

WHY INFRASTRUCTURE STILL CHALLENGING IN ASIA? MODIFIED SOLOW GROWTH MODEL APPROACH

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Abstract. Infrastructure is an essential part of a country's economic growth. Previous research has shown that infrastructure has a positive effect on growth. However, this study shows that infrastructure relative minor effect on economic growth, and inter-island development inequality in Indonesia is vast. By using the Modification of the Solow model, we examine on infrastructure under branch Ministry of Public Works and People's Housing. It's consisted of highway, road and bridge area, water resources area, human settlements area, and housing provision area. Further research needs to clarify this research.

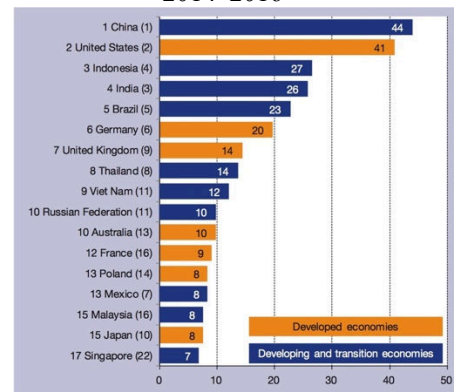
Keywords: economics growth; infrastructure; GDP; Solow growth

I. INTRODUCTION

In the case of the Indonesian economy, even though the performance of economic growth has not yet reached the Asian average, strong economic fundamentals, accompanied by improvements in macro and microeconomic risks, have encouraged various international institutions to provide a positive assessment of Indonesia's economic outlook. As a result, Indonesia is again categorized as an investment grade by several international institutions. The results of the UNCTAD survey in the 2014-2016 (Graphics.1) World Investment Prospects Survey put Indonesia at the third rank of the most attractive investment destination by investors after China, the United States, Indonesia, India, and Brazil. According to Japan Credit Rating Agency, Indonesia in 2019 on level BBB / Positive.

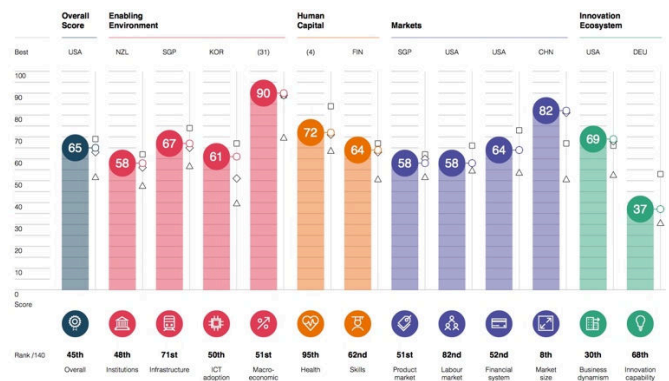
However, the medium and long-term Indonesian economy is facing a critical challenge, namely the constraints on the development of production factors which hinder the achievement of higher and better-quality economic growth. The World Economic Forum (WEF) revealed that Indonesia's competitiveness is still lagging (Figure 2) in the 2018 Global Competitiveness Report 2018 (GCR 2018), three mainly on infrastructure pillars, technology readiness pillars, and innovation pillars. This WEF assessment shows that the structural constraints facing Indonesia (the most binding constraints). More specifically, the constraints on infrastructure pillars stem from the low quality of roads, ports, airports, trains, and the quality of electricity supply. Meanwhile, the constraints of the pillars of technological readiness and innovation include the low level of mastery of technology and innovation activities. GCR 2018 stated "There is also a physical infrastructure gap among G20 economies (about 30 points between Japan and Indonesia, the best and worst performers, respectively). There are stark contrasts in terms of innovation capabilities, too."

