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THE INFLUENCE OF INFRASTRUCTURE ON FOREIGN DIRECT INVESTMENT IN INDONESIA

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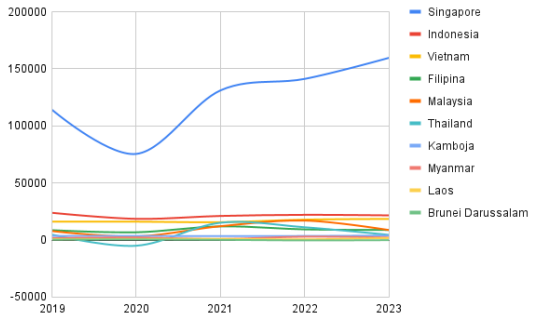
Abstract: Foreign Direct Investment (FDI) refers to capital investment made by foreign entities in a host country through the establishment or acquisition of a company, with the intention of directly managing and controlling the business operations. The growth of FDI in a country can be influenced by various factors, one of which is infrastructure development. This study aims to analyze the influence of road, telecommunications, electricity, and clean water infrastructure on Foreign Direct Investment (FDI) in Indonesia, both simultaneously and partially. The study was conducted in Indonesia over a 21-year observation period from 2003 to 2023. The dependent variable is foreign direct investment in Indonesia, while the independent variables include total road length, number of telephone connections, volume of distributed electricity, and volume of clean water supply. This study employs a literature review approach using secondary data and applies descriptive analysis and multiple linear regression techniques. The results indicate that, simultaneously, all four infrastructure variables significantly affect FDI in Indonesia. However, partially, only the volume of clean water shows a statistically significant influence on FDI. The variables of road length, telephone connections, and electricity distribution do not exhibit significant effects. These findings suggest that basic infrastructure such as clean water plays a crucial role in attracting foreign investment, while traditional infrastructure indicators need to be re-evaluated in the digital era. Therefore, enhancing the quality and accessibility of infrastructure particularly basic infrastructure that supports industrial needs constitutes an essential strategy for promoting FDI growth in Indonesia.
Keywords: Infrastructure, Foreign Direct Investment, Roads, Telecommunications, Electricity, Clean Water

INTRODUCTION

An open economy, marked by active participation in international trade and global integration, has become one of the main drivers of economic growth in the modern era. Such openness allows countries to leverage comparative advantages, expand export markets, increase production efficiency, and access technologies and innovations from other nations. Countries with open economies tend to experience faster productivity gains and economic growth compared to those with protectionist policies (Ahmad et al., 2024). Investment is inherently linked to the functioning of an open economy.

Investment refers to the expenditure on various production equipment and capital goods with the aim of replacing and increasing the capital stock in the economy, which will be used to produce goods and services in the future (Sukirno, 2000: 366). Foreign investment is defined as capital investment carried out by foreign investors within a country to gain profit from the business operations they undertake (Irawan and Suparmoko, 1992). Essentially, there are two types of foreign investment: portfolio investment and foreign direct investment (FDI). Investment is described as an addition to the capital stock that will generate future income (Samuelson & Nordhaus, 2019: 410–412). Investment is one of the solutions to help close development gaps and promote economic growth in a country.

Foreign Direct Investment (FDI) tends to be more beneficial and less burdensome for a country's economy compared to debt-based financing methods such as loans, development funding, and export credits, which constitute national debt (Osmosola, 2018). Foreign investment is inseparable from economic cooperation or relationships between countries. A notable example of such cooperation is the ASEAN region. ASEAN was initially established to maintain political and security stability in Southeast Asia. However, over time, ASEAN has increasingly focused on strengthening economic cooperation to enhance regional growth and global competitiveness.

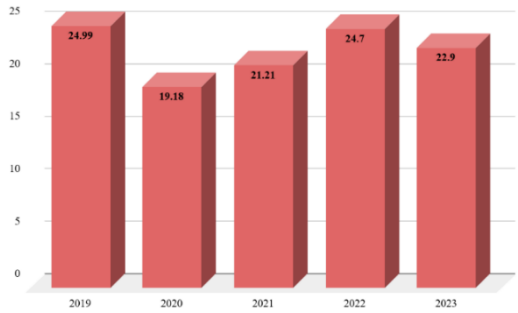


Source: ASEAN Statistical Yearbook, Data processed 2024

Picture 1. FDI Development in ASEAN 2019 to 2023 (billion million US$)

Based on Figure 1 above, it shows that the level of foreign direct investment in the ASEAN region is still fluctuating, both in developed and developing countries. ASEAN countries are open to economic cooperation, one of which is foreign direct investment (FDI) which is part of a strategy to accelerate economic growth, increase competitiveness, and create jobs. With various policies and economic integration that have been carried out, ASEAN is now one of the most attractive regions for global investors. From the existing figure, it can be seen that foreign investment in real form is very much needed by developing countries such as Indonesia, Indonesia is a developing country in the ASEAN region that has a fairly high level of foreign direct investment compared to other developing ASEAN countries.

Indonesia has many collaborations with many other countries that provide many benefits to Indonesia's economic growth. One of the collaborations carried out by Indonesia is by joining ASEAN and playing an active role in it. The large amount of investment entering Indonesia can help accelerate economic growth. With this foreign investment, it is hoped that development can run well and rapidly, because relying on domestic capital is considered insufficient. According to World Bank data, the development of foreign direct investment (FDI) in Indonesia has grown since the last 3 years.



