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Prospects of Infrastructure Development in the Perspective of Economic Growth

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A B S T R A C. T

Infrastructure is one of the primary parts to drive economic growth. An area with adequate infrastructure will have good and stable economic growth. West Nusa Tenggara Province, as one of the disaster-prone areas, is facing significant problems in development, especially related to infrastructure and economic growth. After the disaster in 2018, the economy of West Nusa Tenggara Province has a sharp contraction to the negative value. Therefore, this study aims to analyze the prospects for infrastructure development to boost economic growth in the province of West Nusa Tenggara with panel data analysis. The results show that the infrastructures of electricity, water infrastructures, schools, health facilities, and capital expenditure have positive and significant effects on economic growth, while the length of the road has no significant effect. The effort to boost economic growth, the infrastructure development must be focused on the non-mining and non-quarrying sector. Also, areas with high earthquake potential must be considered to build earthquake-resistant infrastructure. For the road, it needs to improve the quality, just not the quantity.

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1. Introduction

Infrastructure development is capital to increase the economic productivity of a region (Susantono & Berawi, 2015; Stephan, 1997). Infrastructure as something that is very needed. Without infrastructure, production activities in various sectors of economic activity cannot function (Hirchman, 1958). Infrastructure also has an essential influence on improving the quality of life and human welfare (Rioja, 2001), among others in increasing the value of consumption, increasing labour productivity and access to employment. Macroeconomically, the availability of infrastructure influences the marginal productivity of private capital, whereas in the context of microeconomics, the availability of infrastructure influences the reduction of production costs (Kwik, 2002).

According to Suratno (2010), the increased infrastructure built by the government expected to spur economic growth. With the sustainable infrastructure development that is following the needs, will be followed by an improved economy. Positive and rising economic growth shows an indication of the success of economic development that has a good impact on the economy of a region. Conversely, declining, and even negative economic growth indicates that the region's economy is deteriorating.

West Nusa Tenggara as one of the provinces in Indonesia has a good potential in economics especially both in the agriculture and tourism sector (Septarini & Kartikan, 2016). However, the disaster that occurred in 2018 has aggravated the economic conditions (Hidayat, 2018). Based on BNPB's report, the loss caused by the disaster reached 10.15 trillion rupiahs in the infrastructure sector, and 2 trillion rupiahs in the economic sector (Gumelar, 2018). Therefore, after the earthquake in 2018, the economic growth contracted by -13.99 per cent. This contraction is significant higher compares to before the earthquake occurred with a decrease in -0.83 per cent.

Referring to study conducted by Owusu-Manu et al. (2019), Bakar & Mat (2017), Sherkulovich (2015), Ismail & Mahyideen (2015), Maryaningsih et al. (2014), and Esfahani & Ramírez (2003), the existence of infrastructure is essential to drive economic growth recovery. Meanwhile, for the West Nusa Tenggara Province case, there is not enough evidence to show the role of the infrastructure in economic growth. However, with the disaster occurred, the government definitely will rebuild infrastructure as the effort to restore the socio-economic conditions. Therefore, it is necessary to analyze the effectiveness of infrastructure on economic growth in West Nusa Tenggara Province. So that the government has guidance in determining priorities for infrastructure recovery which have a positive impact on society, especially in economic terms.

2. Methods

In this study, the dependent variable used is the regional gross domestic product at constant prices (CP-RGDP) for non-mining. While the independent variable is the length of district roads with a good and moderate condition, the number of school buildings, the number of health facilities, the amount of water supplied by PDAM, the amount of electricity connected, and the realization of RIEB (Regional Income and Expenditure Budget/APBD) expenditure. All of these data obtained from BPS-Statistics Indonesia and the Ministry of Finance. Generally, it shows as this table below.

Table 1. Details of the Variables Used

Variabel	Unit Scale	Source	Note
Regional gross domestic product of non-mining	Billion rupiah	BPS-Statistics Indonesia	Constant price base on 2010
The length of regency/city roads in a good and moderate condition	Kilometres	BPS-Statistics Indonesia	-
The number of regency/city school buildings	Unit	BPS-Statistics Indonesia	-
The number of regency/city health facilities	Unit	BPS-Statistics Indonesia	-
The amount of water that channelled to regency/city	Units of thousand cubic meters (m^3)	BPS-Statistics Indonesia	-
The amount of electric power connected to regency/city	Megavolt ampere (MVA) units	BPS-Statistics Indonesia	-
Realization of regency/city capital expenditure	Units of billion rupiah	Ministry of Finance	-

