Domestic Product on the Island of Sumatra

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### ABSTRACT

Indonesia's infrastructure, especially in Sumatra, is considered inadequate to support the strength of the Indonesian economy in facing free market competition in the global era, lack of accessibility to reach remote areas so that the Gross Regional Domestic Product (GRDP) value in the region has a fairly small value. The study aims to determine the effect of road infrastructure, health facilities, educational facilities, water infrastructure, and electricity infrastructure on the level of gross regional domestic product (GRDP) in Sumatra, for the purpose of this study is to determine the effect of road length infrastructure, health facilities, educational facilities, clean water distribution and electricity partially on gross regional domestic product. This study uses a panel data model with the selected model, namely the Random Effect Model (REM). This study focuses on all provinces in Sumatra, namely 10 provinces in 2019-2023. The results of this study have a simultaneous effect where the relationship with the independent variables is Road Length Infrastructure (X1), Health Facilities (X2), Educational Facilities (X3), Clean Water Distribution (X4) and Electricity (X5) against the dependent variable, namely Gross Regional Domestic Product (Y). Then, the test results for each dependent variable on the variables of Road Length (X1), Health Facilities (X2), Education Facilities (X3), and Electricity (X5) significantly influenced Gross Regional Domestic Product (Y), while the test of Clean Water Distribution (X4) on Gross Regional Domestic Product (Y) did not have a significant effect. This is thought to be due to the uneven distribution of Clean Water Distribution facilities or infrastructure in Sumatra.

## **INTRODUCTION**

Development is a planned effort to make changes with the main goal of improving and improving people's living standards, welfare, and human quality. Development is a continuous process with the ultimate goal of improving community welfare. Therefore, every development strategy must emphasize production and infrastructure development to spur economic growth (Owolabi-Merus, 2015). Therefore, the implementation of development must be directed to areas that are able to improve the welfare of the community.

The success of a development program is influenced by several factors, including macro indicators determined by economic growth. According to (Arsyad, 1999), economic growth is the main goal that must be achieved in the economic development process to increase national income. High economic growth is the main target of development. Rapid economic growth does not necessarily result in uneven development. If only a few contribute to the economy, it will cause income inequality.

Infrastructure is one of the determining factors of economic development. Infrastructure development is believed to be able to drive the real sector, absorb labor, increase public and government consumption, and encourage productive activities. This is emphasized by (Yeung, 2017) who states that infrastructure development is part of social overhead capital which is important and necessary to drive other economic sectors. The success of national development that seeks to improve the country's welfare is highly dependent on the development of its infrastructure. Infrastructure development will always have a positive impact on economic growth and development, so that it will increase the level of economic competitiveness of a region in the domestic and global markets. Infrastructure is not only necessary to increase competitiveness, but also accelerate equitable development, and prevent regional disparities (Kamilla & Hutajulu, 2020).

Gross Regional Domestic Product (GDP) is a measure of a country's economic performance (Mankiw, 2005). GDP is useful in determining the direction of future development. Positive economic growth indicates an increase in the economy, while negative economic growth indicates a decline.

The increase in GDP growth is influenced by the availability of infrastructure in each region. Increasing the infrastructure capacity of a region can improve the regional economy and several other aspects of life. The rate of economic growth is a large economic indicator to see how far the development of a region has succeeded in a certain period of time. This makes economic growth as a guide for a policy in future development.

Sumatra is one of the largest islands in Indonesia, with The island covers an area of 473,481 km<sup>2</sup>, which has 10 provinces, namely Aceh, North Sumatra, West Sumatra, South Sumatra, Lampung, Bengkulu, Jambi, Riau, Riau Islands, and Bangka Belitung Islands. Based on BPS 2024 data, the population of Sumatra is recorded at 56,795,305 people with a population density of 120 people per square kilometer.

Infrastructure has an influence and an important role in economic growth, so with the increase in infrastructure growth in West Sumatra every year, of

course, it is one of the drivers of increasing GDP in Sumatra. However, based on the fact that the growth of Sumatra's island infrastructure every year fluctuates irregularly and sometimes decreases every year while Sumatra's GDP has increased, but based on BPS data, the GDP of all provinces in Sumatra amounted to 2330515.26 billion rupiah in 2019, increasing to 2603911.41 billion rupiah in 2023. This figure shows an increase which means that economic activity is quite good.

In the previous research on the role of infrastructure in gross regional domestic product, there were several such as in the research that has been conducted by Kamilla & Hutajulu (2020), which conducted a study on the role of infrastructure in gross regional domestic product for West Sumatra Province with research variables, namely road length, electricity distribution and irrigation, obtained from the results of the study, namely irrigation infrastructure does not have a constant effect on GDP. In addition to this research, there is also a study from Humayra (2022), with the result that the role of road and electricity infrastructure in GDP has a significant effect. Then in the previous study from Aswanto (2023) with research on the role of health facility infrastructure and education facilities on GDP in Riau in 2010-2012, it was found that the results of health and education facilities had a significant effect on provincial GDP.

