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Original Article

The Impact of Infrastructure Development on Economic Growth in West Nusa Tenggara Province

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This article contributes to:

Abstract. Infrastructure as one of the main supporting factors is believed to have an important role in driving economic growth, both through increasing accessibility and the quality of public services. This study aims to analyze the effect of infrastructure including roads, clean water, education, and health on economic growth in 10 districts/cities in West Nusa Tenggara Province (NTB) during the period 2019–2023. The method used is a quantitative approach with panel data analysis techniques, which combine time series data and cross-regional data (cross section). Data were obtained from the NTB Central Statistics Agency (BPS) and various supporting literature. The analysis was carried out using a panel data regression model with the help of Eviews 10 software. The selection of the best model was carried out through the Chow, Hausman, and Lagrange Multiplier Tests. Classical assumption tests and hypothesis tests (t-test and F-test) were carried out to ensure the validity of the model. The results of the study showed that clean water and education infrastructure had a positive and significant effect on economic growth, while road and health infrastructure did not show a significant effect. However, simultaneously, all infrastructure variables together have a significant effect on economic growth. The regression model used has an Adjusted R^2 value of 0.978966, which indicates that 97.8% of the variation in economic growth can be explained by the infrastructure variables analyzed.

Keywords: Economic Growth, Infrastructure, Panel Data, GRDP, West Nusa Tenggara.

1. Introduction

Economic growth is a measure of the success of an economy and the quality of a region's policies in a certain period [1]. It has a close relationship with the process of increasing the production of goods and services in the economic activities of society. Strong economic growth will encourage the development of sectors and labor mobility with the aim of improving the standard of living and welfare of society. The main objective of economic growth is to create the highest possible rate of economic growth, followed by poverty eradication, overcoming income inequality, providing employment, better education, improving health and nutrition standards, improving environmental conditions, and equalizing opportunities, as well as refreshing cultural life.

According to Mose [2], argue that in the theory of neo-classical economic growth, economic growth comes from the following three factors: an increase in the quantity and quality of workers (labor), an increase in capital (through savings and investment) and an increase in technology. Every increase in the number of workers, capital and technology will affect changes in the level of output produced. The capital referred to by Sollow comes from the infrastructure sector or physical investment. The existence of

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infrastructure will encourage increased productivity for production factors, and conversely, ignoring it will reduce productivity.

Infrastructure development is an effort or series of growth and change efforts carried out in a planned manner to build infrastructure or anything that is the main support for the implementation of a development process [3]. Good infrastructure development will ensure efficiency, facilitate the movement of goods and services, and increase the added value of the economy [4]. The development of a region aims to improve welfare and realize social justice for all levels of society. For this reason, development requires the right approach, in order to produce growth accompanied by equity. Infrastructure plays an important role in increasing investment and expanding the reach of community participation, as well as equalizing development results [5].

In the current era of globalization, infrastructure is one of the benchmarks to see the development of a region. Infrastructure is one of the most crucial and important factors in accelerating regional and national development [6]. In addition, infrastructure is also a significant contributor to economic expansion. The availability of infrastructure is the foundation of sustainable economic development that cannot be separated from the rate of economic growth and investment in a country or region. Infrastructure in this case is the foundation of long-term economic growth.

The West Nusa Tenggara Province, located in central Indonesia, is one of the regions that has received great attention in terms of infrastructure development [7]. This province consists of two large islands, namely Lombok and Sumbawa, which have high natural and tourism potential. Based on data from the NTB Province BPS, it is known that the mining sector and tourism sector are the largest contributors to GRDP in NTB Province. Both sectors are highly dependent on the quality of the available infrastructure. High GRDP can support massive infrastructure development. Over the past few years, the central and regional governments have increased infrastructure development in NTB as part of an effort to increase the competitiveness of this region at the national level. The following is data on the development of ADHK GRDP in the Regency/City of West Nusa Tenggara Province.

Infrastructure development plays an important role in increasing regional economic growth. The availability of infrastructure is one of the important supporting factors as a driving force of economic growth. According to Doran et al. [8] stated that infrastructure development is a public service obligation, which is something that should be the government's obligation because infrastructure is the most primary public infrastructure in supporting the economic activities of a region. The availability of infrastructure also greatly determines the level of efficiency and effectiveness of economic activities and is a prerequisite for the wheels of the economy to run smoothly.

