Chapter 2

Indonesia's Infrastructure and Inclusive Economic Growth

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This chapter examines if infrastructure – as an exogenous variable – is a vital source of inclusive or quality economic growth in Indonesia. This inclusive formulation combines the Solow growth model, Harrod-Domar model, Keynes's identity equation, and Cobb-Douglas model. It also examines if infrastructure helps achieve the Sustainable Development Goals to reduce the economic gap, poverty rate, and open unemployment and increase efficiency for the freer flow of goods and services, making Indonesia more attractive for foreign direct investment inflows. It concludes by examining the geopolitical and geoeconomic elements of infrastructure financing, featuring China's Belt and Road Initiative.

1. Background

During the past decade, Indonesia's efforts towards achieving inclusive growth have accelerated, resulting in improvements to the country's poverty rate and Gini coefficient. However, the COVID-19 pandemic set this achievement back. During the pandemic, the country's poverty rate rose to double digits, from 9.41% 2019 to 10.14% in 2021, before returning to 9.54% in 2022 (Statistics Indonesia). Similarly, before the pandemic, unemployment had steadily decreased from 6.14% in 2012 to 5.18% in 2019 (Statistics Indonesia). However, it rose to 7.07% in 2020 due to a shock to the labour market, given various activity restrictions and weak economic demand. The rate fell back to 5.86% in 2022.

Infrastructure development leads to higher productivity and growth, facilitates trade and connectivity, and promotes economic inclusion (ADBI, 2020). Despite a compelling argument for infrastructure development, some critics point out that infrastructure may not address inequality or substantially contribute to economic growth, or may be executed inefficiently. Calculating the incremental capital–output ratio (ICOR), which indicates the quantity of capital required to produce one unit of output, is one of the methods employed. The greater the ICOR, the greater the amount of capital required to produce the output. However, using the ICOR to assess the impact of massive infrastructure development through the *Proyek Strategis Nasional* (PSN) on economic growth is imperfect, as the ICOR covers only output impacts for a particular period. Indeed, results would be misleading, as the PSN is a multiyear project that needs time to generate complete impacts. Another weakness is that the ICOR's measurement is post-factum, while the development of the PSN is ongoing.

This chapter thus argues that an analysis of the PSN requires quality growth analysis as a proxy for the inclusive aspect. It also needs to consider that amidst the long period of PSN development, Indonesia's economic growth has been secure. In the realm of industrial sector development, encompassing infrastructure and manufacturing, Indonesia has made notable progress since the Asian Financial Crisis of 1998 During this period, the country successfully elevated the infrastructure's contribution to GDP, rebounding from a low of 35% in 2015 to 43% in 2019, as reported by Statistics Indonesia. This increase can also be viewed in annual terms, where the share of infrastructure in GDP climbed from 5.5% in 2000 to a significant 10.4% in 2021. Conversely, the manufacturing sector has been experiencing a reduction in its share, declining from 25% in 1998 to 19% in 2022, according to Statistics Indonesia. The upswing in infrastructure's contribution to GDP since 2015 reflects the effectiveness of the *Proyek Strategi Nasional* (PSN), which was initiated in 2016 and has played a pivotal role in this positive trajectory.

Another determinant of growth is participation in global trade. This can be assessed through indicators such as the country's current account and foreign direct investment (FDI). Both of these factors are closely tied to the performance of the manufacturing sector (Verico and Natanael, 2018). Specifically, a nation's manufacturing sector's economic competitiveness plays a pivotal role in determining the level of export-oriented FDI it attracts. This competitiveness is closely linked to the market mechanism indicator, which facilitates the free flow of goods and services. A conducive environment for such trade supports and enhances manufacturing competitiveness. Furthermore, it is worth noting that infrastructure, as an exogenous factor, comes into play subsequent to the assessment of total factor productivity (TFP) in influencing a country's growth trajectory. Therefore, another dimension for analysis is the impact of the PSN on the Logistic Performance Index (LPI) as a reflection of the free flow of goods and services as a driver of current account-oriented FDI inflows, reflecting the country's savings rate and economic growth.

In terms of a global consensus, infrastructure development is also a part of the Sustainable Development Goals (SDGs). SDG 9 touches on resilience infrastructure that promotes inclusiveness, implying a clear distributive impact and support for innovation towards sustainable industrialisation. In Indonesia, public investment and private financing play significant roles in providing infrastructure – as in the PSN – and are expected to maintain stable investment flows to the economy. Yet in the early period of the pandemic, public infrastructure spending was scaled back; in recent years, it has again increased. At the sub-national levels, infrastructure spending is also part of Indonesia's mandate of decentralisation.

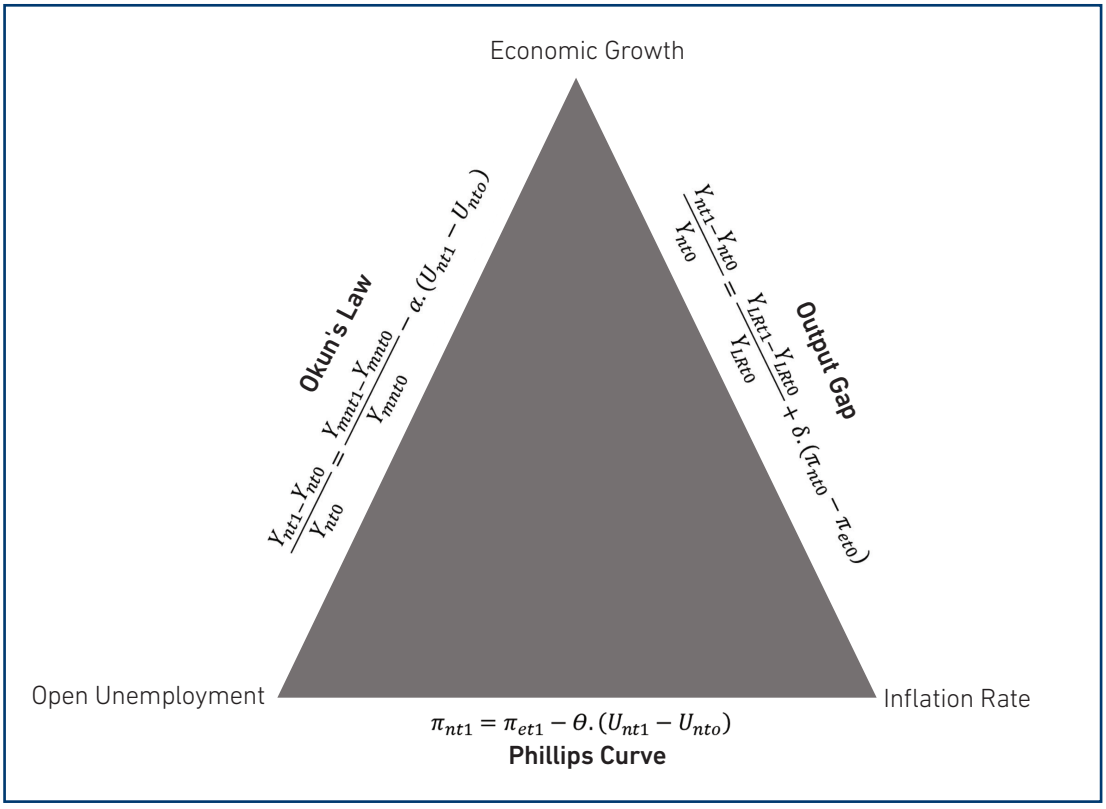
While some argue that a lack of available financing impedes infrastructure development, the literature has noted that infrastructure development must match financing with investable projects (Ehlers, 2014; Walter, 2016). Thus, the main challenge is to connect demand-side projects with economic viability – including project risk and risk mitigation – with the supply side of investable funds in search of optimal portfolio allocation. Project financing depends on banking expertise and lending as the funding source during the construction phase, while securitised bank debt and government bonds are the primary sources of funds during the operating phase (Walter, 2016). This financing aspect holds geopolitical and geoeconomic factors. From an international economics perspective, infrastructure development aims to enhance the bond amongst logistics services, current account, and FDI inflows as well as to accelerate economic growth.

This chapter seeks to examine the relationship between the extensive infrastructure development within the PSN and its impact on Indonesia's inclusive economic growth. It employs a mixed-method approach, encompassing one quantitative analysis exploring the triangular relationship between inclusive growth, open unemployment, and inflation rates (as per Verico, 2021) (see Appendix 2.1), as well as two desk-research methods involving descriptive data analysis and literature review.

The initial section of this chapter delves into the influence of infrastructure on Indonesia's inclusive economic growth. It asserts that higher infrastructure quality is correlated with more inclusive economic growth. To measure this quality, a triangular relationship is used, examining economic growth vis-a-vis open unemployment (utilising Okun's Law), open unemployment in relation to the inflation rate (as per the Phillips Curve), and economic growth juxtaposed with inflation (depicting the output gap) (refer to Figure 2.1).