Source: World Bank, Data processed 2023

Picture 2. FDI Development in Indonesia 2019 to 2024 (Billion US$)

During the 2019–2023 administration period, Indonesia's Foreign Direct Investment (FDI) showed fluctuating trends. This can be observed in the FDI growth rate of 2020, which reached only USD 19.18 billion, a decrease from USD 24.99 billion in 2019. In 2022, Indonesia's FDI rose to USD 24.7 billion, but in 2023 it declined by 10.57% to USD 22.09 billion. Nevertheless, in terms of realization, FDI in Indonesia has shown an overall increasing trend over the years.

As a developing country, Indonesia highly relies on foreign investment to support its economic growth and development, aiming to catch up with developed nations. This aligns with Sarwedi's (2002) research, which asserts that Indonesia, as a developing country, requires substantial capital to carry out national development, especially to bridge the gap in various sectors compared to developed countries, both regionally and globally.

Countries that are open to Foreign Direct Investment (FDI) often succeed in accelerating infrastructure development and improving the quality of human capital through knowledge transfer and advanced technology. In the context of infrastructure development, the construction and enhancement of infrastructure are crucial for any nation. Infrastructure development refers to the process of building or expanding physical facilities, systems, and essential services needed to support economic activities, social development, and public life.

Technically, infrastructure is defined as physical assets organized within a system to provide essential public services. Therefore, infrastructure comprises interconnected facilities and networks that are integral components of a larger system. According to Grigg (1988), infrastructure includes physical systems that provide transportation, irrigation, drainage, buildings, and other public facilities necessary to meet fundamental human needs—both social and economic. Infrastructure reflects the efficiency of a country's economy; weak infrastructure often correlates with inefficiencies in economic operations. J'afar M. (2007) argues that infrastructure positively contributes to short-term economic growth by creating construction-related employment and supporting related sectors.

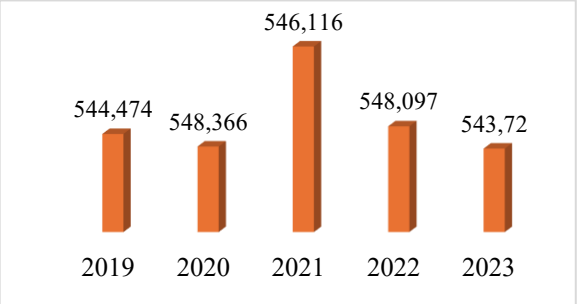
The World Bank (1994) classifies economic infrastructure as infrastructure developed to support economic activity, including public utilities (electricity, telecommunications, water, sanitation, gas), public works (roads, dams, canals, irrigation, and drainage), and transportation sectors (roads, railways, ports, airports, etc.).

From 2014 to 2024, Indonesia's seventh president, Joko Widodo, has undertaken large-scale infrastructure development, as reflected in the significant increase in infrastructure budget allocations—from IDR 163 trillion in 2014 to IDR 392 trillion, a rise of 131.95%. The government also reoriented infrastructure development from a centralized to a decentralized model, distributing infrastructure projects more evenly across remote regions of Indonesia. This strategy is expected to establish a strong foundation for advancing the national economy. A well-functioning infrastructure system is essential to support the daily economic activities of the population.

According to Tambunan (2006), several factors significantly influence the investment climate in Indonesia. These factors include not only political and social stability but also economic stability and the quality of basic infrastructure such as electricity, telecommunications, water supply, roads, and ports. Thus, infrastructure is viewed as a system of interdependent facilities and networks.

Infrastructure availability is also a critical consideration for potential investors. Adequate infrastructure can significantly attract foreign investors. Research by Ahmad et al. (2015) highlights that infrastructure has garnered increasing attention due to its vital role in investment decisions. Developing countries are likely to face substantial challenges integrating with the global economy without high-quality and adequate infrastructure.

Infrastructure development is one of the key pillars in promoting economic growth in Indonesia, particularly in attracting Foreign Direct Investment (FDI). Adequate infrastructure such as roads, telecommunications, electricity, and clean water—plays a strategic role in enhancing operational efficiency, improving connectivity, and supporting business activities. For instance, road length indicates the level of accessibility and interregional connectivity within Indonesia.



Source: Central Statistics Agency, Data processed 2024

Figure 3. Development of Road Length in Indonesia 2019 to 2023 (kilometers)

Based on Figure 3 above, it shows that the development of the number of paved roads in Indonesia has decreased, seen in 2021 there was an increase in the length of roads in Indonesia by 546.116 KM and decreased until 2023 to 543.72 KM. According to data from the Central Statistics Agency (BPS) of Indonesia, the development of roads in Indonesia in 2023 reached 47,763.20 km and has always increased every year. Over the past two decades, the length of roads in Indonesia has increased by 57.54%, reaching 548,366 thousand km in 2020.

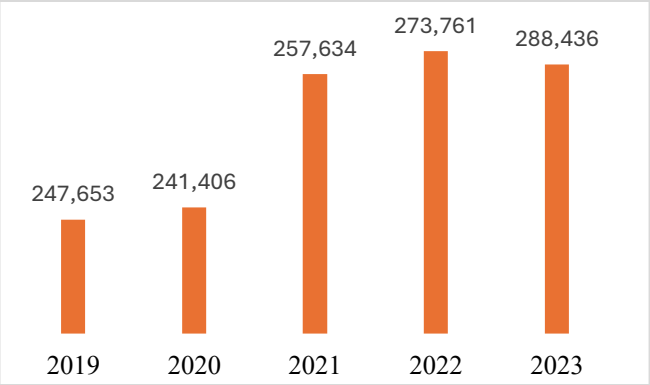
Roads are vital facilities in supporting development between regions. Ease of access caused by the availability of roads will automatically have a positive impact on the continuity of economic transactions between regencies/cities in each province. A good road system provides an advantage for a country or region to compete competitively in marketing its products, developing its industry, distributing the population and increasing income. With a good road network, the distribution of goods and mobility of workers can run more efficiently, which is an attraction for foreign investors (Sembanyang, 2011).