Based on the description of the problem above, this study aims to: (1) To determine the influence of road length infrastructure, health facilities, educational facilities, distribution of clean water and electricity simultaneously on gross regional domestic product (2) To determine the influence of road length infrastructure, health facilities, educational facilities, distribution of clean water and electricity partially on gross regional domestic product.

## LITERATURE REVIEW

### Economic Growth

Economic growth is the main focus in developing a country's economic activities. In the process of increasing the production of goods and services contained in the country's economy, it is always related to economic growth in each period. In economic growth, it is generally also related to the production process which includes certain types of products used in certain production (Humayra, 2022).

The long-term problem in the economy is the current economic growth. This is because in economic growth, the basis is a process of growth in output per capita in the long term. Output growth in the long term includes welfare increases in the consumption of goods and services and is followed by people's purchasing power (Regina, 2022).

Factors that affect economic growth are capital accumulation, including human resources, land investment, equipment, facilities, and infrastructure. Then the next factor is natural resources, *human resources* which include the quality of the population, access to information, technological advances and the work culture of the population. (Hutauruk et al., 2023). In modern theory, it is stated that there are other factors that have a great impact on the economic growth of a region, namely the state and amount of infrastructure, political stability, the rule of law, and government policies (Amrullah et al., 2020). Based

on Presidential Regulation No. 42 of 2005 concerning funding for infrastructure provision, it is stated that there are several infrastructures that are specifically regulated by the government, namely road infrastructure, transportation, sanitation, irrigation, electricity, clean water and telecommunications.

### **Gross Regional Domestic Product (GDP)**

Gross regional domestic product is the amount of added value on goods and services produced by various sectors in each province on the island of Sumatra within a period of one year (Wasilaputri, 2016).

Gross Regional Domestic Product is the amount of products and services produced by the economy in one period or one year. Gross Regional Domestic Product per capita is used to measure economic growth in each region to see the welfare of the population on a regional scale. Economic development and economic growth have two aspects that cannot be separated. In economic growth, it can be seen from two things, namely Gross Regional Domestic (GDP) according to constant prices and Gross Regional Domestic (GDP) according to prevailing prices. Gross Regional Domestic (GDP) according to constant prices is economic growth seen from income growth. In the economic growth of a region, it can be seen using GDP per capita data (Marsus et al., 2020).

Regional income statistics used to evaluate development results as the basis for economic development planning in a region are called Gross Regional Domestic Product (GDP) Data. This is because GDP is the sum of the value of products and services collected in one area to be used for final public consumption (BPS East Java, 2022).

Gross regional domestic product of provinces in Indonesia by expenditure of the 2019-2023 edition. The prevailing price GDP can be used in looking at the economic structure, while the constant price GDP is used to determine economic growth from each year (BPS Indonesia, 2024).

### **Infrastructure**

Infrastructure is the main service of a country that allows the realization of economic and social activities through the provision of transportation facilities, public health services, educational services and buildings for community activities. Infrastructure is an important part of economic growth in a country. Discussions about infrastructure often lead to discussions about public goods. Realizing the essence of structure as a public good, the structural concept is compared with the external concept. This situation is similar to the nature of infrastructure provided by the government without direct payment as a group that uses the infrastructure (Amalia, 2022).

In the Indonesian dictionary, the word infrastructure is one word that means a physical building that has a certain function and a building that has a relationship between others. For example, road infrastructure which is one of its functions greatly affects settlements, trade, government and industry. So that in determining infrastructure development in a region, always think about the function and utilization for the community (Berlin et al., 2019).

According to Hudson 1997, infrastructure is a system of public facilities, which is fundamentally aimed at the public to serve and facilitate the community (Warsilan & Noor, 2019). According to Hudson 1997, in infrastructure there are

three types, namely physical infrastructure that has a tangible and real use that comes from the form it has, for example roads and buildings. Then non-physical infrastructure, this infrastructure is infrastructure that benefits and its impact when combined with physical infrastructure, examples of this infrastructure are electricity and clean water infrastructure. The last infrastructure is soft infrastructure, this infrastructure is in the form of an institution or legal institution and other examples are government buildings or public service buildings (Warsilan & Noor, 2019).