The subsequent segment elucidates the role of infrastructure in fostering economic efficiency and economies of scale. To analyse economic efficiency, this chapter draws on pertinent literature reviews and descriptive data comparisons, particularly assessing progress in the Logistic Performance Index (LPI) and net foreign direct investment (FDI) inflows. It also provides an overview of Indonesia's infrastructure development over the past decade, focusing on its alignment with Sustainable Development Goals (SDGs), with a special emphasis on connectivity. Additionally, the chapter identifies trends in Indonesia's logistics sector performance and compares them with those of other Association of Southeast Asian Nations (ASEAN) Member States (AMS). It addresses ASEAN regional connectivity and offers recent updates on digital infrastructure and maritime connectivity. Lastly, the chapter delves into the geopolitical and geoeconomic dimensions of infrastructure financing.

Figure 2.1. Triangle of Economic Growth, Open Unemployment, and Inflation Rate



Source: Authors.

2. Analysis

2.1. Infrastructure and Inclusive Economic Growth

The notion that infrastructure development promotes economic growth has been documented in the literature (e.g. Calderón and Servén, 2004; Egert, Kozluk, Sutherland, 2009; Irawan et al., 2012). Extensive, good-quality infrastructure improves mobility and connectivity, which leads to the efficient distribution of goods and services and lower transport costs. To accelerate infrastructure development in Indonesia, the government – under *Komite Percepatan Penyediaan Infrastruktur Prioritas* (Committee for the Acceleration of Provision of Priority Infrastructure, KPPIP) – has identified 208 projects and 10 programmes to be a part of the PSN, according to the latest Ministerial Regulation (Permenko No. 7/2021).

In a multilevel government, like that of Indonesia, the infrastructure provided by the central government potentially expands the tax base at the central and sub-national levels. For example, regarding land transport infrastructure, the Trans-Sumatra Toll Road construction has been associated with an increase in per capita central government taxes in the region by 13% (Syahputra and Qibthiyyah, 2022). Road length has also been positively correlated with increased provincial tax revenues (Andriany and Qibthiyyah, 2018).

At the static level, infrastructure is a necessary condition and exogenous factor in accelerating economic growth. It is a necessary condition because infrastructure – in addition to human capital productivity – is essential to increase the value addition of land. Since it is exogenous, infrastructure development requires government intervention, which varies amongst countries; China tends to lean towards using state-owned enterprises, while the United States employs private enterprises.

This chapter shows that economic growth has two major factors: the increasing capital productivity (i.e. technological progress) and the quality of the institution (see Appendix 2.2 for the mathematical formulation and derivation). Both indicators reflect the country's efficiency or economies of scale. The output reflects the composite of long-run investment and net exports. Investments and net exports represent a country's competitiveness at the global level. Both trade competitiveness and long-run investment inflows are the results of the endogenous growth factors of environmental justice, population size, human productivity, and exogenous growth factors of land capital with the stimulating capital of infrastructure and technological level. It also represents continuous, never-ending reforms, which reflect the quality of institutions that depends on share value, integrity, transparency, anti-corruption behaviours, good governance, and clean government.

However, developing infrastructure from the construction phase to operation takes time. Costs arrive immediately, while the impact on output and outcome comes often much later. A commonly used indicator is the ICOR, which increases amidst massive infrastructure development like what Indonesia has been experiencing since 2016. The ICOR has increased, and the quality of economic growth during PSN development has been consistently good. This good quality can be seen in the triangular relationship between economic growth, open unemployment, and inflation (amongst Okun's Law, Phillips Curve, and the output gap) from 2016 to 2019 (see Appendix 2.3 for mathematical derivation).

This chapter shows that in the static-level analysis, the relationship between economic growth and infrastructure development is only accurate if not anchored to the ICOR – again, as the impact comes after, while the cost comes immediately. The output impact works only during the infrastructure construction phase; growth impact takes some time. Therefore, the measurement must include the quality of economic growth using the inclusive economic growth concept, which utilises the quality economic growth measurement of open unemployment, the Phillips Curve, Gini coefficient, poverty rate, and output gap. The last index compares economic growth and the inflation rate, which reflects the comparison of short- and long-run economic growth.

This chapter argues that if economic growth is higher than the inflation rate at the time of an open unemployment rate decline, this indicates that short-run economic growth is above that of the long run. This condition confirms the positive outcome of the output gap and that of Okun's Law on the quality of economic growth and Phillips Curve on a healthy inflation rate. To complete the output gap that compares short- and long-run economic growth, economic growth and the inflation rate are compared.

In 2019 – the pre-pandemic era – Indonesia's savings rate achieved 33.26% of gross domestic product (GDP) (Table 2.1). Indonesia's savings rate – compared to those of other AMS – was not low, with an economic multiplier of around three. It also shown that the higher the income per capita, the higher the savings rate or the lower the marginal propensity to consume. This comparison is consistent – except between Malaysia and Thailand, as Malaysia is supposed to hold a higher savings rate than Thailand (Table 2.1).

Table 2.1. ASEAN Member State Savings Rates, 2019
(% of GDP)

ASEAN Member State	GDP per capita (current $)	Gross Domestic Savings (% of GDP)
Singapore	65,831	54.19
Brunei Darussalam	31,086	54.51
Malaysia	11,433	28.57
Thailand	7,814	34.06
Indonesia	4,135	33.26
Philippines	3,485	14.33

ASEAN = Association of Southeast Asian Nations, GDP = gross domestic product.

Source: World Bank, World Development Indicators, https://data.worldbank.org/indicator (accessed 30 March 2023).

As Indonesia's economic growth was on average about 5.1%, the ICOR is 6.5. If Indonesia's ICOR is at its best, for instance, at 4.42 in the late 1980s and early 1990s, Indonesia's economic growth could be 7.5% (Table 2.2).

Table 2.2. Indonesia's ICOR by 5-Year Period, 1979–2019

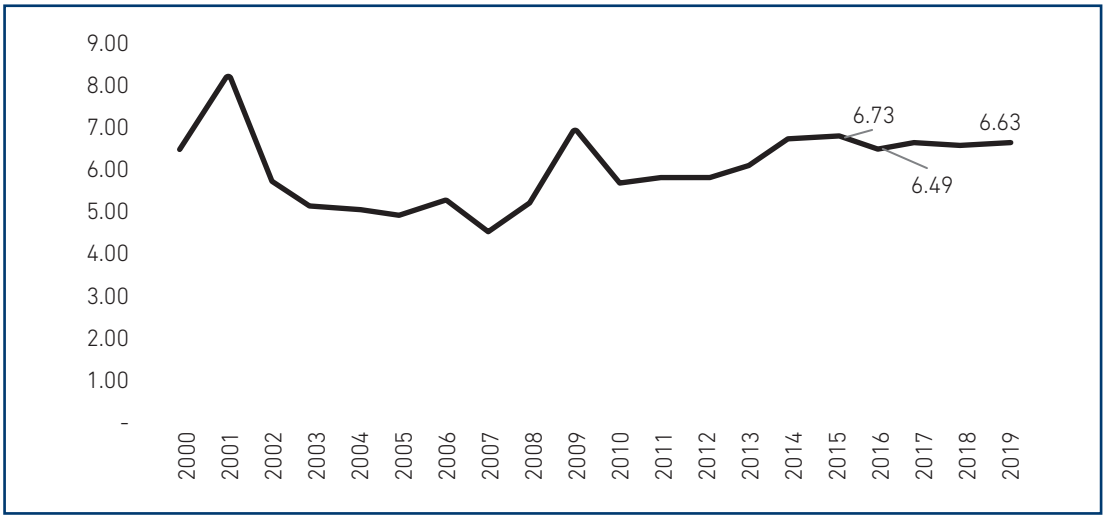
Period	ICOR
1979–1983	4.90
1983–1987	6.34
1987–1992	4.42
1992–1997	4.63
2000–2004	6.04
2004–2010	5.29
2010–2014	5.96
2014–2016	6.63
2016–2019	6.58

ICOR = incremental capital–output ratio.

Source: Authors.

Indonesia aims to increase its efficiency or to achieve economies of scale, which means decreasing its ICOR by developing massive infrastructure (i.e. the PSN). During the PSN, Indonesia's average ICOR from 2016 to 2019 increased to around 6.6. Yet, it decreased from 6.7 in 2015 (Figure 2.2).