According to Eni Setyowati (2001), the increase in national economic growth is also caused by technological developments. Based on the World Economic Forum (WEF) Report, countries that follow technological developments are superior economically and in social development. It is meant that if a country wants to progress, it must follow technological developments. The digitalization era has proven that technological developments have been very rapid in recent years. Technology offers conveniences that have not been obtained before, especially in terms of information and communication.

According to Prasetyo (2019), telecommunications infrastructure as measured by mobile phone user indicators also contributes significantly to facilitating smooth communication and supporting modern business operations. Telecommunications infrastructure can reflect the level of telecommunications penetration in a country. Looking at the level of telecommunications in Indonesia, the number of mobile phone subscribers in Indonesia is 352 million subscribers, while the number of fixed line telephone subscribers is 9.16 million subscribers in 2023. According to the Central

Statistics Agency of Indonesia, Indonesian mobile phone subscribers continue to increase from 2018 by 319.43 million subscribers and increase to 365.87 million subscribers in 2021. However, it decreased in 2022 by 6.22 percent and increased again to 352.16 million subscribers in 2023. The increase in the number of mobile phone subscribers in Indonesia shows the growth of telecommunications penetration, which is an important supporting factor in attracting foreign investment.

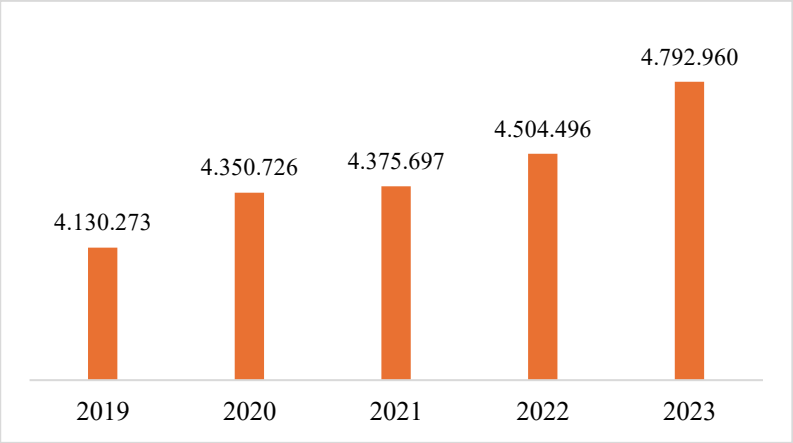
Indonesia, which is located in a region of tectonic plate collisions and the equator, makes this country have huge geothermal energy reserves, but the utilization of Indonesia's new renewable geothermal energy nationally is only around 2,130 MW of Indonesia's total new renewable geothermal energy potential of 23.9 GW. According to Rahayu (2023), the implementation of foreign investment policies is in line with increasing energy consumption as well as population and economic growth in a country. The utilization and consumption of this energy can be seen from the national electrification ratio in a country.



Source: BPS, Data processed 2024

Picture 3. Development of the Amount of Electricity Distributed in Indonesia from 2019 to 2023 (GWh)

Based on Figure 4 above shows the availability of electricity in Indonesia, the development of the amount of electricity that has been distributed in Indonesia has increased in 2023, shown in 2022 at 273,761 GWh and increased by 5.36% to 288,436 GWh. This shows that the need for electricity plays a major role in the lives of the Indonesian people. Looking at the national electrification ratio, it says that Indonesia's national electrification ratio has reached 99.78 percent in 2023, up from 99.67 percent in 2022. The availability of adequate electricity is a fundamental aspect because it can ensure that companies can operate without interruption, which is a determining factor for foreign investors in choosing investment locations so that investors are more interested in countries with good electricity infrastructure because it ensures the sustainability of company operations.



Source: BPS, Data processed 2024

Picture 4. Development of Clean Water Volume in Indonesia 2019 to 2023 (m3)

Based on Figure 5, it shows that clean water infrastructure has increased from year to year, it can be said that the availability of clean water in Indonesia has begun to increase and is evenly distributed in Indonesia. Water infrastructure is also a crucial aspect in viewing infrastructure development. Adequate water infrastructure ensures the availability of clean water for industrial needs, which in turn increases the country's attractiveness to foreign investors. With good water availability, it will show a country's economic growth and can attract more foreign investors (Ma'aruf & Daud, 2013). The availability of clean water can reduce operational costs for foreign companies and increase production efficiency. This makes countries with good water infrastructure more competitive in the eyes of foreign investors.

The combination of development and adequate infrastructure development can play an important role in attracting foreign direct investment or FDI, which not only brings capital, but also technology transfer, job creation, and increasing Indonesia's competitiveness in the global market. So with adequate infrastructure such as roads, electricity, telecommunications, and clean water are important foundations that support the smooth running of economic activities. With good infrastructure, logistics costs can be reduced, accessibility increased, and production efficiency can be achieved, thus attracting foreign investors.

METHOD

This study employs a quantitative approach with a descriptive method to analyze the impact of infrastructure on Foreign Direct Investment (FDI) in Indonesia over the period 2003–2023. The data used are secondary in nature and obtained from the Central Bureau of Statistics (Badan Pusat Statistik/BPS) and the World Bank. The independent variables in this study include road length (X1), telecommunications users (X2), electricity distribution (X3), and clean water volume (X4), while the dependent variable

is Foreign Direct Investment (Y). All data are analyzed in time series form, consisting of 100 observations.