This research covers all regencies/cities in West Nusa Tenggara province, namely Bima Regency, Dompu Regency, West Lombok Regency, Central Lombok Regency, East Lombok Regency, North Lombok Regency, Sumbawa Regency, West Sumbawa Regency, Bima City, and Mataram City. The period used was 2010 to 2017. In 2008, the Province of West Nusa Tenggara expanded from 9 regencies/cities to 10 regencies/cities. The effort to get more stable in post-autonomous conditions and the availability of data, this study uses the early period of 2010 while the end of the period of 2017. The seven variables above are secondary data obtained from the BPS-Statistics Office and the Ministry of Finance. Data come by publications are recapitulated in the Microsoft Excel 2016 application. For some empty data are estimated using simple linear regression. As for data processing program used is Eviews 10 to get the panel data regression modelling. To illustrate the concept of thinking in this study, it uses a Keynesian equation. In the Keynesian equation, there is a factor of government spending. These expenditures include capital expenditures which used to finance public facilities, and one of them is infrastructure. Therefore, the existence of infrastructure will affect all factor in the Keynesian equation (except the factor of government expenditure itself). Referring to the theory and several previous studies, economic and social infrastructure have a positive relationship with economic growth. Therefore, an overview of the research framework is as follows:

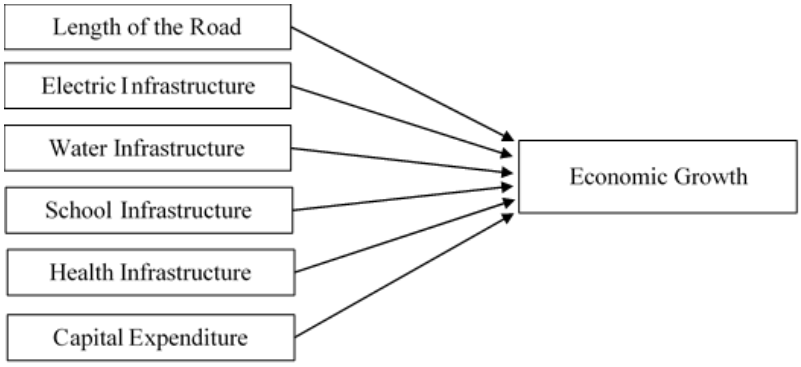

Figure 1. Research Framework

This study using panel regression approach. This analysis used to see the relationship between the length of the road, the number of schools, the number of health facilities, the amount of water supplied, the amount of electricity connected, and the realization of capital expenditure to CP RGDP in all regencies/cities in the province of West Nusa Tenggara in 2010 to 2017. While the panel data used is a balanced panel consisting of regencies/cities that were studied using the same year. The model specifications used to see the effect of the independent variable with the dependent variable are as follows:

$$RGDP_{it} = \alpha + \beta_1 Road_{it} + \beta_2 Electricity_{it} + \beta_3 Water_{it} + \beta_4 School_{it} + \beta_5 Health_{it} + \beta_6 Capital\ Expenditure_{it} + u_{it}$$

Technical explanation:

i	: regency/city in West Nusa Tenggara
t	: research time period, which is in 2010 to 2017
α	: intercept
β_k	: slope of the k-free variable; k = 1, 2, ..., 6
u_{it}	: *error term*
$RGDP_{it}$	: gross regional domestic product
$Road_{it}$	: the length of the road is good and moderate
$Electricity_{it}$	: the amount of electrical power connected
$Water_{it}$	: the amount of water supplied by the PDAM
$School_{it}$	: the number of elementary schools to high school buildings
$Health_{it}$	: number of health facilities
$Capital\ Expenditure_{it}$	: realization of regional capital expenditure

3. Result and Discussion

Result

Selection of the Best Estimation Model

To get one of the best estimation models, several stages of testing need to be done. The first stage is to better compare between common effects and fixed effects. The second step is comparing the random effects and fixed effects models. The third stage is comparing the common effects model with random effects.

Selection of the Best Model Between Common Effects and Fixed Effects Models

To get the best model between common effects and fixed effects, the test used is the Chow test. Based on the Chow test results obtained p-value smaller than the five per cent significance level so that the null hypothesis is rejected. Based on these results, it can conclude that the fixed effects model is better than the common effects model.