### **Long Road Infrastructure**

Based on the R.I Law No.38 of 2004 concerning land transportation infrastructure, it includes everything on the road including buildings located on the shoulder of the road, but with the exception of trains and lorry roads and cable roads. The function of public roads is also distinguished by several things, namely, primary arteries, primary neighborhoods, primary collector roads, secondary collector roads, primary local roads, secondary neighborhood roads, and secondary neighborhood roads (Oktarina, 2020).

In the medium to long-term sector, road infrastructure is the main sector in creating jobs to increase productivity in the economic sector. So that this infrastructure development can encourage the improvement of the quality of education, economy, quality of life and mobility of products and services (Husen & Baranyanan, 2021).

The development of road infrastructure is one of the important needs in the development of land transportation in Indonesia (Asiva, 2015). Road infrastructure is the core or central thing in the development of an area. A good transportation network will bring prosperity in an area. In Law No. 38 of 2004, road construction has three active roles, namely: the first is the role in the economic, socio-cultural, defense and environmental security aspects for the prosperity of the community. Then the second role is in the distribution of goods and services that make road infrastructure the lifeblood of an area. And the last role is as a unity of the network system that binds between regions in Indonesia.

### **Healthcare Facility Infrastructure**

This health infrastructure is one of the factors in achieving health development in Indonesia. In preparation for welfare, the government has prepared a health welfare budget of the Ministry of Health of the Republic of Indonesia which is distributed to each district or city of 5% of the state budget funds which plays a role in helping to improve and develop health infrastructure for the community. The government plays a role in all health budgets, both the salary budget for health workers, and related to the development of health infrastructure which includes an increase in the number of facilities such as hospitals, health centers, and posyandu, as well as other facilities (Reza et al., 2022).

Health infrastructure refers to all services and areas that contribute to public health. One of the supporting factors for the development of a region is health infrastructure. This infrastructure includes health facilities and infrastructure, including: public hospitals and health centers owned by the

government and private sectors. To build a healthy society, adequate health infrastructure is required. With adequate health infrastructure, people can access services quality and affordable health and can reduce the burden of health service costs. In this article, health infrastructure research data uses data from health facilities consisting of government and private hospitals and health centers (Pohan & Halim, 2018).

Health infrastructure is one of the factors affecting economic growth. The uneven health infrastructure greatly affects the services provided by the government to the community. This is because it is difficult for people to reach health facilities if the uneven development of health facilities in a region is uneven. In addition, services in health facilities also affect the role itself, one of which is in medical services, media support, and several things related to health administration. This unequal health infrastructure often occurs due to regional disparities in an area (Lubis et al., 2023).

### **Educational Facility Infrastructure**

Educational Infrastructure is the development and improvement of educational facilities in an area. The purpose of educational infrastructure is to improve access and quality of education in an area, so that children in the area have the opportunity to obtain quality education. Educational infrastructure is a physical infrastructure that can support and support teaching and learning activities in schools. In this article, educational infrastructure research data uses data on educational facilities in the form of the number of government- and private-owned elementary, junior high, high school, and vocational school buildings (Sitorus et al., 2024).

Educational infrastructure is an important determining factor in the growth of a nation's education system. Educational infrastructure includes various physical and non-physical elements that support the teaching and learning process. The influence of Integrated Education Infrastructure on improving the quality of life of the community is very significant. Through the provision of high-quality educational infrastructure, convenient accessibility, and relevant course offerings, individuals can gain the knowledge and competencies necessary to improve their well-being and productivity. Integrated education also opens up economic opportunities, reduces the unemployment rate, and strengthens the social foundation of a community. Over time, this can create a more empowered and quality environment, providing a sustainable positive impact on people's lives (Dhia et al., 2024).

### **Clean Water Distribution Infrastructure**

The need for clean water in an area will increase in proportion to the increase in population growth, this is related to the density of the population so that it can affect social economic activities, and the development of public facilities. However, currently the quality of water is inversely proportional to this fact because

increased population growth, which is related to population density so that it affects economic activities, but in fact the quality of clean water and water sources is inversely proportional to the increase in population growth, especially

in remote rural areas. This condition results in the condition of services in receiving clean water is still very far from fulfilling, so efforts to develop clean water infrastructure in each region are urgently needed (Nelwan et al., 2013).

Based on the Indonesian government regulation Number 42 of 2008 concerning Water Resources Management, it is stated that the unity of the river area for water resources management is divided into rivers and/or small islands whose area is less than or equal to 2,000 km<sup>2</sup>. Then in the watershed is a land area that flows water based on rainfall, naturally limited by topography and sea boundaries (Asiva, 2015).

In this clean water supply system, it is one of the core infrastructure in the city. This infrastructure has a very important role in the growth and development of a city, this is because it can have an impact on improving the quality of life of the community, as well as the pattern of growth and economic development. Clean water is one of the most important priorities in urban planning, which is useful for meeting the household needs of every community (Yasmin, 2023).