The data testing process was conducted in stages, beginning with a stationarity test using the Augmented Dickey-Fuller (ADF) method to ensure data stability. Subsequently, multiple linear regression analysis was carried out using the Ordinary Least Squares (OLS) method to determine both the simultaneous and partial effects of the independent variables on FDI. This study also applies classical assumption tests, including tests for normality, multicollinearity, autocorrelation, and heteroscedasticity, to ensure the validity of the regression model.

To assess the statistical significance of the model, F-tests (for simultaneous significance) and t-tests (for partial significance) were employed, along with the coefficient of determination (R^2) to evaluate the explanatory power of the independent variables on the variation in FDI. Significance testing was conducted at a 5% significance level, and the results indicate whether infrastructure variables—such as roads, telecommunications, electricity, and clean water—have a significant effect on FDI in Indonesia. The regression model is considered robust if it satisfies the BLUE (Best Linear Unbiased Estimator) criteria and passes all classical assumption tests.

RESULTS AND DISCUSSION

Results of Analysis of Research Data

Descriptive Analysis

Table 1. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std Deviation
Foreign Direct Investment	21	-596,9238	25120.73	15097.37	8600,679
Total Length of Road	21	0.358000	0.548000	0.488095	0.063695
Number of Telephone Connections	21	41,60000	446,2470	266,9825	128,3669
Amount of Electricity Distributed	21	0.036000	0.288000	0.173095	0.081076
Clean Water Volume	21	0.594000	4,792000	3.051952	1.079747
Valid N (listwise)	21				

Based on the results of the descriptive statistical test presented in Table 1, the number of observations (N) is 21. This indicates that there are 21 observation data points, covering the period from 2003 to 2023. The descriptive statistics for the research variables—namely, road length, number of telephone connections, amount of

electricity distributed, clean water volume, and foreign direct investment in Indonesia—are explained as follows:

1. Foreign Direct Investment Variable (Y)

   The average value of foreign direct investment (FDI) in Indonesia is 15,097.37. This means that the average FDI value in Indonesia over the 21-year period from 2003 to 2023 is approximately US$150 million. The minimum FDI value is -596.92 million US dollars, which occurred in 2003, indicating a possible deficit. The maximum FDI value is 25,120.73, meaning the highest FDI recorded in Indonesia reached US$25 billion in 2014.

2. Road Length Variable (X1)

   The average road length in Indonesia is 0.488095, indicating an average road length of 488.095 kilometers over the 21-year study period (2003–2023). The minimum road length is 0.358000, or 358.000 kilometers, which occurred in 2003. The maximum road length is 0.548000, or 548.000 kilometers, recorded in 2020.

3. Number of Telephone Connections Variable (X2)

   The average number of telephone connections in Indonesia is 266.9825, indicating an average of 266.98 connections during the 21-year research period. The minimum number of telephone connections is 41.60000, or 41.6 connections, which occurred in 2004. The maximum number is 446.2470, or 446.25 connections, recorded in 2017.

4. Amount of Electricity Distributed Variable (X3)

   The average amount of electricity distributed is 0.173095, or 173.095 GWh, over the period from 2003 to 2023. The minimum value is 0.036000, or 36.000 GWh, which occurred in 2003. The maximum value is 0.288000, or 288.000 GWh, recorded in 2023.

5. Clean Water Volume Variable (X4)

   The average clean water volume is 3.051952, which means the average clean water volume in Indonesia over the 21-year period is 3,051 m^3. The minimum volume is 0.594000, or 594.000 m^3, recorded in 2016. The maximum volume is 4.792000, or 4,792 m^3, which occurred in 2023.

Stationary Test Results

Stationary test is a crucial step in time series data analysis to ensure that the data used meets one of the basic assumptions in the time series model: stationarity. As explained by Gujarati & Porter (2012), a time series data is said to be stationary if it has a mean value and variance that are constant over time and a covariance that only depends on the lag, not on the actual time. The following are the results of the stationary test from this study:

Foreign Direct Investment

Table 2. Foreign Direct Investment Stationary Test Results

		t-Statistic	**Prob.***
Augmented Fuller	Dicky	-2,287895	0.1849

It is known that the foreign direct investment variable has an Augmented Dicky Fuller (ADF) Prob Value at the unit level of 0.1849 (>0.05), so it can be concluded that the data does not pass the Stationary Test, so the First Difference approach is used.

Table 3. Results of the First Difference Approach to Foreign Direct Investment

		t-Statistic	**Prob.***
Augmented Fuller	Dicky	-5,913128	0.0001

After the First Difference approach was carried out, the foreign direct investment variable has a Prob. Value of 0.0001 (<0.05) so it can be concluded that the data has passed the Stationary Test.

Total Length of Road

Table 4. Stationary Test Results Total Road Length

		t-Statistic	**Prob.***
Augmented Fuller	Dicky	-4.264696	0.0033

It is known that the variable of the number of road lengths has an Augmented Dicky Fuller (ADF) Prob Value at the unit level of 0.0038 (<0.05), so it can be concluded that the data passes the Stationary Test.

Number of Telephone Connections

Table 2. Stationary Test Results Number of Telephone Connections

		t-Statistic	Prob.*
Augmented Fuller	**Dicky**	-1.393349	0.5646

It is known that the variable number of telephone connections has an Augmented Dicky Fuller (ADF) Prob Value at the unit level of 0.5646 (>0.05), so it can be concluded that the data does not pass the Stationary Test, so the First Difference approach is carried out.