Graphics.1: Top prospective Countries in Investment, 2014-2016



Source: UNTAC 2014-2016 World Investment Prospect

Graphic 2. Indonesia's Ranking/Performance in the World



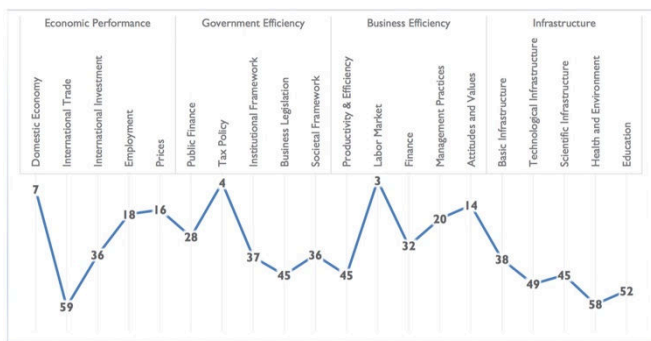
Source: Global Competitiveness Report 2018

Table 1. Indonesia Ranking and Score compete to other countries

Indonesian Infrastructure Quality			
Indicator	Value	Score	Ranking in the Word
Overall Infrastructure (0-100 (Best))	-	66.8	71
Road connectivity index 0-100 (Best)	34.6	34.6	120
Quality of roads 1-7 (best)	3.9	48.1	75
Railroad density km of roads/square km	2.5	6.1	82
Efficiency of train services 1-7 (best)	4.7	61.4	19
Airport connectivity	972,336.6	100	5
Efficiency of air transport services 1-7 (best)	5	66.7	49
Liner Shipping Connectivity Index 0-157.1 (best)	40.9	40.9	41
Efficiency of seaport services 1-7 (best)	4.2	54.1	61

Source: WEF, Global Competitiveness Report 2018

Research conducted by the International Institute for Management Development in 2019 concluded that Indonesia still poor performance among countries in the world. The table below describes the Indonesian position.



Source: International Institute for Management Development, 2019

Regarding the improvement of infrastructure conditions, the obstacles faced are funding problems and legal problems. The allocation of Government expenditure for Government infrastructure development in the past eight years has averaged only around 1.6% of GDP. This ratio is relatively low when compared to other countries such as China and India, which each reach 5.3% and 7.3% of GDP.

Research conducted by Calderon states that there are two significant results: (1) growth is positively affected by the stock of infrastructure assets, and (2) income inequality decreases with higher quantity and quality of infrastructure. A series of specification tests show that these results do capture the causal impact of exogenous components on the quantity and quality of infrastructure on growth and inequality. The combination of these two results shows that infrastructure development can be instrumental in fighting poverty (Calderón, 2004). Canning stated that although infrastructure tends to cause economic growth in the long run, and the results obtained vary substantially in various countries. There is significant evidence that each type of infrastructure available reaches the maximum value of global growth averages. However, there are also supply shortages in

some countries and oversupply in several other countries (Canning, Pedroni, 2008).

II. LITERATURE REVIEW

Given the critical role of infrastructure in encouraging economic growth, an empirical study of the effects of physical infrastructure includes: means of transportation (length of road and port loading and unloading), electricity, and the quality of human resources (education) in 36 provinces in Indonesia but by considering several factors related to government policy, economic structure, and community structure.

The allegations of disparity in the Indonesian economy will be studied more deeply in this study by adopting the theory of convergence and using static panel data methods. Explicitly, the purpose of this paper first is to provide an up-to-date description of the condition of infrastructure at national and regional levels; second, knowing the condition of economic disparity between regions in Indonesia, namely through the identification of convergence; and third, identify the influence of infrastructure on economic growth at the national and regional levels.

III. METHOD

The economic growth model used as a reference is the modified exogenous growth model or modified Solow growth model. The Solow model assumes that economic growth is only influenced by changes in the factors of production of physical capital (savings and investment) and labour (population growth), while the technology that describes the level of efficiency is an exogenous variable and is considered a residual. The Solow model is a development of the Harrod-Domar growth model by adding labour and technology factors to the growth equation. Labour and capital are assumed to experience diminishing returns if both are analysed separately and constant returns to scale if both are analysed together (Todaro and Smith, 2006)

The Solow growth model emphasizes the importance of the role of investment in the process of accumulation of physical capital. The rate of economic growth determines by the level of capital accumulation per workforce. Based on this model, regions that have better capital accumulation will grow higher. Thus, if the investment ratio increases, the steady-state output per labour will be higher. Regions with the same initial capital but higher investment ratios will have a higher steady-state income per capita so that disparities between regions will be more comprehensive. Meanwhile, regions with lower initial capital but with higher investment ratios will grow higher.