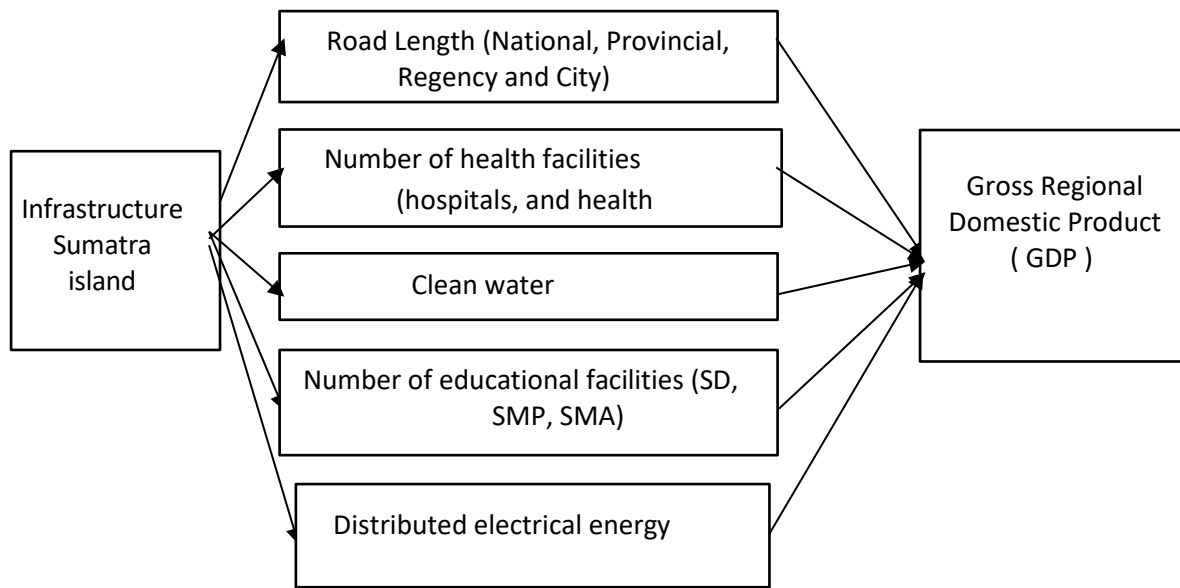
### **Electricity Distribution Infrastructure**

Electricity infrastructure is everything related to electric power generation, electric power transmission, electric power distribution, substations, and other supporting facilities (Presidential Decree No. 19 of 2016, 2016). Electrical infrastructure is a system used to generate and distribute electricity from power plants to consumers. This electrical infrastructure includes power plants, power grids, and power substations. The power grid includes substations, transformers, and power lines that connect power plants with consumers.

The classification of distribution networks is carried out based on the location of the network that functions as a distributor of medium-voltage electricity. Electricity transmission can be in the form of underground cables or aerial wires, this is used to connect substations with distribution substations or connection substations (Syahputra, 2016).

The marketing of PLN's electricity in each region to the community is an effort to meet electricity needs in Indonesia. Based on the results of the calculation of electricity needs for 2003 - 2020 carried out by the system planning office for PT PLN, it was found that so far the average electricity demand in Indonesia has increased to 6.5% every year. In the distribution of electricity itself, it requires an electric power that meets this in order to be able to adjust the electricity reception in each place. In this electricity distribution, a distribution system uses a large enough resource (*Bulk Power Source*) to reach the community (Silalahi et al., 2022).

## Hypothesis and frame of mind



### Simultaneous Hypothesis

H<sub>0</sub> = It is suspected that the infrastructure of long roads, health facilities, educational facilities, distribution of clean water and electricity simultaneously has no effect on the gross regional domestic product

H<sub>a</sub> = It is suspected that the infrastructure of long roads, health facilities, educational facilities, distribution of clean water and electricity simultaneously affects the gross regional domestic product

### Partial hypothesis

H<sub>0</sub> = It is suspected that the infrastructure of long roads, health facilities, educational facilities, distribution of clean water and electricity partially has no effect on the product  
Gross Regional Domestic

H<sub>a</sub> = It is suspected that the infrastructure of long roads, health facilities, educational facilities, distribution of clean water and electricity partially affects domestic product  
Regional Gross

## METHODOLOGY

This type of research is a type of descriptive quantitative research. The data used in this study is secondary data, namely GDP data, on the island of Aceh, precisely in the provinces of Aceh, North Sumatra, West Sumatra, South Sumatra, Riau, Jambi, Bengkulu, Lampung, Bangka Belitung Islands, and Riau Islands in 2019-2022. This data was obtained from BPS (Central Statistics Agency). This study uses the data collection method of literature techniques, the data from this technique is obtained from secondary data, and the main search for data focuses on related data sources.