The development of infrastructure in West Nusa Tenggara Province shows significant progress in various sectors, one example is related to road construction which aims to improve connectivity between regions. The road construction in question is a bypass road project connecting Lombok International Airport with the Mandalika area which can trigger increased accessibility to tourist destinations, facilitate the flow of goods transportation and support local economic growth. This reflects the government's commitment to improving the quality of life of the community, supporting sustainable development that can improve the economy and improve community welfare. The following is data on the development of road infrastructure in the Regency/City of West Nusa Tenggara Province in 2019-2023. Road length data for the period 2019-2023 shows an increase in road length that occurred in two regencies in NTB Province, namely Central Lombok and East Lombok. Economic infrastructure such as roads can directly affect

economic productivity, in this case including increasing the amount of output produced, availability of job opportunities, and the development of certain economic sectors which ultimately have an impact on the economic growth of a region.

In line with research conducted by Syaharuddin et al. [9] which shows that road infrastructure has a positive influence on economic growth in NTB Province as measured by the GRDP value at current prices. This is because roads are one of the important infrastructures as a link in the economic activities of a region which will facilitate the flow of goods and services between production centers and marketing areas or vice versa [10].

Government spending to increase economic growth is a comprehensive indicator and productivity of public spending. There are two components that are measured, namely the contribution of public sector output to economic growth and the efficiency of this spending on its output. In developing countries, investment in infrastructure is a preferred choice and has a very large portion of total government spending. This shows the large role of government in the procurement of infrastructure, especially in the transportation, communication, and energy sectors. While other public spending in the health and education sectors, although they tend to be ignored, have a fairly high level of productivity due to the direct and indirect impacts in the form of increasing the productive capacity of human resources [11].

The impact of infrastructure deficiencies and low quality can cause a slowdown in economic growth and employment. In this case, it can cause many companies to exit the business or may cancel their cooperation. Therefore, adequate infrastructure can play a role in the production process needed to attract private sector capital accumulation. Good and adequate infrastructure can also increase productivity and reduce production costs. Infrastructure development in the form of transportation such as roads, seaports, airports, health facilities, education and water are very important in order to improve the economy of the community in a region. Regions with adequate infrastructure have a greater advantage in attracting investment to enter the region and will develop faster than regions with minimal infrastructure [12].

2. Method

This study uses a quantitative method with a panel data approach, which combines time dimensions (2019–2023) and cross-section (10 regencies/cities in NTB Province). The aim is to analyze the influence of infrastructure (roads, clean water, education, and health) on economic growth, as measured by Gross Regional Domestic Product (GRDP) at constant 2010 prices. Data were obtained from the NTB Central Statistics Agency (BPS) and supporting literature such as journals and government reports. The research variables consist of one dependent variable (PDRB) and four independent variables, namely road length (km), percentage of clean water distribution (%), number of schools (units), and health facilities (units). The analysis was conducted using panel data regression using Eviews 10 software, with the equation model:

$$Y_{it} = \alpha + \beta 1 X1_{it} + \beta 2 X2_{it} + \beta 3 X3_{it} + \beta 4 X4_{it} + \varepsilon_{it} \qquad (1)$$

where Y is GRDP, X1–X4 are infrastructure variables, and ε is the error term. Before conducting the estimation, a model specification test was conducted to determine the best approach between the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM) through the Chow, Hausman, and Lagrange Multiplier (LM) tests. Furthermore, the model was tested with classical assumptions, including multicollinearity (correlation between variables <0.8), heteroscedasticity (Glejser Test, sig. >0.05), autocorrelation (Durbin-Watson Test, value approaching 2), and residual

normality (Jarque-Bera Test, sig. ≥ 0.05). After the model was formed, hypothesis testing was conducted through the t-test (to see the partial effect of each variable) and the F-test (to test the significance of the simultaneous effect). The strength of the model is measured by the coefficient of determination (R^2), which shows how much the independent variables are able to explain the variation in GRDP. Data collection was carried out through documentation studies (BPS data) and literature studies (review of related literature).

3. Results and Discussion

3.1 Results of Model Selection Estimation

Data from all variables used in this study, namely the GRDP variable, road infrastructure variable, water infrastructure variable, education infrastructure variable and health infrastructure variable by showing the regression results using Eviews 10. In this panel data regression model estimation, it is done to find out what model is used for panel data regression. In the regression analysis that applies panel data regression, the initial step taken is to choose the right approach among three approaches, namely the Common Effect Model (Pooled Least Square) with the OLS (Ordinary Least Square) method, the Fixed Effect Model with the OLS (Ordinary Least Square) method, and the Random Effect Model by calculating the error from panel data using GLS (Generalized Least Square).