Table 6. First Difference Approach Results Number of Telephone Connections

	t-Statistic	Prob.*
Augmented Dicky Fuller	-4.445087	0.0028

After the First Difference approach was carried out, the variable number of telephone connections had a Prob. Value of 0.0028 (<0.05) so it can be concluded that the data has passed the Stationary Test.

Amount of Electricity Distributed

Table 3. Stationary Test Results of the Amount of Electricity Distributed

	t-Statistic	Prob.*
Augmented Dicky Fuller	-0.971566	0.7421

It is known that the variable of the amount of electricity distributed has an Augmented Dicky Fuller (ADF) Prob Value at the unit level of 0.7426 (>0.05), so it can be concluded that the data does not pass the Stationary Test, so the First Difference approach is carried out.

Table 4. Results of the First Difference Approach: The Amount of Electricity Distributed

	t-Statistic	Prob.*
Augmented Dicky Fuller	-5,055351	0.0008

After the First Difference approach was carried out, the variable of the amount of electricity distributed had a Prob. Value of 0.0008 (<0.05) so it can be concluded that the data has passed the Stationary Test.

Clean Water Volume

Table 9. Clean Water Volume Stationary Test Results

	t-Statistic	Prob.*
Augmented Dicky Fuller	-2.401543	0.1536

It is known that the clean water volume variable has an Augmented Dicky Fuller (ADF) Prob Value at the unit level of 0.1537 (>0.05), so it can be concluded that the data does not pass the Stationary Test, so the First Difference approach is carried out.

Table 10. Results of the First Difference Approach to Clean Water Volume

	t-Statistic	Prob.*
Augmented Dicky Fuller	-7,409301	0.0000

After the First Difference approach was carried out, the clean water volume variable had a Prob. Value of 0.0000 (<0.05), so it can be concluded that the data has passed the Stationary Test.

Multiple Linear Regression Analysis

Table 5. Multiple Linear Regression Results

Variable	Coefficient	Std.Error
C	4968,322	10534.05
X1	-12740.72	20805.28
D(X2)	13.22462	31.91517
D(X3)	133821.4	76105.15
D(X4)	4498,386	1179,809

Based on the results of multiple linear regression analysis as presented in the table, the following structural equation can be formed:

$\hat{Y}$ =4968.322+ -12740.72X1 + 13.22462X2 + 133821.4X3 + 4498.386X4 +ŭ….

From this equation, we can see the magnitude of the influence of each variable, the Total Length of Road (X_1), Number of Telephone Connections (X2), Amount of Electricity Distributed (X3), and Volume of Clean Water (X4) on Foreign Direct Investment in Indonesia (Y) with the following interpretation:

ß0 = 4968.322 : It means that if all independent variables (X1, X2, X3, X4) are zero, then the value of foreign direct investment in Indonesia is estimated at 4968.322 billion US Dollars. This is the basic value of foreign direct investment if there are no other variable assumptions in this case are the Number of Road Lengths (X1), Number of Telephone Connections (X2), Number of Electricity Distributed (X3), and Number of Clean Water Volume (X4)

ß1 = -12740.72 : It means that every 1 kilometer (KM) increase in road length in Indonesia will reduce the value of Foreign Direct Investment in Indonesia by 12740.72 billion million dollars assuming other variables remain constant. This could indicate that road construction has not directly impacted the influx of foreign direct investment or there are other factors that make road construction less efficient.

ß2 = 13.22462 : It means that every 1 million additional telephone connections in Indonesia will increase the value of Foreign Direct Investment in Indonesia by 13.22462 billion million dollars. This shows that telecommunications infrastructure plays a positive role in increasing foreign direct investment in Indonesia.

ß3 =133821.4 : It means that every additional 1 GWH of electricity distributed in Indonesia will increase the value of Foreign Direct Investment in Indonesia by 133821.4 billion million dollars. This is an influence that indicates that electricity is a very important variable in supporting foreign direct investment in Indonesia.

ß4 =4498.386: It means that every additional 1 thousand m3 of clean water distributed in Indonesia will increase the value of Foreign Direct Investment in Indonesia by 4498.386 billion million dollars. This shows that the availability of clean water is also an important factor in supporting foreign direct investment.

Normality Test

Table 12. Normality Test Results

Jarque-Bera	0.398787
Probability	0.819227

The results of the normality test in table 12 obtained a Jarque-Bera Probability value of 0.8192, where this figure is greater than (>0.05) so it can be concluded that the residuals are normally distributed or pass the Normality Test.

Multicollinearity Test

Table 6. Multicollinearity Test Results

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	1.11E+08	83.16958	NA
X1	4.33E+08	80.38157	1.027823
X2	1018,578	1.244062	1.082890
X3	5.77E+09	2.028752	1,339654
X4	1391949	1.272596	1.254709

The test results show that the tolerance value of each variable is smaller than (<10.00). This indicates that there is no correlation between the independent variables or passes the Multicollinearity Test.

Autocorrelation Test

Table 7. Autocorrelation Test Results

F-Statistic	0.560204	Prob. F(2,13)	0.5971
Obs*R-squared	1.586935	Chi-Square Prob.(2)	0.4665

The output results above show the value of the Prob. Chi-Square (2) of 0.4665, which is greater than (> 0.05), so it can be said that there is no autocorrelation problem in this study or it passes the Autocorrelation Test.