Figure 2.2. Indonesia's ICOR, 2000–2019



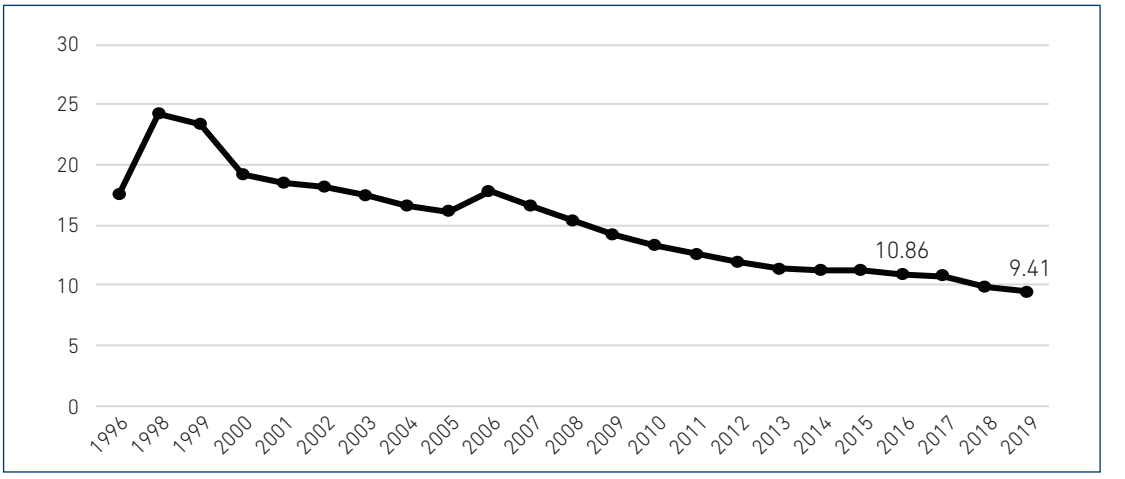
ICOR = incremental capital–output ratio.

Source: Authors.

Using ICOR as a measure to gauge the impact of infrastructure on growth can be misleading This is because ICOR is calculated by dividing the GDP investment share by the GDP growth rate during the same period, which may not align with the actual timing of infrastructure influence. A more appropriate approach is to assess the quality of economic growth using ICOR. This perspective integrates the concept of inclusive economic growth (Smith and Todaro, 2020; Jiang et al., 2022).

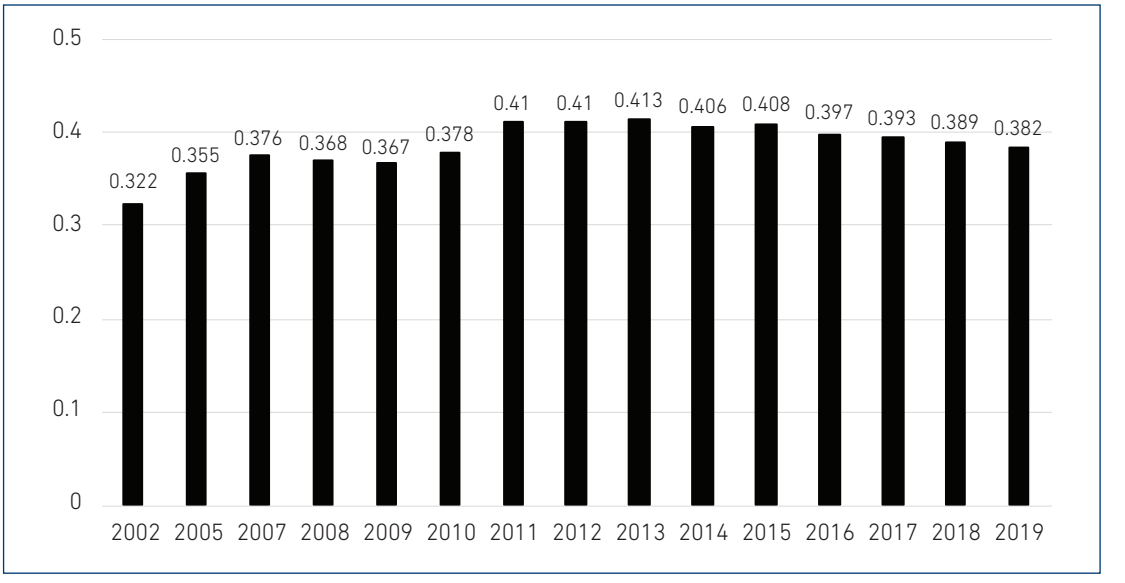
During the PSN period, spanning from 2016 to 2019, notable improvements were observed in key socio-economic indicators. Figures 1.3. illustrate a decrease in poverty rates, reflecting a decline in the percentage of individuals living below the poverty line. Additionally, there was a reduction in income inequality, as indicated by a decrease in the Gini coefficient (see Figures 1.4). These classical indicators help prove that the PSN's establishment did not reduce economic growth quality. Economic growth has been on track.

Figure 2.3. Indonesia's Poverty Rate, 1993–2019
(%)



Source: Statistics Indonesia.

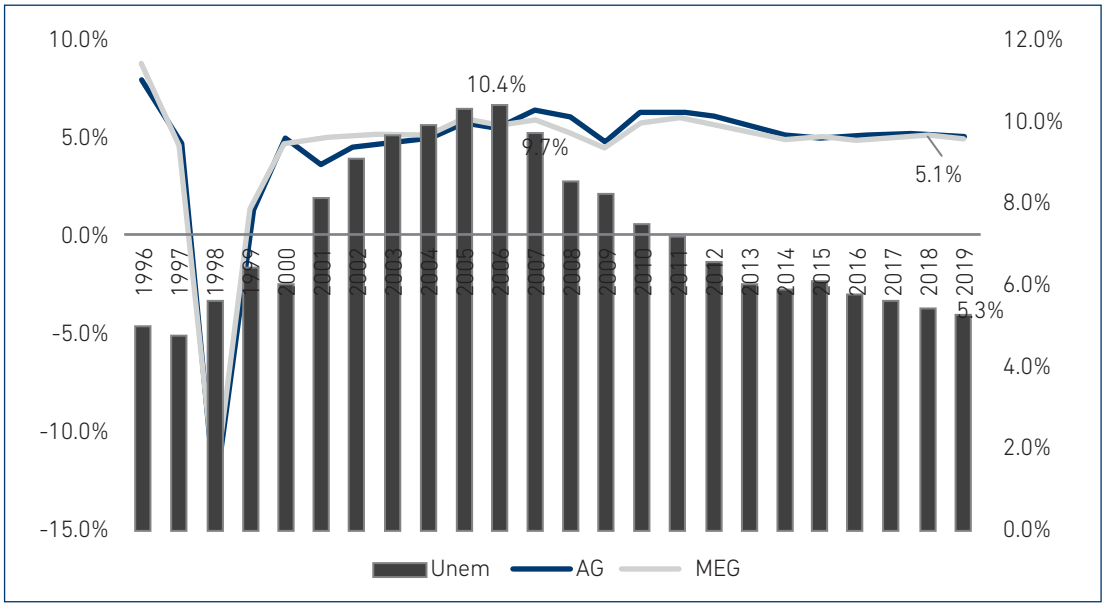
Figure 2.4. Indonesia's Gini Coefficient, 2002–2019
(%)



Source: Statistics Indonesia.

The triangular relationship further confirms the finding of these two economic growth measurements.

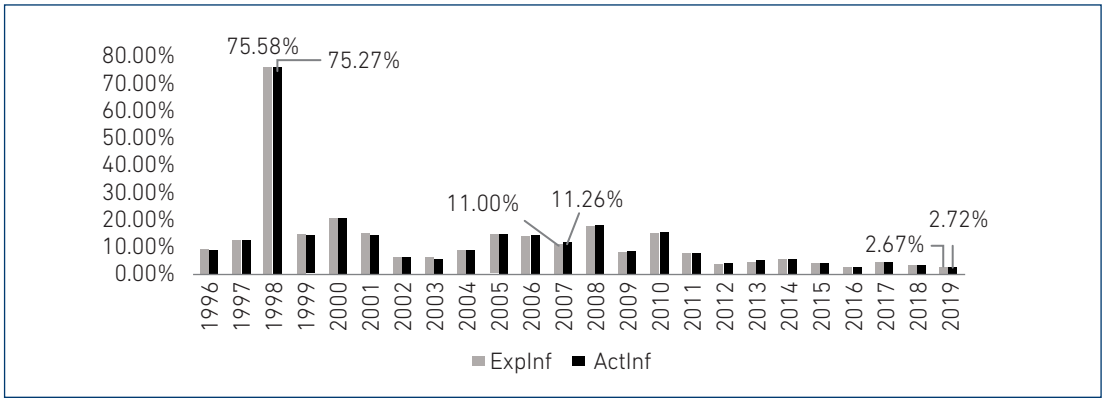
Figure 2.5. Okun's Law on Indonesia's Open Unemployment, 1996–2019
(%)



Unem = open unemployment, AG = average economic growth, MEG = minimum economic growth to generate jobs.
Source: Authors.

Moreover, the correlation between economic growth and open unemployment, commonly referred to as Okun's Law, indicates that prior to the pandemic, the real rate of economic development above the threshold required to generate employment opportunities within the labour market. This finding demonstrates an enhancement in the quality of economic growth during the period from 2016 to 2019.