Besides, there is an assumption that the mobility of production factors both capital and labour at the beginning of the development process is not smooth so that capital and skilled labour tend to concentrate in more developed areas. The result is a vast regional inequality. However, with the better communication infrastructure and facilities between regions along with the sustainable development process, the mobility of capital and labour will be smoother. If the country progresses, regional development inequality will decrease. This estimate is the second conclusion of this model and came to be known as the Neoclassical Hypothesis.

Model formulate using static panel data:
 $LnGDP_{it} = \alpha_{it} + Ln Capital Inv_{it} + Ln Labour_{it}$
 $+ Ln Highwaybridge_{it} + Ln Water R_{it}$
 $+ Ln Human Settlements_{it}$
 $+ Ln Housing Provision_{it}$

IV. RESULT

Static Panel Data for Indonesia result show below:

Table 1. Estimation Result for Indonesia Period 2011-2016

Independence Variable	Dependent Variable: Income Per Capita		
	OLS	Fixed	Random
Constanta	-2.720123 0.367276***	-0.778249 0.086911***	-0.800991 0.101529***
Capital investment	0.214448 7.939738***	0.003998 0.004558	0.006607 0.004546
Labor force	0.75864 0.027009***	0.837309 0.007572***	0.836565 0.007484***
Highway, road and bridge area	0.072279 0.049468	0.013663 0.010839	0.014055 0.010758
Water resources area	-0.141493 0.048098***	0.017445 0.008910*	0.014896 0.008880*
Human Settlements area	-0.039222 0.052387	0.01409 0.007905*	0.013399 0.007897*
Housing Provision area	0.087001 0.022641***	0.021377 0.003655***	0.022511 0.003648***

***, **, and * significant at 1%, 5%, and 10%. Number on second row standard error. Variable in form of Natural Logarithm

Sumatra Island for comparison show below:

Table 2. Estimation Result for Sumatra Period 2011-2016

Independence Variable	Dependent Variable: Income Per Capita		
	OLS	Fixed	Random
Constanta	-5.353442 0.748935***	-4.277786 1.498057**	-4.406909 1.185966***
Capital investment	0.841088 0.057794***	0.003998 0.092882***	0.829611 0.080076***
Labor force	0.213246 0.085455**	0.090778 0.176302	0.10121 0.135835
Highway, road and bridge area	-0.045024 0.068056	0.016492 0.012581	0.016151 0.012539
Water resources area	-0.020828 0.038432	4.34E-06 0.007721	-4.65E-05 0.007605
Human Settlements area	-0.041022 -0.054160	0.015213 0.009584	0.015138 0.009574
Housing Provision area	-0.012672	0.004187	0.003904

0.023682 0.004749 0.004394

***, **, and * significant at 1%, 5%, and 10%. Number on second row standard error. Variable in form of Natural Logarithm

And Java Island for Highest Growth in Indonesia:

Estimation Result for Java Period 2011-2016

Independence Variable	Dependent Variable: Income Per Capita		
	OLS	Fixed	Random
Constanta	-5.318884 0.979764***	-6.248768 2.502362**	-NA- -NA-
Capital investment	0.703147 0.077399***	1.026933 0.085004***	-NA- -NA-
Labor force	0.37323 0.088479***	0.004184 0.204955	-NA- -NA-
Higway, road and bridge area	-0.135902 0.082073*	-0.011734 0.008275	-NA- -NA-
Water resources area	-0.025559 0.062349	0.003258 0.008479	-NA- -NA-
Human Settlements area	-0.034285 0.060695	-0.00299 0.005642	-NA- -NA-
Housing Provision area	0.118831 0.049574**	0.007908 0.006396	-NA- -NA-

***, **, and * significant at 1%, 5%, and 10%. Number on second row standar error. Variable in form of Natural Logarithm

From the results obtained at the national level, the water resources area harmed the growth of -14% whereas Housing provision area gave a significant and positive contribution of 2% on average. None of the results obtained for the Sumatra Corridor showed significant value. Whereas for the Java Corridor, only the Housing provision, which contributes 11% of the remaining does not have a significant influence on economic growth.

V. DISCUSSION

Indonesia has a dilemma because the ratio of infrastructure budget to GDP is only 1%. So that infrastructure does not have too much influence on economic growth and development evenly distributed. From the 1% budget, not all absorbed in physical expenditure, but only 40% spent on physical expenditure and 60% spent on non-physical expenditure. The government needs to find new alternatives for development financing so that it does not burden the state budget.

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