Heteroscedasticity Test

Table 15. Heteroscedasticity Test Results

F-Statistic	0.717538	Prob. F(4,15)	0.5930
Obs*R-squared	3,212230	Chi-Square Prob.(4)	0.5230
Scaled explained SS	1.856305	Chi-Square Prob.(4)	0.7622

Based on table 15, it is known that the Probability Obs*R-squared value is0.5230 (>0.05) then it can be concluded that there is no similarity between variables or passes the Heteroscedasticity Test.

Simultaneous Regression Coefficient Significance Test (F Test)

1) Hypothesis formulation
   H0 :ß1 = ß2 = ß3 = ß4 = 0 , meaningtotal length of road (X1), number of telephone connections (X2), amount of electricity distributed (X3), and volume of clean water (X4)has no impact on Indonesian foreign direct investment.
   H1, at least one of:ß1≠ 0 (I = 1, 2, 3, 4) means the length of roads (X1), number of telephone connections (X2), amount of electricity distributed (X3), and volume of clean water (X4) have an effect on foreign direct investment in Indonesia.
2) Real level
   The actual level used (α) = 5 percent or 95 percent confidence level with degrees of freedom of the numerator V1 = (k-1) and degrees of freedom V2 = (nk), then Ftable (α) (V1, V2) then Df = (6-1) = 5, (nk) = (21-6) = 15. Thus Ftable with df = (5) (15) is 2.90
3) Testing criteria
   H0 is accepted if Fcount ≤ 2.90 or p ≥ 0.05
   H0 is rejected if Fcount ≥ 2.90 or p ≤ 0.05
4) Calculation
   The results of the simultaneous test of this study can be seen in table 4.16

Table 16. Simultaneous Test

R-Squared	0.511719	Mean dependent variable	1134,142
Adjusted R-squared	0.381511	SD dependent var	6568,903
SE of regression	5166,053	Akaike information criterion	20,14992
Sum squared residual	4.00E+08	Black criterion	20.39886
Log likelihood	-196,4992	Hannan-Quinn Criterion	20,19852

F-statistic	3.930006	Durbin-Watson stat	2,106269
Prob(F-statistic)	0.022371		

5) Conclusion

From the processed E-Views data, the result of Fcount = 3.930006 with a significance of 0.0223 was obtained. Therefore, Fcount (3.930) > Ftable (2.90) or a significance value of 0.02 < 0.05, then H0 is rejected and H1 is accepted. This means thatThe length of roads (X1), the number of telephone connections (X2), the amount of electricity distributed (X3), and the volume of clean water (X4) simultaneously have a significant effect on Indonesian foreign direct investment.

T-statistic test (Partial Effect)

Partial regression test (t-test) is conducted to test the partial influence or each variable. the number of road lengths (X1), the number of telephone connections (X2), the amount of electricity distributed (X3), and the volume of clean water (X4) on Indonesia's foreign direct investment (Y) with the assumption that other independent variables are considered constant. The results of the partial testing of this study can be seen in table 4.17

The results of partial influence (t-test). The constant is4889,279This means that if the value of the total length of roads (X1), the number of telephone connections (X2), the amount of electricity distributed (X3), and the volume of clean water (X4) is 0, then the value of Indonesia's foreign direct investment is4889,279billion million dollars.

1) The effect of road length on Indonesian foreign direct investment

The steps in analyzing the relationship between the length of roads and Indonesian foreign direct investment partially are as follows:

a. Hypothesis Formulation

H0 :ß1 = 0, meaning that the variable of the number of road lengths (X1) has no partial effect on Indonesian foreign direct investment.

H1 :ß1 > 0, meaning that the variable of the number of road lengths (X1) has a partial positive effect on Indonesian foreign direct investment.

b. Determining the real level (α) = 5% using a one-sided test, namely the right side. With a real level of(α) = 5% or a 95% confidence level and degrees of freedom (nk) = (21-6), then t table =1,753

c. Testing Criteria

H0 is accepted if the value± tcount ≤ 1.753 or p ≥ 0.05.

H0 is rejected if the value± tcount ≥ 1.753 or p ≤ 0.05.

d. Based on calculations using the E-Views program, the calculated result for the total length of the road is-0.612379≤1.753 with a significant value of 0.5495 ≥ 0.05

e. Conclusion

Based on the results of the analysis of the influence of the length of roads on Indonesian foreign direct investment, a significance value of 0.54 ≥ 0.05 was obtained with t count =-0.6123≤ 1,753. The partial length of roads does not have a significant effect on Indonesian foreign direct investment.

2) **The influence of the number of telephone connections on Indonesian foreign direct investment**

a. Hypothesis Formulation
   H0 :ß1 = 0, meaning the variablenumber of telephone connections (X2) partially has no effect on Indonesian foreign direct investment.
   H1 :ß1 > 0, meaning the variablenumber of telephone connections (X2)partially has a positive effect on Indonesian foreign direct investment.
b. Determining the real level (α) = 5% using a one-sided test, namely the right side. With a real level of(α) = 5% or a 95% confidence level and degrees of freedom (nk) = (21-6), then t table =1,753
c. Testing Criteria
   H0 is accepted if the value± tcount ≤ 1.753 or p ≥ 0.05.
   H0 is rejected if the value± tcount ≥ 1.753 or p ≤ 0.05.
d. Based on calculations using the E-Views program, the calculated result for the number of telephone connections was0.414368≤ 1.753 with significant value0.6845≥ 0.05
e. Conclusion
   Based on the results of the analysis of the influence of the number of telephone connections on direct foreign investment in Indonesia, a significance value of 0.68≥ 0.05 with tcount =0.4143≤ 1,753. The number of telephone connections partially does not have a significant effect on Indonesia's foreign direct investment.