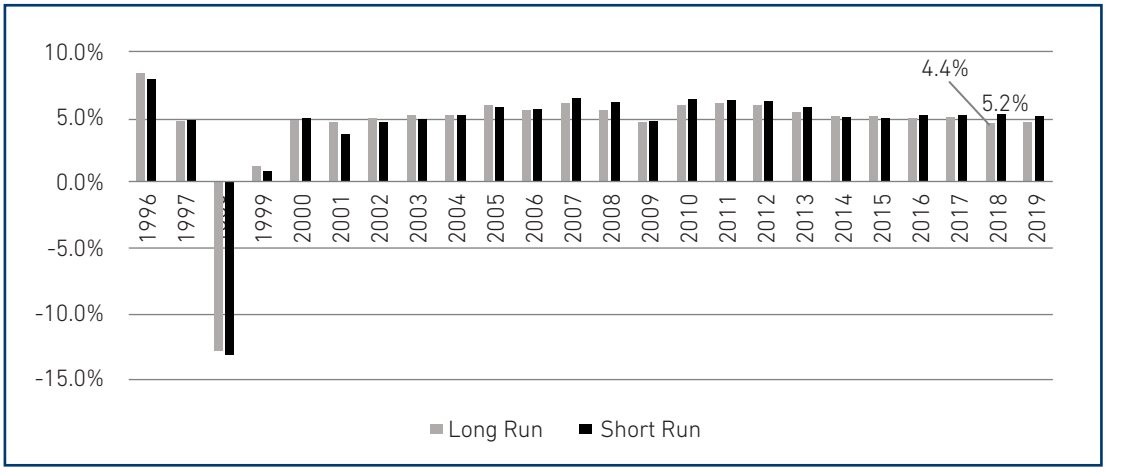
Figure 2.6. Phillips Curve on Indonesia's Inflation Rate, 1996–2019
(%)



Source: Authors.

The Phillips Curve confirms the findings of Okun's Law. From 2016 to 2019, Indonesia's inflation rate was healthy, validating the positive expectations for Indonesia's economy during this period. This finding is also useful as an early indicator that Indonesia's economy was productive, creating output more than raising prices.

Figure 2.7. Indonesia's Output Gap per Year, 1996–2019
(%)



Source: Authors.

Therefore, the comparison between short- and long-run growth as a proxy of the output gap shows that from 2016 to 2019, short-run economic growth was above long-run economic growth, indicating that the output gap was always positive amidst the massive infrastructure development of the PSN (Figure 2.7).

To further illustrate the positive output gap, economic growth and inflation rates are compared. The findings indicate that the period from 2016 to 2019 was a productive phase, defined as a period during which economic growth exceeded inflation. This implies that the economy generated more real output than it stimulated price hikes. In contrast, a less productive period is defined as a period when economic growth was lower than inflation. During the period from 1960 to 2022, there were a total of 15 productive years. The extensive infrastructure development of the PSN took place during these productive years. Throughout this period, the PSN consistently maintained a pace of inclusive economic growth, as reflected in Table 2.3. Additionally, this methodology helps identify recessionary periods marked by negative economic growth.

Table 2.3. Indonesia's Periods of Productivity, 1960–2022

Productive Years	1971, 1972, 1986, 1989, 2000, 2009–2012, 2016–2019, 2021, 2022
Less Productive Years	1960–1962, 1964–1970, 1973–1985, 1987–1988, 1990–1997, 1999, 2001–2008, 2013–2015
Stagflation Years	1963, 1998
Liquidity Trap	2020

Source: Authors.

Indonesia has only experienced 2 years of a negative growth crisis, in 1963 and 1998. It has never experienced a liquidity trap, where the inflation rate is below the economic growth rate. Yet a liquidity trap almost occurred in 2020 due to the pandemic, which made Indonesia's annual economy grow at –2.00% with a lower inflation rate with the absolute value of 1.68%.

In terms of green infrastructure, Verico (2022) confirmed that population and human productivity are the essential factors for achieving the SDGs.[1] This equation explained that the depletion and degradation of the environment are due to human capital. The better the productivity from improving ecological technology, the better the environment. The commitment to a green economy depends on human capital and technology orientation. The increasing population must be balanced with improving welfare, again showing the importance of inclusive economic aspects.

[1] $y_{nt(k_{nt})} = (\partial_{nt}) + n_{nt} + g_{nt}).k_{nt}$ ..... (a)
$MPK_{nt} = \partial_{nt} + n_{nt} + g_{nt}$ ..... (b)
$MPK_{nt} = \partial_{nt} = g_{nt} + n_{nt}$ ..... (c)
where $y_{nt(k_{nt})}$ is economic growth, ∂_{nt} is environmental justice, n_{nt} is population size, $g_{nt} = \frac{\partial E}{E\ nt}$ is human productivity, and MPK is marginal productivity of capital.

2.2. Infrastructure and Competitiveness

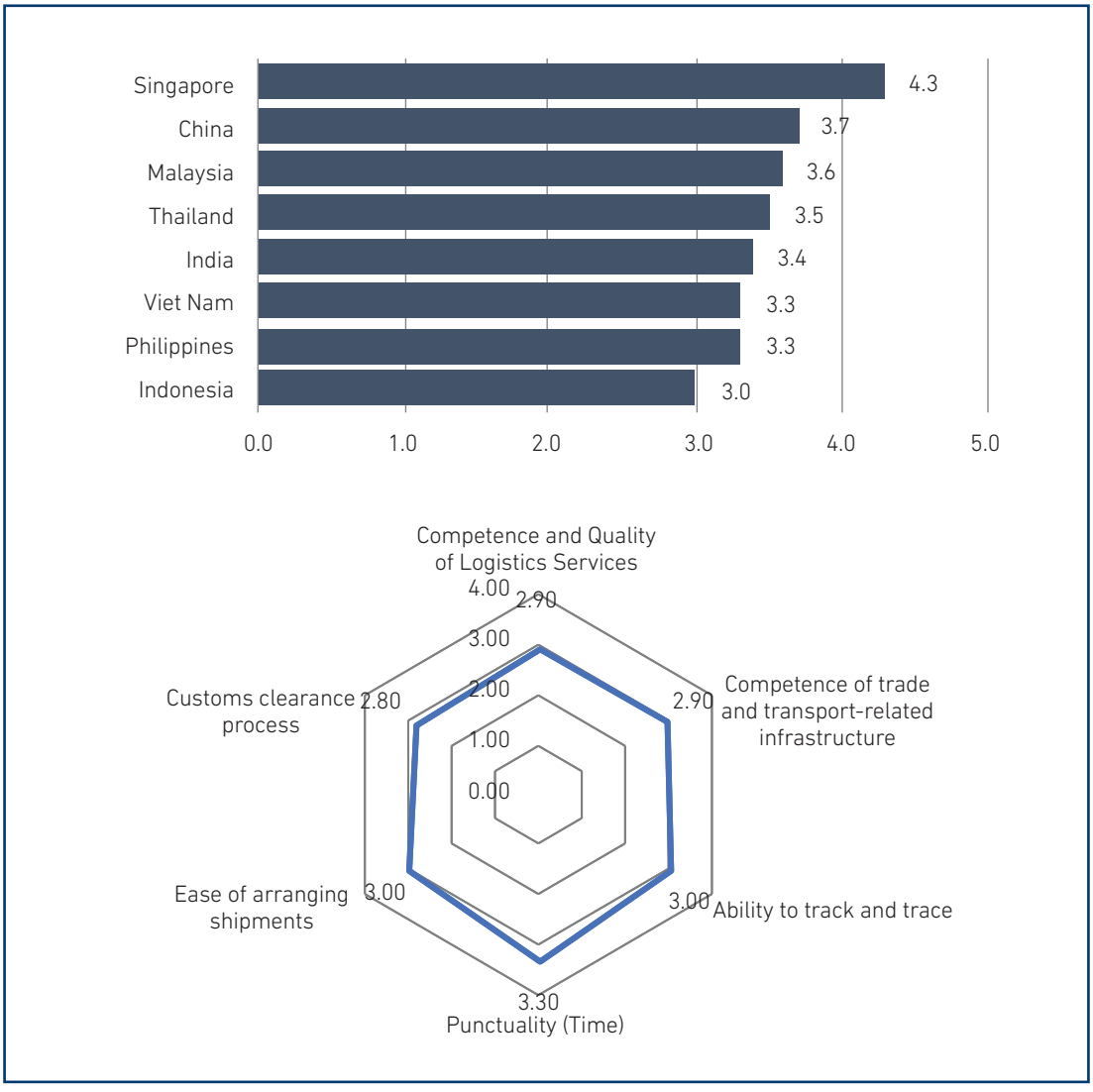
According to Tongzon (2012), the evaluation of infrastructure's impact on economic growth through the Harrod-Domar-Keynesian framework suggests that trade liberalisation in Indonesia necessitates more extensive deregulation in logistical services, particularly infrastructure support. This is a challenge for Indonesia. Logistics services are a significant prerequisite to improving the free flow of goods, both exports and imports. This improvement increases the current account and attracts future FDI inflows. The rising connection between the current account and FDI inflows boosts economic growth and international reserves, which will strengthen the local currency.

The World Bank (2023) produced an index to measure each country's logistics performance, conducted bi-annually since 2010. In 2018, Indonesia measured a 2.60 in its customs clearance process; 2.89 in the quality of trade and transport-related infrastructure, indicating the need to invest in new vessels and to rehabilitate its main ports; and a 3.67 in punctuality. In 2023, its customs clearance process rose to a 2.80, and the quality of trade and transport-related infrastructure reached a 2.90 (Figure 2.8).