The results of the Chow and Hausman tests can be seen in Table 1.

Table 1. Chow and Hausman Test Results

Effects Test	Statistic	d.f.	Prob.
Chow Test Results			
Cross-section F	143.282472	(9,36)	0.0000
Cross-section Chi-square	180.302898	9	0.0000
Hausman Test Results			
Cross-section random	8.157729	4	0.0560

Based on the Chow Test above, the Cross-section Chi-square value is 0.0000 <0.05, then the selected model is FEM and continues to the Hausman test. The Cross-section random value is 0.0560 ≤ 0.05, then the selected model is FEM. So for the right model in this study using FEM (Fixed Effect Model). After conducting the Chow Test and Hausman Test, the selected model is FEM (Fixed Effect Model), so there is no need to continue to the LM test.

3.2 Classical Assumption Test Results

According to Lovaglio [13], the classical assumption test is an important step in ordinary least square (OLS)-based panel data analysis. In the panel data regression model, we can perform several classical assumption tests, namely only multicollinearity and heteroscedasticity tests. The results of the multicollinearity test can be seen in Table 2.

Table 2. Multicollinearity Test Results

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	1.95E+10	1352.312	NA
Road Length (Km)	807.8118	49.82513	9.115522
Water	1463006.	925.1239	1.268444
Education	1.49E+09	3450.279	9.802553
Health	7.13E+08	2059.119	6.645095

Based on the test above, the centered VIF value of all independent variables is <10. The centered VIF value of X1 is 9.115522 <10. The centered VIF value of X2 is 1.268444 <10. The centered VIF value of X3 is 9.802553 <10. The centered VIF value of X4 is 6.645095 <10. So it can be concluded that the data used passes multicollinearity.

The following heteroscedasticity results are also presented in Table 3.

Table 3. Results of Heterosced-asticity Test (Glejser Test)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	192056.8	215914.2	0.889506	0.3796
Road Length (Km)	-15.80713	67.12947	-0.235472	0.8152
Water	-408.9557	255.3038	-1.601839	0.1179
Education	-351.7195	461.8969	-0.761468	0.4513
Health	-1.120534	17.92366	-0.062517	0.9505

Based on the test above, the prob value of all dependent variables is > 0.05. The prob value of X1 is 0.8152 > 0.05. The prob value of X2 is 0.1179 > 0.05. The prob value of X3 is 0.4513 > 0.05. The prob value of X4 is 0.9505 > 0.05. So it can be concluded that the data used passes heteroscedasticity.

3.3 Hypothesis Test Results

The results of the t-test, F, and coefficient of determination are shown in Table 4.

Table 4. Regression results using FEM

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1101452.	385224.2	-2.859250	0.0070
Road Length (Km)	108.9869	119.7693	0.909974	0.3689
Water	1401.475	455.5015	3.076774	0.0040
Education	2306.861	824.0954	2.799264	0.0082
Health	12.65860	31.97857	0.395846	0.6946
R-squared	0.978966	Mean dependent var		27064.94
Adjusted R-squared	0.971371	S.D. dependent var		29753.45
S.E. of regression	5034.345	Akaike info criterion		20.11745
Sum squared resid	9.12E+08	Schwarz criterion		20.65282
Log likelihood	-488.9363	Hannan-Quinn criter.		20.32132
F-statistic	128.8870	Durbin-Watson stat		2.048777
Prob(F-statistic)		0.000000		

Based on the analysis results shown in Table 4, it is known that the road infrastructure variable has a t-statistic value of 0.909974 which is smaller than the t-table value of 1.651 at a significance level of 5%. In addition, the probability value of 0.3689 is greater than 0.05. Based on results indicate that the test is in the area of acceptance of H0 and rejection of the alternative hypothesis. Thus, it can be concluded that road infrastructure does not have a significant effect on economic growth in the districts/cities of West Nusa Tenggara (NTB) Province during the 2019–2023 period. Meanwhile, water infrastructure shows a t-statistic value of 3.076774 which is greater than the t-table of 1.651, with a probability value of 0.0040 which is smaller than 0.05. Therefore, it can be concluded that water infrastructure has a significant and positive effect on economic growth [14].