Table 2. The Result of Chow Test

Effects Test	Statistic	d.f.	Prob.
Cross-section F	10.973223	(9.64)	0.0000
Cross-section Chi-square	74.671004	9	0.0000

Selection of the Best Model Between Random Effects and Fixed Effects Models

To get the best model between random effects and fixed effects, the test used is the Hausman test. Based on the Hausman test, obtained p-value smaller than the five per cent significance level so that the null hypothesis is rejected. Based on these results, it can be concluded that the fixed effects model is better than the random-effects model. Because the Chow and Hausman test have proven that the fixed-effects model is better than random-effects, so there is no need for a BP-LM test.

Table 3. The Result of Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	26.626629	6	0.0002

Testing the Residual Variance-Covariance Matrix Structure

To determine the correct parametric estimation, it is necessary to test the assumption of the residual variance-covariance matrix. The first step is testing whether the residual covariance matrix variance is homoscedastic or heteroscedastic using the Lagrange Multiplier (LM) test. Based on the calculation results, the calculated LM value is 17.0249 and is greater than the chi-square table value of 16.9190, so the null hypothesis is rejected. The null hypothesis is rejected, which means it can be concluded that the residual variance-covariance matrix structure is heteroscedasticity. The second step, testing whether there is a cross-sectional correlation or not using the λLM test. Based on the calculation results, the calculated λLM value of 116.6656 is greater than the chi-square table value of 61.66562, so the null hypothesis is rejected. The null hypothesis is rejected, which means it can be concluded that the residual variance-covariance matrix structure is heteroscedastic, and there is a cross-sectional correlation. Therefore, a good estimation method used is Feasible Generalized Least Squares (FDLS) which is a fixed-effects model with cross-section SUR (PCSE) weighing.

Classical Assumption Testing

Test for Assumption of Normality

In testing the assumption of normality, we used the Jarque-Berra test. Based on the result of Jarque-Berra test, the probability value of the Jarque-Berra test is 0.7657. This result shows that the p-value of the test results is higher than the significance level of five per cent, which means the null hypothesis fails to be rejected. So, it can conclude that the residuals follow the normal distribution.

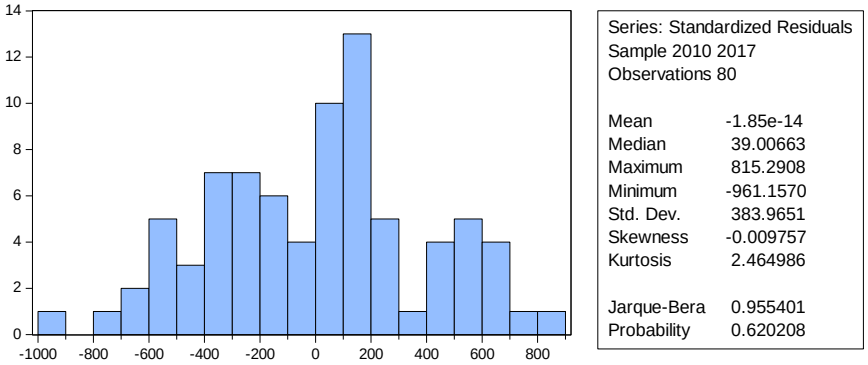

Figure 2. Normality Test

Nonmulticollinearity Assumption Test

To test the assumption of non-multicollinearity, we use the value of Variance Inflating Factor (VIF). The following is a summary of the results of testing the non-multicollinearity assumption. Based on Table 3, none of the variables in the model has a value of more than 10, so it can conclude that there is no multicollinearity between independent variables.

Table 4. Results Summary of the Non-Multicollinearity Test

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	476171.3	186.1395	NA
Road	0.2126	10.2814	1.8428
Electricity	1.1748	13.2511	5.7163
Water	0.0046	44.5903	5.5331
School	4.4916	314.5418	2.1591
Health	0.7258	191.9902	2.8708
Capital Expenditure	0.1428	3.6173	1.3117

Selected Model

Based on the results previously that have carried out, a summary of the outputs from the estimation of the selected model is as follows:

Table 5. Outputs Summary of Fixed Effects Models with Cross-Section SUR (PCSE)

Variable	Regression Coeefficient	Std. Error	Prob.
C	-1.636.236	690.0517	0.0208
Road	0.4315	0.461109	0.3529
Electricity	3.8699	1.083860	0.0007
Water	0.2579	0.067695	0.0003
School	7.8417	2.119333	0.0005
Health	3.0307	0.851950	0.0007
Capital Expenditure	0.8586	0.377869	0.0264
R-Squared	0.9920	F-Statistik	528.0494
Adjusted R-Squared	0.9901	Prob. (F-Stat.)	0.0000