Some studies have shown that the declining cost of logistics decreases total costs by 30% (e.g. Fink, Matoo, Neagu, 2000) and increases profits 5%–8% for every 1% decrease in logistics costs (Hummels, 1999). Indonesia's international economic efficiency has several positive factors: port infrastructure, bonded zones, export-processing zones, custom clearance, other administration, and digital platform utilisation. They cover 15%–25% of the total cost (Tongzon, 2012; World Bank, 2013). Yet according to Arvis et al. (2010), in the second World Bank's release of LPI in 2010, Indonesian infrastructure reached 2.54[2] while its customs clearance reached 2.43 and logistics competence 2.47. Its highest scores were for timeliness (3.46), international shipment services (2.82), and tracking-tracing (2.77).

[2] The LPI covers customs clearance, infrastructure, international shipment, logistics service quality, tracing and tracking, and timeliness.

Figure 2.8. Logistics Performance Index by Category, 2023



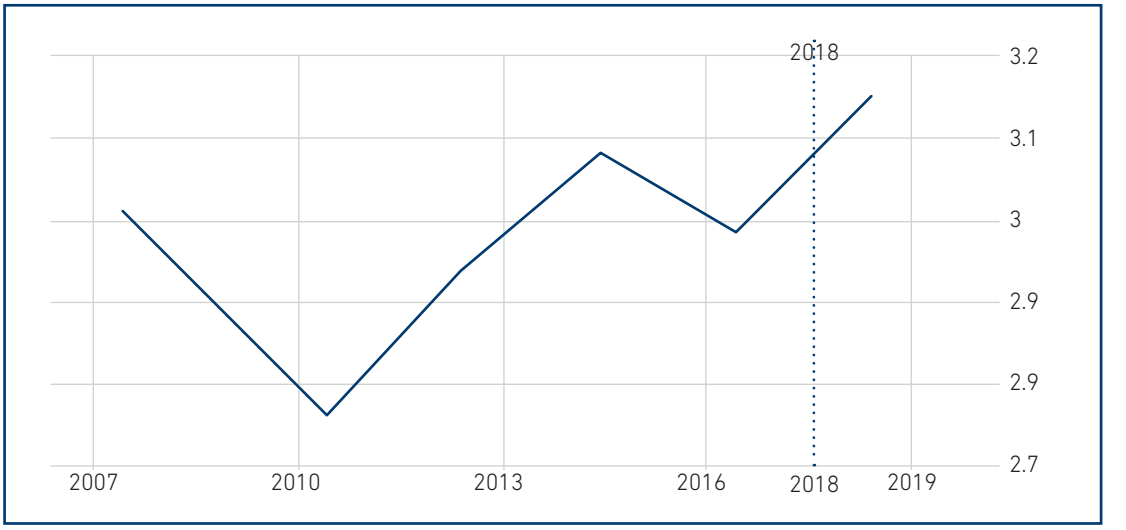
Source: World Bank (2023).

The Government of Indonesia has placed maritime connectivity at the core of its infrastructure improvement policy. Given this, the cargo loaded in 2021 increased 2.5 times since 2006. In 2015, the government launched the Maritime Highway Programme to induce new economic activity and to reduce the price disparity between islands. The programme aims to subsidise private operators and state-owned enterprises in specific transport lanes to minimise transport costs. The Economic Research Institute for ASEAN and East Asia (ERIA) (2021) evaluated this policy's effectiveness, finding that it comes with increased economic activity in areas near the ports, increased household consumption, and a heterogenous effect on price disparity for several commodities.

From 2007 to 2023, Indonesia recorded LPI scores between 2.5 to 3.2, classified as a partial performer (Fajarini, 2023).[3] This classification is in line with the income per capita of this lower middle-income country. The first step to improve Indonesia's logistics and related infrastructure is establishing a lead institution; in 2018, it began a national single window under the Ministry of Finance to oversee the free flow of goods and services.

Using 2018 as the cut-off year (before the pandemic affected global trade and logistics), Indonesia's LPI scores, which cover both administration and infrastructure, improved (Figure 2.9). This indicates that government interventions are essential in enhancing the necessary exogenous sources of economic growth-entitled infrastructure.

Figure 2.9. Indonesia's Logistics Performance Index, 2008–2019

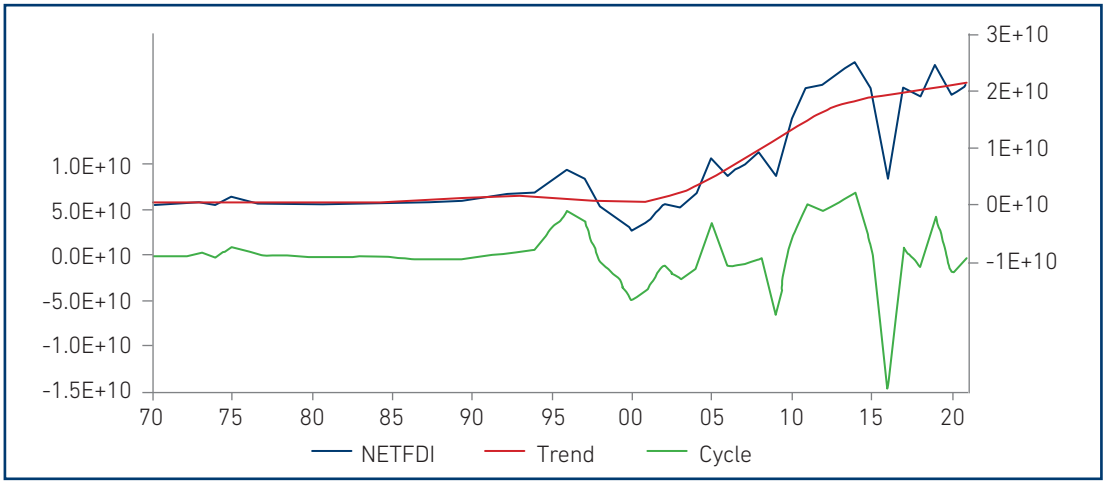


Source: World Bank (2023).

[3] There are four classifications for the LPI: poor (below 2.5), partial (2.5–3.2), consistent (3.3–3.6), and excellent/logistic friendly (above 3.6).

Hypothetically, the improvement of Indonesia's LPI scores since 2018 has attracted more FDI inflows. Figure 2.10 indicates that since 2018, the net FDI inflows have indeed been growing above their potential level. Yet the COVID-19 pandemic hit the global economy and caused a decline in flows of FDI around the globe, including towards Indonesia. The overshot effect had stopped by 2019, just before the pandemic impact hit Indonesia. This figure initially proves the hypothesis that the LPI's improvement positively affects FDI inflows.

Figure 2.10. Net Foreign Direct Investment Inflows of Indonesia with the Hodrick-Prescott Filter, 1970–2021



FDI = foreign direct investment.

Source: Authors.

Figure 2.10 also indicates that the LPI had a 1-year lag effect on FDI inflows. Indonesia's rank improved from 2014's 53 to 2018's 46, and FDI inflows increased significantly from 2018 to 2019. Moreover, it fell from the rank of 17 with a score of 3.15 in 2018 to 63 in 2023 with a score of 3.0-. This decreasing index will affect Indonesia's FDI inflows in 2024, as it now needs to put more effort into attracting investment in 2024 (Fajarini, 2023). Efforts can focus on improving the decreasing points in the LPI in 2023: timeliness, tracking and tracing, international shipments, and logistics competence and quality. Two improved indexes were customs, from 2.67 to 2.80, and infrastructure, 2.89 to 2.90. Timeliness and international shipment require international collaboration, while tracking and tracing and logistics competence need strong cooperation between the government and related business entities.

Efficiency in logistics and infrastructure can transform the Indonesian economy from forwards participation (i.e. exporting raw materials) to backwards participation (i.e. a production base country for intermediate input). Indonesia favours keeping forwards participation above backwards participation, which would create a down-streaming unorthodox approach.

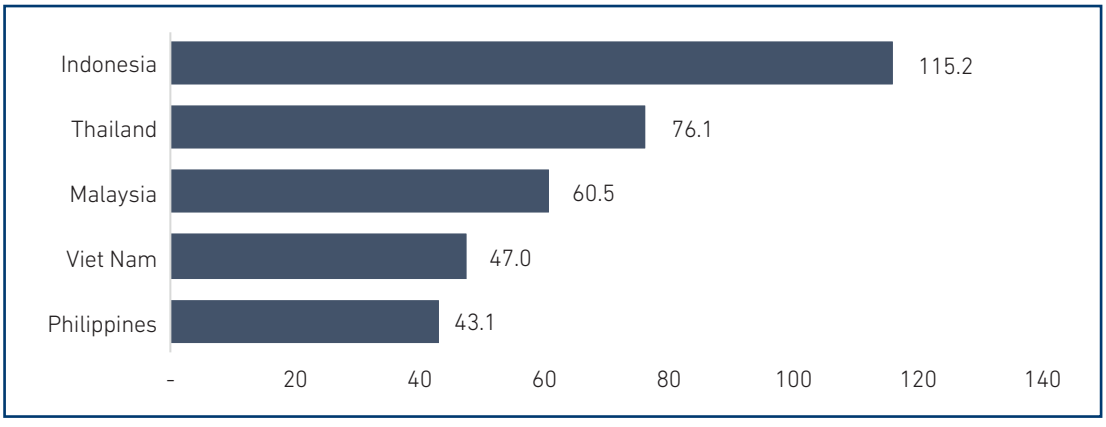
2.3. Transport and Digital Infrastructure

Infrastructure is critical to the development agenda. The 17 SDGs require infrastructure, both directly and indirectly. Transportation is an essential enabler of various SDGs. It makes a significant contribution to the SDGs in terms of economic development, industrial development, and SMEs. These will affect employment creation and welfare while reducing disparities and exclusion. Furthermore, information and communication technologies (ICTs) can help to accelerate progress toward the SDGs. ICTs enable the delivery of high-quality goods and services in some sectors, including health care, education, banking, trade, agriculture, and governance. They can help in generating new employment opportunities, fighting poverty and hunger, promoting better health, increasing energy efficiency, enhancing adaptation and mitigation efforts, and ensuring the sustainability of living spaces and ecosystems. In this section, we discuss the development of transport and digital infrastructure in Indonesia.