The analysis methods applied to this study are quantitative descriptive analysis, reference analysis, causality relationships. Descriptive analysis was

carried out to explain the general picture of economic growth. Inferential analysis was carried out to analyze the reciprocal relationship and influence between economic growth and income inequality as well as to analyze the impact of infrastructure development and its determinants on economic growth. Analysis of the causality relationship of the variable (Y) of GDP.

In this study, the data used is panel data in the 2019-2022 period obtained from the central statistical agency which has been further processed. The analysis method used aims to determine the magnitude of the influence of infrastructure development on economic growth in Sumatra, precisely in the provinces of Aceh, North Sumatra, West Sumatra, South Sumatra, Riau, Jambi, Bengkulu, Lampung, Bangka Belitung Islands, and Riau Islands. This data uses panel data, the data used is time series and cross section data. *Common Effects*, *Fixed Effects*, and *Random Effects* will be used in the panel data regression model to determine the probability value of each panel data.

The model specification applied to this study is a model of Linear Regression equations, using *the eviews 13* analysis tool. The specifications of the simultaneous equation model formed are:

$$\text{PDRBit} = \text{B0} + \text{B1 X1} + \text{B2X2} + \text{B3 X3} + \text{B4 X4} + \text{B5X5} + \epsilon \text{less (1)}$$

**Information:**

- PDRBit = GDP on the basis of constant prices of the *ith* province in the *tth* year (million rupiah)
- X1 = The number of road lengths that include national, provincial road lengths, Regencies or cities in Sumatra cover all provinces, namely in Aceh, North Sumantra, South Sumatra, West Sumatra, Riau, Jambi, Bengkulu, Lampung, Bangka Belitung Islands, and Riau Islands. Data units in the form of (km)
- X2 = number of health facilities which include the number of special hospitals, homes general hospitals, inpatient health centers, and non-inpatient health centers in Sumatra which cover each province, namely in Aceh, North Sumatra, South Sumatra, West Sumatra, Riau, Jambi, Bengkulu, Lampung, Bangka Belitung Islands, and Riau Islands.
- X3 = the number of school facilities which includes the number of elementary schools, schools junior high school, and high school. which is in Sumatra which includes each of its provinces, namely in Aceh, North Sumatra, South Sumatra, West Sumatra, Riau, Jambi, Bengkulu, Lampung, Bangka Belitung Islands, and Riau Islands.
- X4 = Distribution of clean water from the publication of Water Statistics per Aceh province, Sumantra North, South Sumatra, West Sumatra, Riau, Jambi, Bengkulu, Lampung, Bangka Belitung Islands, and Riau Islands.
- X5 = Amount of electrical energy distributed in each province in Aceh, Sumantra North, South Sumatra, West Sumatra, Riau, Jambi, Bengkulu, Lampung, Bangka Belitung Islands, and Riau Islands.
- B0, B1, B2, B3, B4, B5 = Regression coefficient.

- $\varepsilon_{it}$  = Disruptor variable (*error term*).
- $i$  = province,  $i = 1, 2, \dots, 34$
- $t$  = year,  $t = 2019, 2020, \dots, 2023$

## RESEARCH RESULT AND DISCUSSION

The results of this study were obtained from the analysis of the merger of time series and cross section data from sample data from 10 provinces on the island of Sumatra, precisely in the provinces of Aceh, North Sumatra, South Sumatra, West Sumatra, Riau, Jambi, Bengkulu, Lampung, Bangka Belitung Islands, and Riau Islands.

### Chow Test

Table 1 Chow Test Results

Redundant Fixed Effects Tests			
Equation: Untitled			
Test cross-section fixed effects			
Effects Test	Statistics	D.F.	Prob.
Cross-section F	49.797032	(9,35)	0.0000
Cross-section Chi-square	131.251365	9	0.0000

Based on the results of the chow test above, a *cross-section F value* of 0.0000 was obtained, which was concluded that if the value was more than 0.05, the test results showed that *the common effect model* method was appropriately used, if *the cross-section F value* was less than 0.05, then *the Regression Fixed Effect Model (FEM)* model was appropriately used.