Based on Table 5, the model used is as follows:

$$\widehat{RGDP}_{it} = (-1636.236 + \mu_{it}) + 3.8699\ Electricity_{it} + 0.2579\ Water_{it} + 7.8417\ School_{it} + 3.0307\ Health_{it} + 0.8586\ Capital\ Expenditure_{it}$$

From this model, the F-statistical probability of 0.0000 is obtained, the value of which is smaller than the five per cent significance level. That is, the null hypothesis is rejected. Means that there is at least

one influence of the independent variables between roads, electricity, water, schools, health, and or significant expenditure on non-mining CP RGDP in all regencies/cities of West Nusa Tenggara Province.

Table 6. The Individual Effect

Regency/City	Individual Effect
Lombok Barat	-60.824
Lombok Tengah	-3944.762
Lombok Timur	-1849.598
Sumbawa	755.195
Dompu	627.990
Bima	13.473
Sumbawa Barat	1057.810
Lombok Utara	691.343
Kota Mataram	1347.298
Kota Bima	1362.076

The fixed-effects model produces different individual effects for each cross-section. In this model, individuals refer to each regency/city in West Nusa Tenggara Province. Based on the results of calculations on the model, Kota Mataram has the highest individual effect, and Central Lombok District has the lowest individual effect. This equation shows that when all the independent variables used are in a constant condition, the non-mining CP RGDP of Mataram City is the highest and Central Lombok Regency is the lowest when compared to regencies/cities in West Nusa Tenggara Province. It means that the economy of Central Lombok Regency tends to be more dependent on infrastructure so that if it does not carry out infrastructure development, the economy in Central Lombok can have the worst impact. On the contrary, the economy of the City of Mataram is not too dependent on infrastructure, so that if it does not carry out infrastructure development, it will not harm the economy of the City of Mataram.

Discussion

Effect of Road Length Variable on Economy

Based on the model, it is obtained that the length of the road with a good and medium condition in kilometres shows insignificant results. The reason for the insignificant existence of the road to boost economic growth is possible due to the increase in road construction that is not matched by the repair of damaged roads. So that the existence of roads as a link between regions is not optimally utilized. Another cause is alleged because the leading sector of West Nusa Tenggara Province is the agricultural sector. The existence of road construction will reduce agricultural land in the community. Even so, this problem can be overcome by maintaining roads and intensifying the repair of damaged roads.

Although it does not have a significant effect, it does not mean that regencies/cities in West Nusa Tenggara Province do not need road infrastructure. Especially when seen from the decline in the quality of roads in Bima City, Bima and Dompu, the proportion of the length of roads both good and moderate to damaged roads showed a decrease from 2010 to 2017. Only the City of Mataram, West Lombok and North Lombok which experienced a slight increase in the quality of roads with a proportion of good and moderate roads of more than 50 per cent. Principally the road becomes the medium to boost various economic activity with direct or indirect influence. The direct effect is to expedite the distribution of raw materials, labours, and products between regions efficiently. As for indirect influence, the existence of roads helps many people to access various facilities which can ultimately have a positive effect on the economy of a region (Adukia et al., 2020).

Effect of Electrical Variable on Economy

Based on the model, the electrical variable connected to the megavolt ampere (MVA) has a positive and significant effect on the non-mining CP RGDP with a regression coefficient of 3.8699. That is, an increase in electric power of 1 MVA can have the effect of increasing the RGDP of 3.8699 billion rupiahs, assuming other variables are constant. This result shows that electricity infrastructure affects productivity to drive the economy. This finding consistent with the research conducted by Toman & Jemelkova (2003), Loayza & Odawara (2010), and Syaputri et.al. (2013). They found that electricity can drive the economy in a region so that it can encourage economic productivity. Follow a statement from Ayres R. (2009) in his book "The Economic Growth Engine: How Energy and Works Drive Material Prosperity", which says that the real driver of the economy is energy, especially electricity. It can be understood because in the modern era electricity has a vital role which difficult to remove from human life part. Electricity has a role as an

energy source for the operation of various equipment, both industry, transportation and others. More than it, electricity also as input for the production process. As like the workforce, the existence of electricity able to influence the amount of marginal product revenue which is high enough so that it affects the total output of production (Bee, 2016). So that electricity has a role in sustaining economic activity (Best & Burke, 2018)