2.3.1. Air Transport

Amongst AMS, Indonesia has the largest passenger air transport market, with as many as 115 million passengers served in 2018 (Figure 2.11). As an archipelagic country with the largest population in the region, air transport is driven by domestic flights. The primary challenge facing this industry stems from the unequal distribution of population across Indonesia's expansive archipelago. As a result, achieving economies of scale in transportation and logistics becomes challenging when attempting to reach remote areas characterised by low population density.

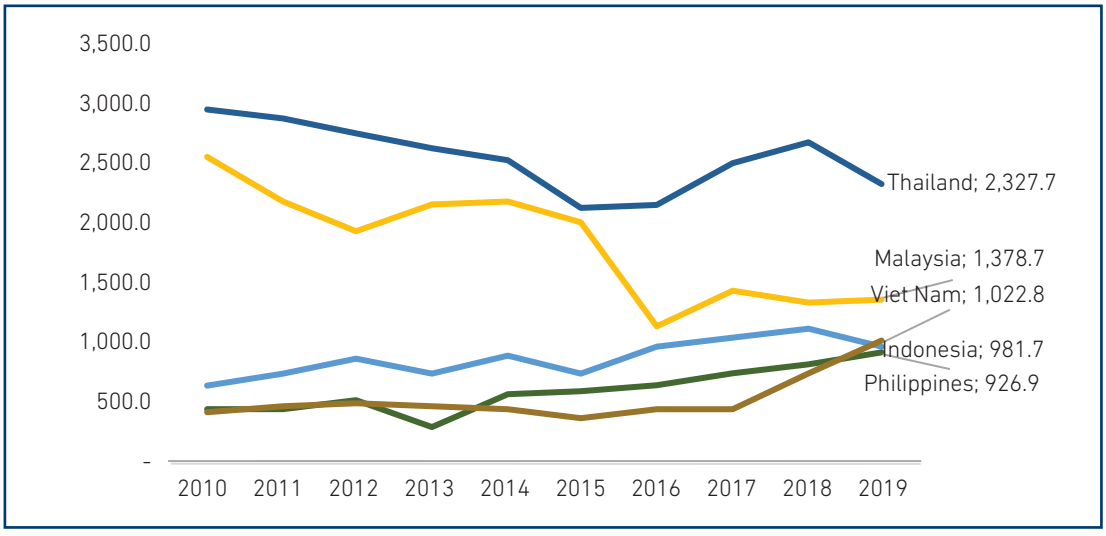
Figure 2.11. Air Transport Passengers in Selected ASEAN Member States, 2018
(million people)



Source: World Bank (2023).

While most logistics are delivered by sea, air freight transport is vital for high-value goods where speed matters. In the last decade, the number of goods transported by air in Indonesia has steadily climbed (Figure 2.12). In 2018, the number of goods transported through air freight transport was around 1.1 billion tonnes-kilometre before falling to 982 million ton-kilometres in 2019. The number, however, is below the statistics of neighbouring countries, like Thailand, Malaysia, and Viet Nam – but higher than the Philippines.

Figure 2.12. Air Transport, Freight, Selected ASEAN Member States, 2010–2019
(million tonne-kilometres)

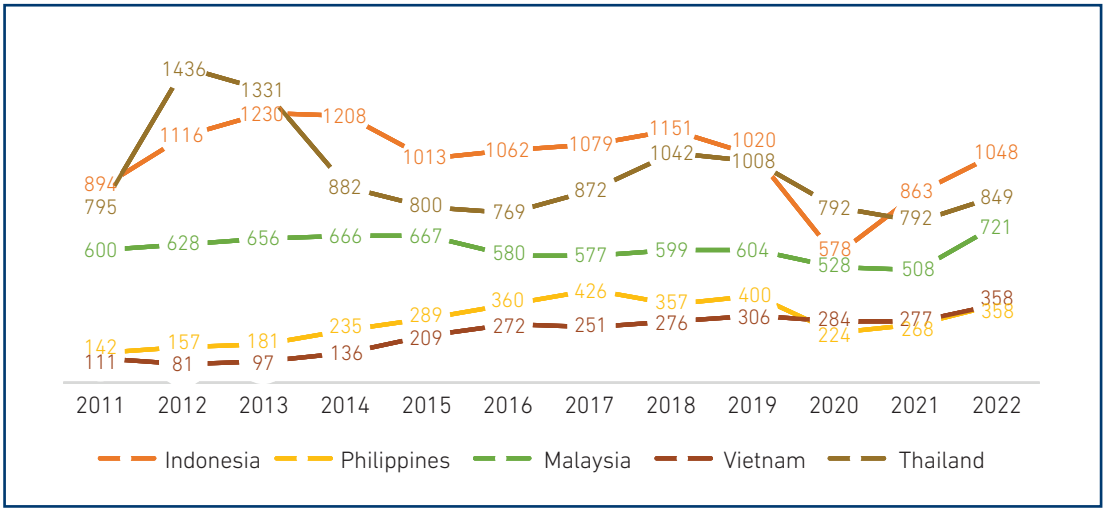


Source: World Bank (2023).

2.3.2. Land Transport

Data show that the number of vehicles sold in Indonesia has been consistently above 1 million per year since 2012. Indonesia experienced the largest decline in vehicle sales in 2020 compared to other AMS, but vehicle sales in 2022 exceeded the pre-pandemic level in 2019. For 2021–2022, vehicle sales in Indonesia were the largest in the ASEAN region (Figure 2.13).

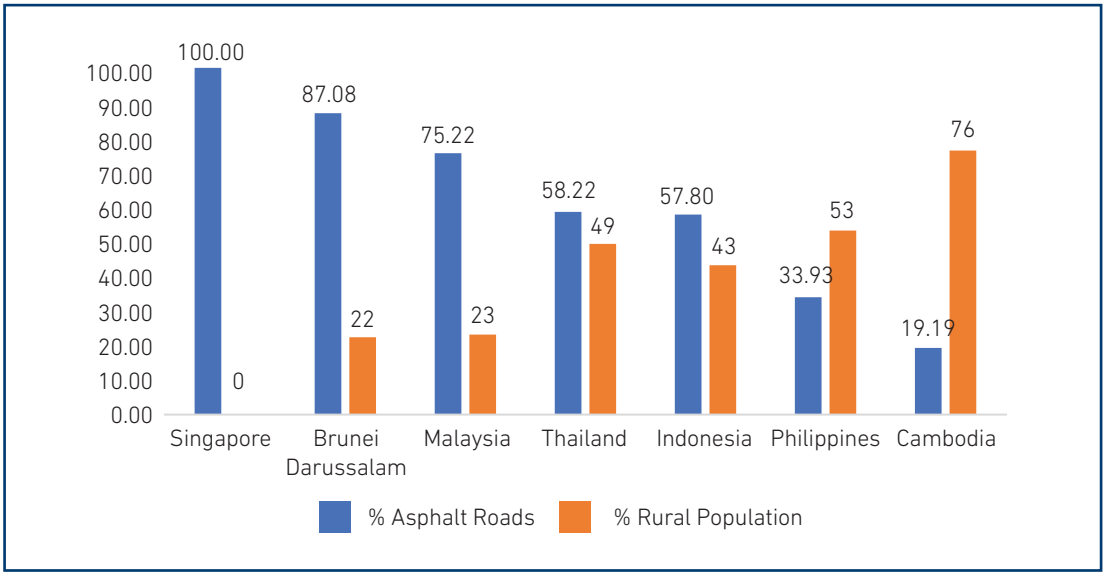
Figure 2.13. Vehicles Sold in Selected ASEAN Member States, 2011–2022
('000 units)



Sources: Gaikindo (2023), CEIC, Indonesia Premium Database, https://insights.ceicdata.com/ (accessed 30 March 2023).

An increased trend of paving roads fell in 2021, however, indicating that roads must improve (Figure 2.14). The percentage of paved roads tends to be higher in relatively urbanised countries.