### Hausman Test

Table 2. Hausman Test Results

Correlated Random Effects - Hausman Test			
Equation: Untitled			
Test cross-section random effects			
Test Summary	Chi-Sq. Statistics	Chi-Sq. D.F.	Prob.
Cross-section random	238.582068	5	0,10508

Based on the results of the hausman test, a random cross-section value of 0.10508 was obtained, which was a greater value than 0.05, this was found that the right model used in this hausman test was the *Regression Random Effect Model (REM)*, this is because the cross section random value is less than 0.05. If the value is more than 0.05, the model used is *the Fixed Effect Model Regression Model (FEM)*

### Lagrange Multiplier (LM) Test

Table 3 Lagrange Multiplier Test Results

Lagrange Multiplier Tests for Random Effects			
Null hypotheses: No effects			
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives			
	Test Hypothesis		

	Cross-section	Time	Both
Breusch-Pagan	2.717515	71.34974	74.06725
	(0.0993)	(0.0000)	(0.0000)

Based on the *Breusch-Pagan* value of 0.0000 which is less than 0.05, this is found that in this LM test the suitable model to use is the *Regression Random Effect Model (REM)*, this is because the data is less than 0.05, if the data obtained is more than 0.05, the right model to use is a *common effect model*.

Table 4. Test Comparison Results

TESTING	CEM	FEM	BRAKE	KET
CHOW TEST		<i>Fixed Effect Model</i>		FEM
HAUSMAN TEST			<i>Random Effect Model</i>	BRAKE
LM TEST			<i>Random Effect Model</i>	BRAKE

From the results of the above tests, namely *the chow* test, the *hausman* test and *the Lagrange Multiplier* test to determine the right model to be used, it was found that the right model to be used was the *Regression Random Effect Model (REM)*.

**Hypothesis test (Random Effect Model (REM) )**

Table 5. Random Effect Model (REM) test results

Periods included: 5					
Cross-sections included: 10					
Total panel (balanced) observations: 50					
Swamy and Arora estimator of component variances					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	Information
X1	-0.013070	0.005979	-2.185847	0.0342	Significant
X2	0.173150	0.036448	4.750619	0.0000	Significant
X3	1.202763	0.041935	28.68174	0.0000	Significant
X4	0.006053	0.024698	0.245079	0.8075	Insignificant
X5	-0.187355	0.042456	-4.412883	0.0001	Significant
C	-1.083089	0.389536	-2.780456	0.0080	Significant
Effects Specification					
			S.D.	Rho	
Cross-section random			0.076756	0.8808	
Idiosyncratic random			0.028233	0.1192	
Weighted Statistics					
R-squared	0.853500	Mean dependent var	2.039917		
Adjusted R-squared	0.836852	S.D. dependent var	0.175563		
S.E. of regression	0.070913	Sum squared resid	0.221258		
F-statistic	51.26811	Durbin-Watson stat	0.692231		
Prob(F-statistic)	0.000000				Significant

Based on the results of the test using the *Random Effect Model (REM) model*, it was found that the variables X1 (road length infrastructure), X2 (health facility infrastructure), X3 (school facility infrastructure), and X5 (electricity)

significantly affected the provincial GDP value, while X4 (clean water distribution) was not significantly influenced by the provincial GDP.

**Normality Test**

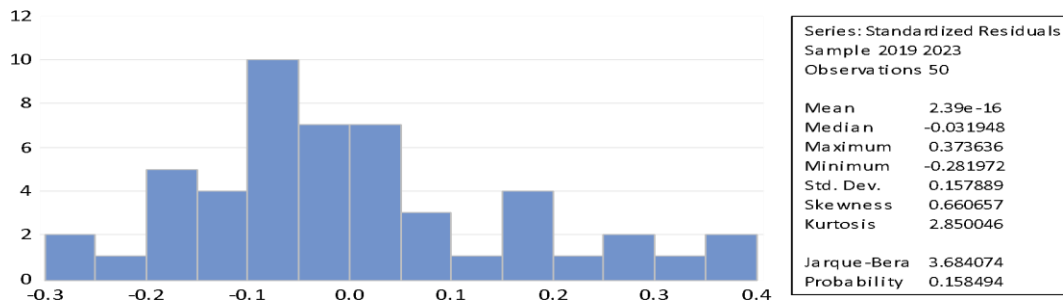


Figure 1. Normality Test Graph

Based on the normality test, it was found that the probability was 0.158494 where the value was greater than 0.05, this can be called normal distributed data.

**Multicollinearity test**

Table 6. Multicollinearity Test Results

Correlation	
X1	1
X2	0.3712263448894652
X3	0.1377559786221209
X4	0.1863859904070342
X5	0.2624278368269252

Based on the multicollinearity test, it was indicated that *the correlation* value of each variable was not below a value of 10, which showed that the model did not experience multicollinearity.