3) **The influence of the amount of electricity distributed on Indonesian foreign direct investment**

a. Hypothesis Formulation
   H0 :ß1 = 0, meaning the variableamount of electricity distributed (X3)partially has no effect on Indonesian foreign direct investment.
   H1 :ß1 > 0, meaning the variableamount of electricity distributed (X3)partially has a positive effect on Indonesian foreign direct investment.
b. Determining the real level (α) = 5% using a one-sided test, namely the right side. With a real level of(α) = 5% or a 95% confidence level and degrees of freedom (nk) = (21-6), then t table =1,753
c. Testing Criteria
   H0 is accepted if the value± tcount ≤ 1.753 or p ≥ 0.05.

H0 is rejected if the value± tcount ≥ 1.753 or p ≤ 0.05.

d. Based on calculations using the E-Views program, the calculated results for the amount of electricity distributed are1.758376≥ 1.753 with significant value0.0991≥ 0.05

e. Conclusion

Based on the results of the analysis of the influence of the amount of electricity distributed on Indonesia's direct foreign investment, a significance value of 0.09≥ 0.05 with tcount =1,758≥ 1,753. The amount of electricity distributed partially does not have a significant effect on Indonesia's foreign direct investment.

4) The influence of clean water volume on Indonesian foreign direct investment

a. Hypothesis Formulation

H0 :ß1 = 0, meaning the variableclean water volume (X4)partially has no effect on Indonesian foreign direct investment.

H1 :ß1 > 0, meaning the variableclean water volume (X4)partially has a positive effect on Indonesian foreign direct investment.

b. Determining the real level (α) = 5% using a one-sided test, namely the right side. With a real level of(α) = 5% or a 95% confidence level and degrees of freedom (nk) = (21-6), then t table =1,753

c. Testing Criteria

H0 is accepted if the value± tcount ≤ 1.753 or p ≥ 0.05.

H0 is rejected if the value± tcount ≥ 1.753 or p ≤ 0.05.

d. Based on calculations using the E-Views program, the calculated result for the volume of clean water is3.812809≥ 1.753 with significant value0.0017≤ 0.05

e. Conclusion

Based on the results of the analysis of the influence of clean water volume on Indonesian foreign direct investment, a significance value of 0.00≤ 0.05 with tcount =3,7953≥ 1,753. The volume of clean water distributed partially has a positive and significant effect on Indonesian foreign direct investment.

Table8. Simultaneous Test Results

Variable	Coefficient	Std.Error	t-Statistic	Prob.
C	4968,322	10534.05	0.471611	0.6440
X1	-12740.72	20805.28	-0.612379	0.5495
X2	13.22462	31.91517	0.414368	0.6845
X3	133821.4	76105.15	1.758376	0.0991
X4	4498,386	1179,809	3.812809	0.0017

Coefficient of Determination

Coefficient of determination (R2)) is used to measure the level of accuracy or how far the model's ability to explain the variation of the dependent variable. Where

the value of the coefficient of determination is between zero and one (O ≤ R ≤ 1). The magnitude of the influence of one independent variable can be known by the coefficient of determination or R square (R2) =0.5117 means that 51.17% of Indonesia's foreign direct investment is influenced by roads, telephones, electricity and water, while the remaining 48.83% is influenced by other factors not included in the research variables.

Discussion

Simultaneous Influence Test (F-Test)

The simultaneous effect based on the F-test results indicates that the hypothesis is accepted, meaning that road length, number of telephone connections, electricity distribution, and clean water volume collectively have a significant impact on foreign direct investment (FDI) in Indonesia. This finding is supported by the R^2 value of 0.5117, which indicates that these four variables simultaneously explain 51.17% of the variation in FDI in Indonesia, while the remaining 48.83% is explained by other factors not included in the model.

This result implies that fluctuations in road length, telephone connections, electricity distribution, and clean water volume have a real effect on FDI in Indonesia. These findings are consistent with Siagian & Srinita (2024), who found that road, electricity, and water infrastructure positively influence foreign investment in Deli Serdang Regency. Similarly, Manuaba & Saskara (2022) revealed that developments in technology and telecommunications significantly affect foreign direct investment in Indonesia.

Partial Influence Test (t-Test)

1. Road Length (X_1) has a p-value of 0.5495, which is greater than 0.05. This means H_0 is not rejected, indicating that road length does not have a significant partial effect on FDI in Indonesia. An increase in road length does not automatically lead to a rise in foreign investment, and conversely, a reduction does not necessarily hinder it. While road infrastructure is important, not all roads directly contribute to investment growth. This indicates that road length alone does not reflect strategic connectivity. This result aligns with Enriquez et al. (2018), who asserted that increasing road length does not necessarily correspond to increased FDI, particularly in ASEAN countries, where quality and connectivity are more influential. Sinha & Das (2025) also emphasize that road length does not guarantee strategic connectivity, underscoring that connectivity and efficiency are more critical. Similarly, Mitakda (2021) found that road infrastructure had no significant effect on FDI in various Indonesian provinces, including Bali. Mahyoga & Sri Budhi (2022) reached similar conclusions. According to Todaro and Smith (2011), effective infrastructure is that which boosts productivity and economic efficiency. Hence, in attracting FDI, it is not only road quantity that matters but also its quality, efficiency, and connection to key economic centers.