Figure 2.14. Asphalt Roads, 2021 and Rural Population, 2020, Selected ASEAN Member States
(%)

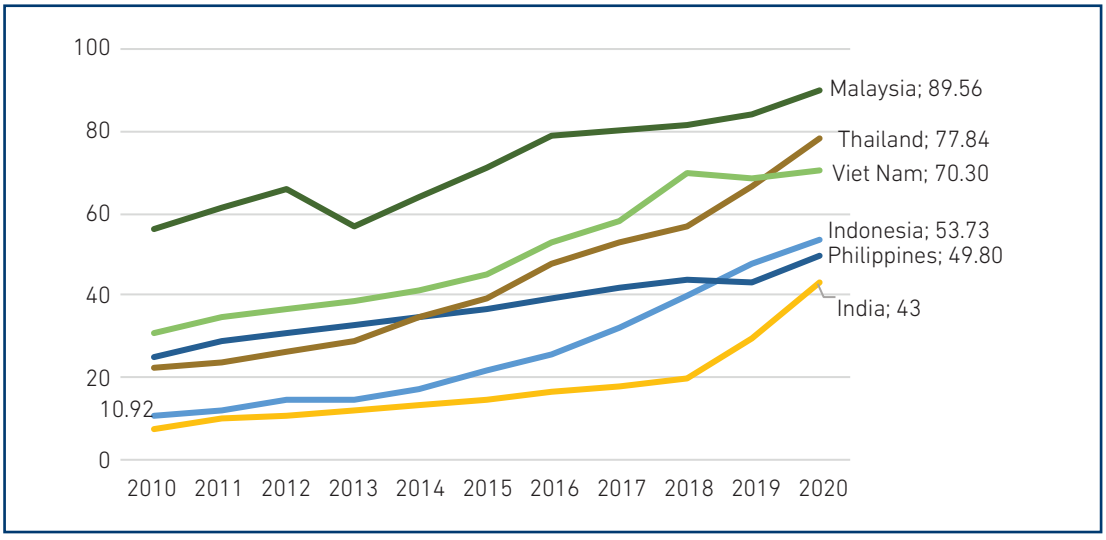


Sources: Gaikindo (2023), CEIC, Indonesia Premium Database, https://insights.ceicdata.com/ (accessed 30 March 2023), ASEAN database dashboard (accessed 30 March 2023), and the ASEAN Rural Landscape (2022).

2.3.3. Digital Infrastructure

Today, connectivity has grown beyond mobility to digital presence, which has been improving due to advancements in technology and the expansion of internet access. Internet adoption has grown strong over the last decade as internet coverage widened and social media use rose. In 2010, only 10.9% of the population in Indonesia used the internet; this number increased almost five times to 53.7% in 2020 (Figure 2.15). Despite rapid growth, this rate is still lower than those in neighbouring countries such as Malaysia, Thailand, and Viet Nam. Nevertheless, the coverage is still superior to that of the Philippines and India.

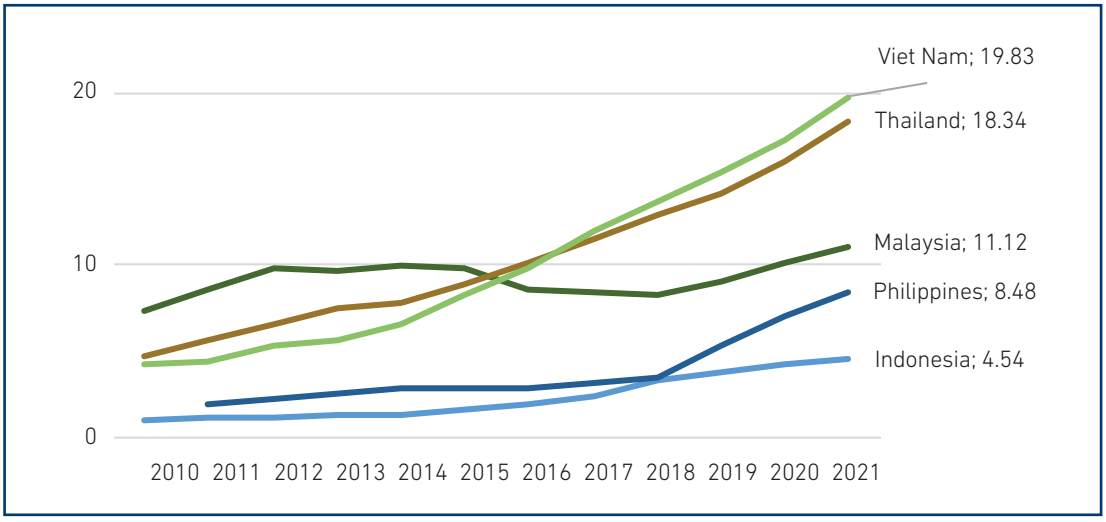
Figure 2.15. Individuals Using the Internet, Selected Countries, 2010–2020
(% of the population)



Source: World Bank (2023).

Indonesia needs to improve in terms of fixed broadband infrastructure, as it has the lowest rate in the region – 4.5 fixed broadband subscriptions per 100 people (Figure 2.16). Viet Nam and Thailand lead with 19.8 and 18.3, respectively, followed by Malaysia (11.1) and the Philippines (8.5).

Figure 2.16.Fixed Broadband Subscriptions, Selected ASEAN Member States, 2010–2021
(per 100 people)



Source: World Bank (2023).

The Digital Evolution Index[4] shows that the Republic of Korea, Singapore, and Malaysia are the three best countries for digital evolution as they have achieved excellent static and momentum levels (Figure 2.17). If the current state is low, but momentum is high, such a countries – which includes China, Indonesia, and Thailand – will soon break out. If momentum is low and the current state is high, a country is classified as a stall out (e.g. Australia and Japan). The Lao People's Democratic Republic is classified at the watch-out level, as both its current state and momentum are slow.

[4] Digital Evolution Index is an index that plots countries across four drivers of digitalisation, including (1) supply condition, (2) demand conditions, (3) institutional environment, and (4) innovation and change. The complete study can be accessed in The Fletcher School, Tufts University, Digital Intelligence Index, https://digitalintelligence.fletcher.tufts.edu/trajectory (accessed 29 March 2023).

Figure 2.17. Digital Intelligence Index

Source: The Fletcher School, Tufts University, Digital Intelligence Index, https://digitalintelligence.fletcher.tufts.edu/trajectory (accessed 30 March 2023).

Digital economic infrastructure and development stages conform to the inclusive principle, and have a positive impact on MSMEs. The transformation from offline to online e-commerce increases smartphone usage, thereby accelerating the development of business and consumer relationships.

2.4. Infrastructure and Geopolitical Aspects

Indonesia, as a significant emerging country, has garnered considerable interest from major stakeholders in the infrastructure industry as it advances its infrastructure development endeavours. Globally, international investors seek profitable ventures. In addition to economic incentives, infrastructure development is not immune to political interests. China has demonstrated a strong inclination towards investment in significant infrastructure projects across the Asian region. It has made investments in and undertaken the development of various significant infrastructure projects within the Indochina area, Southeast Asia, and South Asia. A significant number of these projects are included within the framework of regional connectivity as outlined by the Belt and Road Initiative (BRI). The BRI was launched in 2013 and is part of President Xi Jinping's international cooperation policy to increase China's connectivity with over 100 countries and to connect Asia with Africa and Europe via land and maritime networks. Zhang (2018) argued that the BRI carries much geopolitical weight as it aims to reduce tensions and to increase mutual trust with neighbouring countries.

The BRI comprises the Silk Road Economic Belt, a transcontinental passage that links China with South-East Asia, South Asia, Central Asia, Russia, and Europe by land; and the Maritime Silk Road, a sea route connecting China's coastal regions with South-East Asia, South Asia, the South Pacific, the Middle East, and Eastern Africa, all the way to Europe. The BRI possibly encompasses an area that accounts for 55% of global gross national product, 70% of the world's population, and 75% of all known energy sources (Bondaz, 2015). It aims to improve regional integration, increase trade, and stimulate economic growth. Five priorities include policy coordination, infrastructure connectivity, unimpeded trade, financial integration, and connecting people.

Worried that the BRI would challenge and undermine the influence of the United States, the Donald Trump Administration often publicly criticised the initiative; President Trump once said the initiative was 'insulting' (Karni, 2018). Vice-President Mike Pence claimed the US will not 'offer a constricting belt or a one-way road' when speaking at the Asia-Pacific Economic Cooperation (APEC) meeting in November 2018 (Reuters, 2018).

[5] G7 nations recently established the Build Back Better World programme as an alternate means of assisting lower-income countries with infrastructure development, which is viewed as a counterbalance to the BRI.

Previous studies have indeed identified challenges in the BRI, yet specific details are scarce, particularly at the bilateral level (Bondaz, 2015). Bondaz (2015) discussed a geopolitical and diplomatic offensive. Critics are also apparent in how China uses debt and market traps to 'reshape international relations in its favor' through fostering reliance on BRI partner countries (Mobley, 2019).[5]

The debts of more than half of the nations listed under the BRI are rated as 'junk' or are not graded due to domestic political and economic difficulties. Some of these nations are susceptible to dependency and economic pressures because they have few options. Chinese loans typically lack restrictions but frequently demand that projects be provided to Chinese firms and 'at least 50% of material, equipment, technology, or services' be supplied from China, in contrast to loans from multilateral financial organisations, which insist on responsibility and reforms (Eva et al., 2018 in Mobley, 2019).