**Analysis of partial results of Road Length Infrastructure (X1), Health Facilities (X2), Education Facilities (X3), Distribution of Clean Water (X4) and Electricity (X5) to Gross Regional Domestic Product (Y)**

Based on the results of panel calculations using a measuring tool using eviwes13, the model used in this study is *Random Effect*. The regression equations used in this study are as follows:

Table 7 Results of Hypothesis test on Y against X1, X2 X3 X4X5

Periods included: 5					
Cross-sections included: 10					
Total panel (balanced) observations: 50					
Swamy and Arora estimator of component variances					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	Information
X1	-0.013070	0.005979	-2.185847	0.0342	Significant

X2	0.173150	0.036448	4.750619	0.0000	Significant
X3	1.202763	0.041935	28.68174	0.0000	Significant
X4	0.006053	0.024698	0.245079	0.8075	Insignificant
X5	-0.187355	0.042456	-4.412883	0.0001	Significant
C	-1.083089	0.389536	-2.780456	0.0080	Significant
Effects Specification					
			S.D.	Rho	
Cross-section random			0.076756	0.8808	
Idiosyncratic random			0.028233	0.1192	
Weighted Statistics					
R-squared	0.853500	Mean dependent var	2.039917		
Adjusted R-squared	0.836852	S.D. dependent var	0.175563		
S.E. of regression	0.070913	Sum squared resid	0.221258		
F-statistic	51.26811	Durbin-Watson stat	0.692231		
Prob(F-statistic)	0.000000				Significant

**Source :** Processed products December 2024

$$PDRB_{it} = B_0 + B_1 x_1 + B_2 x_2 + B_3 x_3 + B_4 x_4 + B_5 x_5 + \epsilon_{it}$$

From the results of the hypothesis above, it is obtained from the equation, which can be interpreted. In the first variable, namely road infrastructure, the *probability* value was obtained as 0.0342, this was concluded that H<sub>0</sub> was rejected H<sub>a</sub> was accepted because the probability value of 0.0006 was smaller than alpha by 5% ( $\alpha = 0.05$ ). This means that the independent variable of road infrastructure (national, provincial, district or city) in all provinces in Sumatra has an effect on the Gross Regional Domestic Product. This is in line with previous research conducted by Kamilla & Hutajulu (2021) and Humayra (2022). According to Atmaja & Mahalli (2015), this happens because the length of the road and the number of vehicles are increasingly inappropriate, the imbalance of road length and the number of vehicles to cause problems that are common in each region so that the growth of The economic development of road infrastructure is carried out appropriately and evenly so that the level of congestion and inefficiency of community activities does not occur or decrease, so that it is found that in Sumatra it is suspected that road construction in each province is evenly distributed in each region.

In the second variable, namely health infrastructure, the probability value was obtained at 0.000, this was concluded that H<sub>0</sub> was rejected and H<sub>a</sub> was accepted because the probability value of 0.0000 was smaller than alpha by 5% ( $\alpha = 0.05$ ). This means that the independent variables of health infrastructure (number of general hospitals, special hospitals, health centers, inpatient health centers, and auxiliary health centers) in all provinces in Sumatra have an effect on the Gross Regional Domestic Product. This is in line with previous research conducted by Aswanto (2023). This health infrastructure variable has a significant effect on this because health infrastructure is one of the social infrastructure that supports the economy of a region. Health is also a concern for us because with healthy conditions we are able to work and think better, so the

budget for health and services needs to be increased every year (Pohan & Halim, 2018).

In the third variable, namely educational infrastructure, the probability value was obtained at 0.0000, this was concluded that H<sub>0</sub> was rejected H<sub>a</sub> was accepted because the probability value of 0.0000 was smaller than alpha by 5% ( $\alpha = 0.05$ ). This means that the independent variable of road infrastructure (number of elementary schools, junior high schools and high schools) in all provinces in Sumatra has an effect on the Gross Regional Domestic Product. This is in line with previous research conducted by Sitorus (2024). Educational infrastructure (Number of Elementary Schools, Junior High Schools and Senior High Schools) is the infrastructure that is the core in a region in supporting the world of education so that economic growth has a real effect on the development of educational infrastructure, besides that the alleged cause of this occurs because the Sumatra region in the development of educational facilities is evenly distributed in each region.

In the fourth variable, namely clean water distribution infrastructure, the probability value was obtained at 0.8075, this was concluded that H<sub>0</sub> was accepted, H<sub>a</sub> was rejected because the probability value of 0.8075 was greater than alpha by 5% ( $\alpha = 0.05$ ). This means that the independent variables of road infrastructure (national, provincial, district or city) in all provinces in Sumatra have no effect on the Gross Regional Domestic Product. This is in line with previous research conducted by Kamilla & Hutajulu (2021) and Keusuma & Suriani (2015). The absence of a significant influence of clean water distribution infrastructure on direct economic growth in the provinces in Sumatra is suspected to be due to the uneven development of clean water distribution infrastructure in Sumatra. However, this clean water distribution infrastructure is important for the community even though it is not economically significant.