2. Number of Telephone Connections (X_2) has a p-value of 0.6845 (> 0.05), indicating that H_0 is not rejected, and there is no significant partial effect on FDI in Indonesia. The rise in telephone connections does not automatically increase FDI, nor does a decline deter it. Although telecommunications are essential for business operations, the number of telephone lines may not represent service quality or the technology used. The use of traditional telephone lines, both wired and wireless, has declined in Indonesia, as people transition to advanced mobile phones with internet access. This shift highlights how internet users and capacity have replaced telephone lines as a measure of telecommunications infrastructure. High-quality digital networks and access to advanced technology are now more appealing to investors. Suriani & Keusuma (2015) found that telephone connections positively influence Indonesia's GDP, though the effect is not statistically significant. This is in line with Kaewsompong & Kunasri (2022), who stated that telecommunications infrastructure has a weak impact on FDI, which could improve with significant technological upgrades, such as digital telephone/internet systems. Lin (2008) further noted that in developing countries, reliance on telephone connections is outdated, with a shift toward high-speed internet and advanced tech ecosystems. Thus, the number of telephone lines may no longer reflect a country's technological readiness for foreign investors, who now prioritize digital network quality and information access when assessing FDI potential.
3. Distributed Electricity (X_3) has a p-value of 0.0991 (> 0.05), so H_0 is not rejected, meaning that electricity distribution does not have a statistically significant partial effect on FDI in Indonesia. However, the p-value is close to the threshold, suggesting electricity may play a potential role in attracting FDI. Electricity is indispensable across all sectors, including health and education, and it ensures smooth operations for investors. Despite its practical importance, electricity availability alone is not a decisive factor for foreign investors. Industrial development fueled by FDI increases electricity demand, but what matters more is the reliability, stability, and capacity of supply—ensuring efficient and cost-effective operations. This aligns with Rolnmuch & Astusi (2024), who found no significant effect of electricity on FDI in key Indonesian industrial sectors. Nguea (2021) even found a negative impact of energy infrastructure on FDI in Cameroon, while Bosire (2020) reported that infrastructure development, including electricity, had no significant effect on FDI in Africa. These findings highlight that investors value the reliability and quality of electricity supply to achieve cost efficiency. Therefore, strengthening electricity infrastructure, especially in distribution and continuous supply, is vital for increasing its significance in future FDI inflows. This is supported by Aschauer's (1989) theory, which emphasizes that economic productivity is more affected by the quality of

infrastructure than its quantity. Accordingly, in electricity infrastructure, reliability and network stability are more crucial than the sheer volume of electricity distributed.

4. Clean Water Volume (X_4) has a p-value of 0.0017 (< 0.05), indicating that H_1 is accepted. This means clean water volume has a significant partial effect on FDI in Indonesia. Clean water is a basic necessity for human life and essential for industrial operations. Its availability is a major consideration for foreign investors, particularly in manufacturing, tourism, and other water-intensive industries. Therefore, regions with reliable clean water supplies have greater potential to attract FDI. This is in line with Wekasa, Wawire, and Kosimbei (2016), who found that water infrastructure and waste management positively affect FDI inflows. High-quality water infrastructure can reduce operational costs and enhance investment climates, attracting more foreign investors. Meidayati (2017) also highlighted that basic infrastructure, including clean water, is a key determinant of FDI. Donaubauer, Meyer, and Nunnenkamp (2016) further noted that aid for water infrastructure significantly improves the economic infrastructure endowment of recipient countries, leading to increased FDI. In addition, clean water availability is part of the "location" factor in Dunning's (1997) theory, which states that the quality of a location's infrastructure strongly influences FDI decisions. A stable and reliable water supply not only facilitates business operations but also signals the overall infrastructure quality of a region. Thus, strengthening water infrastructure and expanding service coverage are strategic efforts to attract FDI. A dependable clean water supply is a critical indicator of regional readiness to support global-scale economic activities.

Among the four independent variables analyzed, only clean water volume (X_4) has a statistically significant partial effect on FDI in Indonesia. This is consistent with findings by Sutaryo (2018), who emphasized the importance of basic infrastructure—such as clean water and electricity—in attracting foreign investors. Barno (1991) also noted that quality public infrastructure is a key determinant of economic growth and investment.

CONCLUSION

Based on the findings of this study on the impact of infrastructure development on foreign direct investment (FDI) in Indonesia, the following conclusions can be drawn:

1. Simultaneously, the variables of road length (X_1), number of telephone connections (X_2), distributed electricity (X_3), and clean water volume (X_4) have a significant effect on foreign direct investment (FDI) in Indonesia. This indicates that comprehensive and integrated infrastructure development can create a conducive environment for attracting foreign investment. In other words, the

overall quality and availability of infrastructure are critical factors considered by global investors when deciding to invest in Indonesia.

2. Partially, the influence of each infrastructure variable shows varying results:
   a. The road length variable (X_1) has a probability value of 0.5558 (>0.05), indicating no statistically significant effect on FDI. Although road infrastructure is essential, the mere length of roads may not reflect quality, connectivity, or relevance to strategic economic centers that are of interest to investors.
   b. The number of telephone connections variable (X_2) has a probability value of 0.6777 (>0.05), also indicating no significant impact on FDI. This suggests that traditional telephone connections have become less relevant in the digital age, where investors prioritize digital infrastructure such as internet networks and data centers.
   c. The distributed electricity variable (X_3) has a probability value of 0.1033 (>0.05), meaning it does not yet have a statistically significant effect. However, this value is relatively close to the significance threshold, indicating that the availability and reliability of electricity remain important, especially for the industrial and manufacturing sectors.
   d. The clean water volume variable (X_4) has a probability value of 0.0018 (<0.05), indicating a statistically significant partial effect on FDI. The adequate availability of clean water is a key indicator for supporting business and industrial operations and reflects the infrastructural readiness of a region to attract foreign investment.

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