The education infrastructure variable has a t-statistic value of 2.799264 which is greater than the t-table value of 1.651. The probability value of 0.0082 which is smaller than 0.05 indicates that the test results are in the H0 rejection area. Thus, it can be concluded that education infrastructure has a significant and positive effect on economic growth in the studied area. Furthermore, health infrastructure shows a t-statistic value of 0.395846 which is smaller than the t-table value of 1.651, with a probability value of 0.6946 which is greater than 0.05. Based on these results, it is known that the test is in the H0 acceptance area, so it can be concluded that health infrastructure does not have a significant effect on economic growth.

For simultaneous testing, the F-statistic value of 128.8870 is greater than the F-table of 2.41, with a probability value of 0.000000 which is smaller than 0.05. This shows that all independent variables together have a significant effect on economic growth. The

estimation model used, namely the Fixed Effect Model, produces an Adjusted R-squared value of 0.978966 or 97.9%. This means that the variation in economic growth in the districts/cities of NTB Province of 97.9% can be explained by the infrastructure variables analyzed in this study, while the remaining 2.1% is influenced by other factors not included in the model.

3.4 Discussion

3.4.1 The Influence of Road Infrastructure on Economic Growth in Districts/Cities of West Nusa Tenggara Province 2019-2023

Based on the partial research results for the road infrastructure variable, it can be concluded that road infrastructure does not have a significant effect on economic growth. This can be seen based on the regression results in table 4.10 which show a probability result of 0.3689, which indicates that the relationship between road infrastructure and economic growth in the Regency/City of NTB Province in 2019-2023 has a positive but not significant effect. The insignificance of roads to economic growth is due to the decline and increase in the length of roads that have only experienced slight changes based on data over five years, so that their impact on the economy is small or even insignificant. It can be seen from Table 4 above regarding the development of the length of roads in the Regency/City of NTB Province in 2019-2023, it does not always increase every year. This can happen because of the many problems faced in improving the quality of existing roads. Problems that often arise such as damaged road conditions are caused by many large cars passing by on the road without rules and limited funds spent by the government to repair roads with damaged road conditions, this results in road facilities not being able to be utilized optimally.

This study is not in line with the theory that states that roads have a dual function, namely as a driver of economic growth by facilitating the flow of goods and services between production centers and marketing and vice versa. While on the other hand, roads function to reduce development disparities between regions. Therefore, road construction is the main foundation for the development of a region [15]. This study is in line with research conducted by Fufarida et al. [16] which states that road infrastructure does not affect GRDP in Banjarnegara because if road infrastructure development continues to be carried out while other factors that support economic productivity are inadequate such as limited demand 1 in the distribution of goods and services or other economic factors. In addition, research conducted by Baloch et al. [17] whose research results state that road infrastructure does not have a significant effect on economic growth because the quantity of road infrastructure used by the community is inadequate so that the economy is hampered and cannot support the economy in South Kalimantan.

3.4.2 The Influence of Water Infrastructure on Economic Growth in Districts/Cities of West Nusa Tenggara Province in 2019-2023

Based on the partial research results for the water infrastructure variable, it can be concluded that water infrastructure has a positive and significant effect on economic growth. This can be seen based on the regression results in Table 4 which shows a probability result of 0.0040, which indicates that the relationship between water distribution to households and economic growth in the Regency/City of NTB Province in 2019-2023 has a positive and significant effect. If the amount of water distributed to households increases, economic growth will increase.

Water is a resource that is very much needed in everyday life. As one form of implementation of water provision in each Regency/City is the main source for areas that still lack clean water to carry out all their activities. This makes local governments

increasingly increase water distribution in order to increase regional economic growth. It can be seen in Table 4 above that water distribution continues to increase every year. This is due to the large demand for water and the increasing ease of access to get water. This study is in line with Solow's theory which states that water has a significant influence on economic growth and previous research conducted by Kwilinski et al. [18] states that water has a positive influence on economic growth due to the link between public infrastructure and economic growth, which can be explained, among other things, through the role of infrastructure in increasing the productivity of these workers which are actually used as input in the production process.

The results of this study are in line with research conducted by Yokosawa and Mizunoya [19] which states that the increasing distribution of water will increase the GRDP in Indonesia and research conducted by Vahmanetta [20] which states that the amount of water has a positive and significant effect on economic growth in Pemantangsiantar City.