In the last variable, namely the electrical energy distribution infrastructure, the probability value was obtained at 0.0001, it was concluded that H<sub>0</sub> was rejected H<sub>a</sub> was accepted because the probability value of 0.0001 was smaller than alpha by 5% ( $\alpha = 0.05$ ). This means that the independent variable of electrical energy distribution infrastructure in all provinces in Sumatra has an effect on the Gross Regional Domestic Product. This is in line with previous research conducted by Kamilla & Hutajulu (2021) and Humayra (2022). According to research conducted by Yanti (2018), it was found that in the field of industry and settlements Electrical energy is very important in meeting needs, for example in turning on lights, machines or electronic and industrial tools

**Simultaneous analysis of the results of Road Length Infrastructure (X1), Health Facilities (X2), Education Facilities (X3), Distribution of Clean Water (X4) and Electricity (X5) to Gross Regional Domestic Product (Y)**

Table 8. Simultaneous Hypothetical Results

Weighted Statistics			
R-squared	0.853	Mean	2.039917
	500	dependent var	

Adjusted R-squared	0.836	S.D. dependent var	0.175563
S.E. of regression	0.070	Sum squared resid	0.221258
F-statistic	51.26	Durbin-Watson stat	0.692231
Prob(F-statistic)	0.000		Significant

From the data of the hypothesis table, a probability value of GDP of 0.0000 was obtained simultaneously, so it was explained that H<sub>0</sub> was rejected and H<sub>a</sub> was accepted. This means that infrastructure variables in the field of Economic Growth affect the Gross Regional Domestic Product.

## CONCLUSIONS AND RECOMMENDATIONS

The conclusions of this study are:

1. In the results of the research that has been carried out, it is concluded that this study has a simultaneous effect where the relationship with the independent variables, namely Road Length Infrastructure (X<sub>1</sub>), Health Facilities (X<sub>2</sub>), Educational Facilities (X<sub>3</sub>), Clean Water Distribution (X<sub>4</sub>) and Electricity (X<sub>5</sub>) to the bound variable, namely Gross Regional Domestic Product (Y).
2. In the test results, each variable is bound to the variables of Road Length (X<sub>1</sub>), Health Facilities (X<sub>2</sub>), Educational Facilities (X<sub>3</sub>), ]And electricity (X<sub>5</sub>) has a significant effect on the Gross Regional Domestic Product (Y), while in the Clean Water Distribution test (X<sub>4</sub>) on the Gross Regional Domestic Product (Y) has no real effect, it is suspected that the facilities or infrastructure for Clean Water Distribution in Sumatra have not been evenly distributed.

## ADVANCED RESEARCH

The operational limitations carried out in this study are as follows:

1. The study observed the relationship of independent variables to the gross regional domestic product on the island of Sumatra precisely in 10 provinces (Aceh, North Sumatra, South Sumatra, West Sumatra, Riau, Jambi, Bengkulu, Lampung, Bangka Belitung Islands, and Riau Islands)
2. The research observed in the form of the number of road lengths covering the length of national, provincial, regency or city roads in Sumatra covering all provinces, namely in Aceh, North Sumantra, South Sumatra, West Sumatra, Riau, Jambi, Bengkulu, Lampung, Bangka Belitung Islands, and Riau Islands. Data units in the form of (km)
3. The research observed was in the form of a number of health facilities which included the number of special hospitals, general hospitals, inpatient health centers, and non-inpatient health centers in Sumatra which covered each province, namely in Aceh, North Sumatra, South Sumatra, West Sumatra, Riau, Jambi, Bengkulu, Lampung, Bangka Belitung Islands, and Riau Islands.

4. The research observed is in the form of infrastructure for the number of school facilities which includes the number of elementary schools, junior high schools, and high schools. who are in Sumatra which covers each of its provinces, namely in Aceh, North Sumatra, South Sumatra, West Sumatra, Riau, Jambi, Bengkulu, Lampung, Bangka Belitung Islands, and Riau Islands.
5. The research observed is in the form of the amount of electrical energy infrastructure distributed in each province in Aceh, North Sumantra, South Sumatra, West Sumatra, Riau, Jambi, Bengkulu, Lampung, Bangka Belitung Islands, and Riau Islands.
6. The research observed is in the form of clean water distribution infrastructure from the publication of Water Statistics per province of Aceh, North Sumatra, South Sumatra, West Sumatra, Riau, Jambi, Bengkulu, Lampung, Bangka Belitung Islands, and Riau Islands
7. The Gross Regional Domestic Product (GDP) used is the Gross Regional Domestic Product Rate in percent of constant base prices, with observations for 2019-2022.

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