Effect of Water Variable on Economy

Based on the model, the clean water channeled by PDAM with a unit of thousand cubic meters ($000m^3$) obtained a positive and significant effect on the non-mining CP RGDP with a regression coefficient of 0.2579. This finding means that any increase in the amount of water supplied by 1,000 m^3 has the effect of increasing the RGDP by 257.9 million rupiahs, assuming other variables are constant. The results of this study in line with research conducted by Atmaja & Mahalli (2015), who examined the effect of infrastructure improvements on economic growth in Sibolga City. The results show that water infrastructure has a positive and significant impact on economic growth. Also, the World Bank found that clean water assistance programs in several developing countries, generally reporting the positive impact of access to clean water on community economic activities Sukartini & Saleh (2016). There are two reasons why water availability affects the economy. First, water is a basic necessity for human life. Water scarcity will be an obstacle to economic growth (Qiao et al., 2020) because the people will spend much time to get water than work. Therefore, with the availability of water infrastructure, the allocation of time that was initially used to collect water can be diverted to other more productive activities (Meeks, 2017). Second, water also used as one of the production inputs (Howe, 1976). Various industries, such as manufacturing and restaurants, rely on water as one of the industrial raw materials.

Effects of School Variable on Economy

Based on the model, the variable number of schools (SD/MI, SMP/MTs, and SMA/MA/SMK) has a positive and significant effect on non-mining CP RGDP with a coefficient of 7.8417. That is, every increase in the number of schools by 1 unit can have the effect of increasing the RGDP of 7.8417 billion rupiahs, assuming other variables are constant. This finding is consistent with research conducted by Ramadhan (2019), Roswitha (2015), and Campodonico et al. (2014), which says that educational infrastructure has a significant influence on economic growth. With adequate education facilities, it is expected to increase school participation rates. So that with a good education, the people would get new skills that help to manage and adapt to the changes in a new environment (Singh & Gera, 2015). Also, education makes people have innovation and creativity (Toivanen & Väänänen, 2013). Therefore, these two things will affect the level of productivity at work, so that the impact on the economy is positive.

Effect of Health Variable on Economy

Based on the model, the number of health facilities (hospitals, puskesmas, posyandu and poskesdes) with variable units shows a positive and significant effect on non-mining CP RGDP with a regression coefficient of 3.0307. This finding means that each increase in the number of health facilities is one then the unit can have the effect of increasing the RGDP of 3.0307 billion rupiahs with the assumption that other variables are constant. According to a study conducted by Atmawikarta (2009), i.e. at the macro level, populations with good health are essential inputs to reduce poverty, growing economy and long-term economic development. With adequate health facilities, the population tends to be in good health. A healthy condition they have will encourage people to be more productive (Akingba et al., 2018; Sahnoun, 2018). Therefore, health facilities have a positive impact on economic growth.

Effect of Capital Expenditure Variable on Economy

Based on the model, capital expenditure variable shows a positive and significant effect on non-mining CP RGDP with a regression coefficient of 0.8586. This result means that any increase in capital expenditure of 1 billion rupiahs will increase the RGDP of 0.8586 billion rupiahs, assuming other variables are constant. This conclusion is following research from Syadzwina (2018), which says that the variable capital expenditure has a positive relationship with the growth of CP RGDP. According to him, every 1 per cent increase in capital expenditure growth will increase the CP RGDP by 0.063914 per cent, assuming other variables are constant. It can be understood that government spending has a direct impact on economic growth. It may happen because the amount of aggregate consumption (we saw as GDP) in a region consists of various components, which one of it is government expenditure. Besides, government expenditure also has a multiplier effect on various sectors. Referring to the findings from Hemrit &

Benlagha (2018) and Strobel (2018), government spending has a positive effect on economic growth. However, the magnitude of the impact can vary depending on how the effectiveness of the spending is managed (Wilson, 2012).

4. Conclusion

The results of this study indicate that the existence of infrastructure has a positive and significant effect on economic growth, specifically electricity, water infrastructures, schools, health facilities, and capital expenditure. As for road infrastructure does not have a significant impact on economic growth. Therefore, the prospects for infrastructure development need to prioritize electricity, water infrastructures, schools and health facilities. From these findings, the regional government needs to carry out infrastructure development in a structured manner according to the purpose of economic growth increase. Development needs to focus on the non-mining sector and non-quarrying sector. Also, development not only adds quantity but in terms of quality. More than it, the government specifically need to pay attention to building infrastructure that is resistant to earthquakes. Some the territory of West Nusa Tenggara Province is earthquake-prone, so it should be noted to build the infrastructure which is resistant to the earthquake.

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