3.4.3 The Influence of Educational Infrastructure on Economic Growth in Districts/Cities of West Nusa Tenggara Province in 2019-2023

Based on the partial research results for the educational infrastructure variable, it can be concluded that educational infrastructure has a positive and significant effect on economic growth, which can be seen based on the regression results in table 4.10 which shows a probability result of 0.0082. With the continued increase in the number of school buildings, both from elementary, junior high, and senior high schools, it can contribute to improving the quality of human resources (HR) which will have an impact on increasing workforce productivity, thus also having an impact on the regional economy. The results of this study are in line with the theory put forward by Tawiah et al. [21] which states that education has a positive influence on economic growth. Where education has a major role in shaping the ability of a developing country to absorb modern technology in order to create sustainable growth and development so that with education it can produce quality human resources and workers, then it will encourage productivity that can increase the production of goods and services.

The results of this study are in accordance with research conducted by Jannah et al. [22] which states that educational infrastructure has a positive and significant effect on economic growth in Mataram City from 2013-2022. This indicates that changes in the number of school buildings do have a positive effect on economic growth in Mataram City from 2013-2022. In addition, research conducted by Jannah (2024) shows that increasing the number of schools can improve the quality of human resources by developing soft skills and competent mindsets, which of course can provide added value for someone in developing their work which has an impact on increasing economic activity.

3.4.4 The Influence of Health Infrastructure on Economic Growth in Districts/Cities of West Nusa Tenggara Province in 2019-2023

The partial research results for the health infrastructure variable (number of hospitals, health centers, and clinics) can be concluded that health infrastructure does not have a significant effect on economic growth. This can be seen based on the regression results in Table 4 which shows a probability result of 0.6946, which indicates that the relationship between health infrastructure and economic growth in the Regency/City of NTB Province in 2019-2023 has a positive but not significant effect.

This can mean that the improvement of health infrastructure that is not balanced with easy access to services for the community causes expensive medical costs and this

can also happen if the addition of health infrastructure still has obstacles related to the completeness of providing health services so that services that are not yet optimal make the community unable to enjoy the facilities such as lack of medical personnel, inadequate medical equipment or lack of experience in operating health facilities. This shows that although the development of health infrastructure is important for improving the quality of life, its impact on economic growth is not always immediately visible. Therefore, it is important for policy makers such as the government to consider a more consistent approach in planning the development of health infrastructure, by considering the health sector with other sectors that contribute more directly to economic growth.

The results of this study are in line with the research conducted by Breemer [23] which examined the Analysis of the Influence of Electricity, Road, and Health Infrastructure on Gross Regional Domestic Product in Sidoarjo Regency. The results of the study indicate that health infrastructure does not have a significant influence on Gross Regional Domestic Product in Sidoarjo Regency.

4. Conclusion

Based on the results of the research and discussion that have been conducted, it can be concluded that road infrastructure does not have a significant effect on economic growth in districts/cities in West Nusa Tenggara (NTB) Province during the period 2019 to 2023. On the other hand, water infrastructure has been shown to have a positive and significant effect on economic growth in the region. The same thing also applies to education infrastructure, which shows a positive and significant effect on economic growth at the district/city level in NTB Province. However, health infrastructure does not show a significant effect on economic growth in the same area during the research period. Simultaneously, the four types of infrastructure—namely roads, water, education, and health—jointly influence economic growth in districts/cities in NTB Province. This is evidenced by the significant F-count value at a confidence level of 97 percent. In addition, the regression model used in this study shows that the independent variables are able to explain the variation of the dependent variable by 97 percent, while the remaining 3 percent is influenced by other factors outside the model.

Based on the conclusions above, the researcher provides several suggestions as follows. First, for the government, increasing economic growth can be done through equitable infrastructure development, both from a social and economic perspective. The government needs to formulate and implement an infrastructure equalization program, especially improving the quality of road infrastructure which has a vital role in supporting the smooth running of people's economic activities.

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6. Declaration

Author contributions and responsibilities - The authors made major contributions to the conception and design of the study. The authors took responsibility for data analysis,

interpretation and discussion of results. The authors read and approved the final manuscript.

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Did you use generative AI to write this manuscript? - I do not use AI assistance in my manuscript.
Declaration of generative AI and AI-assisted technologies in the writing process - During the preparation of this work the author did not use AI to write, edit, or other things related to the manuscript.

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