President Xi jointly announced the plan to extend the BRI when visiting Indonesia in October 2013. In the same year, the two countries expanded their longstanding partnership into a comprehensive strategic partnership that includes industry, infrastructure development, and the transport sector (Damuri et al., 2019). In October 2016, it was announced that China won the bidding for the Jakarta–Bandung High-Speed Railway, a flagship project of President Joko Widodo now part of the BRI (Sulaiman, 2023). The first high-speed railway in South-East Asia, it covers 142.3 kilometres and is expected to reduce travel time to 40 minutes, as the train will be able to travel at up to 350 kilometres per hour.[6] A trial run has been conducted since May 2023, and the high-speed railway is expected to begin its operation in August 2023.

[6] The current railway between Jakarta and Bandung takes from 2 hours 50 minutes to 3 hours 29 minutes and covers 168.5 kilometres.

3. Conclusion

The relationship between infrastructure and economic growth must be considered over the medium to long term. Infrastructure requires large upfront investments yet has long-term benefits. It takes time for its effects on economic growth to manifest. As discussed in this chapter, ICOR is not suitable for measuring the effects of infrastructure on economic growth. Consequently, if the ICOR is adopted, it must use dynamic or momentum analysis after the establishment or construction phase. In addition, the ICOR can be misleading if not connected to economic transformation; meanwhile, the acceleration of economic growth for economic transformation requires the manufacturing sector, which usually increases the ICOR.

Amidst the development of infrastructure – particularly massive projects such as the PSN – a measurement of the quality of economic growth should be adopted in addition to the quantity of economic growth. This concept is known as the inclusive aspect of economic growth.

Thus, an ICOR calculation was performed, using both quality measurement forms of the classical inclusive indicator of the poverty rate and Gini coefficient as well as the triangular relationship between economic growth and open unemployment (i.e. Okun's Law), open unemployment and inflation rate (i.e. Phillips Curve), and growth and inflation rate (i.e. the output gap). It showed that during the massive development of the PSN and pre-pandemic period – in order to avoid the bias of the pandemic – the ICOR increased, indicating a greater inefficiency or diseconomy of scale condition. Nonetheless, the quality of all modes of economic growth improved. This finding demonstrated that the PSN improved development quality, resulting in inclusive economic growth.

For Indonesia's economy to be competitive on the global market, logistics and infrastructure must be improved. Government intervention is essential in enhancing the role of infrastructure, given that it is a necessary exogenous factor of economic growth. Consequently, cargo loaded in 2021 increased 2.5 times since 2006. Although sea transport is the predominant mode of logistics in Indonesia, air freight is essential for high-value products because it is faster. Indonesia is not the largest air freight transport market in the ASEAN region but it has grown consistently over the past decade prior to the pandemic. This fact indicates the acceleration of Indonesia's economic development.

Two significant objectives of Indonesian logistics are its customs clearance process and the quality of trade and transport-related infrastructure, which indicate the need to invest in new vessels and to rehabilitate its main ports. Note that infrastructure is the primary asset of Indonesia's logistics performance at present.

One of the Sustainable Development Goals is to develop quality, reliable, sustainable, and resilient infrastructure, including regional and transborder infrastructure, by 2030. As an archipelagic country with the largest population in the region, Indonesia has the largest passenger air transport market in South-East Asia. Regarding road infrastructure, although the length of roads in Indonesia has consistently increased, geographical challenges as an archipelagic country and a still-dominant rural population indicate the need to increase quality to meet proper transport needs. Additionally, Indonesia must enhance its fixed broadband infrastructure. Furthermore, the Digital Evolution Index demonstrates that Indonesia's present state is low but its momentum is high, classifying it as a break-out country.

Lastly, there has been a notable emergence of substantial competition between the G7 and China in their efforts to provide assistance to lower-income nations in the realm of infrastructure development.

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Appendix

Appendix 2.1. Digital Intelligence Index

Okun's Law (Economic Growth and Open Unemployment):

$$\frac{Y_{nt1} - Y_{nt0}}{Y_{nt0}} = \frac{Y_{mnt1} - Y_{mnt0}}{Y_{mnt0}} - \alpha.(U_{nt1} - U_{nto}) \quad (1)$$

where Y = gross domestic product (GDP) constant price, n = country, m = minimum economic growth to generate employment, U = open unemployment rate, t = time, and α = elasticity of economic growth and unemployment.

Phillips Curve (Inflation Rate and Economic Growth):

$$\pi_{net1} = \pi_{nat1} - \beta.\left(\frac{Y_{nt1} - Y_{nt0}}{Y_{nt0}} - \frac{Y_{mnt1} - Y_{mnt0}}{Y_{mnt0}}\right) \quad (2)$$

where π = inflation rate, na = actual of n country, e = expected of n country, and β = elasticity of economic growth relative.

Unemployment Gap (NAIRU and Inflation Rate):

$$NAIRU_{nt1} = U_{nt1} + \gamma.(\pi_{nat1} - \pi_{net1}) \quad (3)$$

where NAIRU = non-accelerating inflation rate of unemployment of country n at time t, and γ = elasticity of inflation rates relative.

Long-Run Aggregate Supply (LRAS) and Inflation Rate:

$$\frac{Y_{nt1} - Y_{nt0}}{Y_{nt0}} = \frac{Y_{LRt1} - Y_{LRt0}}{Y_{LRt0}} + \delta.(\pi_{nat1} - \pi_{net1}) \quad (4)$$

where LR = natural growth/long run, and δ = elasticity of economic growth and inflation rate.

This formula requires secondary data analysis regarding Okun's Law, Phillip's Curve, and Output Gap. This chapter provides the data analysis to confirm the equations. The critical factor in this triangular relation is open unemployment, meaning job creation reflects the quality of economic growth, healthy inflation rate, and positive output gap.

Appendix 2.2. Understanding the Role of Infrastructure as a Necessary Exogenous Factor

$$\frac{\Delta y_{it}}{y_{it}} = \frac{s_{it}\sqrt{\frac{K_{it}}{L_{it}}} - \left((\partial_{it} + n_{it} + g_{it})\sqrt{\frac{K_{it}}{L_{it}}}\right) + s_{it}\sqrt{\frac{k_{it}}{l_{it}}} - \left((\partial_{it} + n_{it} + g_{it})\sqrt{\frac{k_{it}}{l_{it}}}\right)}{icor_{it}}$$

$$\frac{\partial y_{nt}}{y_{nt}} = \frac{\left\{\left[[I_{nt} + (X_{nt} - M_{nt})] - \left(\partial_{nt} + \rho_{nt} + \frac{\partial E}{E}_{nt}\right)\right].\left[\sqrt{\frac{(K,k)_{nt}}{(L,l)_{nt}}}\right]\right\}}{c_{nt}}$$

where $\frac{\partial y_{nt}}{y_{nt}}$ = real economic growth for country *n* at time *t*, s_{it} = savings rate, I_{nt}=manufacturing strategies–based investment, X_{nt} - M_{nt} = current account, ∂_{nt} =depreciation and depletion of environment, ρ_{nt} = population, $\frac{\partial E}{E_{nt}}$ = marginal productivity of labour, K_{nt}/L_{nt} = infrastructure support, k_{nt}/l_{nt} = *level of technology (manufacturing strategy),* and c_{nt} = ICOR.

Appendix 2.3. Determining Quality of Economic Growth

Closed Economy:

$$Y_{it} = C_{it} + I_{it}; \frac{Y_{it} - C_{it}}{l_{it}} = \frac{I_{it}}{l_{it}}; sy_{it} = i_{it} \quad \text{(A)}$$

where C is consumption, I is investment, i is country dimension, t is time dimension, s is savings rate, y is gross domestic product (GDP), and l is labour.

Solow Growth:

$$\frac{\Delta K_{it}}{l_{it}} = \frac{I_{it} - (\partial_{it}.k_{it})}{l_{it}} = i_{it} - \partial_{it}k_{it}; \Delta k_{it} = sy_{it} - \partial_{it}k_{it} \quad \text{(B)}$$

where K is the capital factor, and ∂ is the depreciation value.

Cobb-Douglas:

$$\frac{Y_{it}}{l_{it}} = \frac{K_{it}^{\frac{1}{2}} . l_{it}^{\frac{1}{2}}}{l_{it}} = \frac{K_{it}^{\frac{1}{2}}}{l_{it}^{\frac{1}{2}}} = \sqrt{\frac{k_{it}}{l_{it}}}; \sqrt{\frac{K_{it}}{L_{it}}}; \sqrt{k_{it}} = y_{it}; k_{it} = {y_{it}}^2 \quad \text{(C)}$$

where k is infrastructure for input land (L) and technology type for input labour (l).

Harrod-Domar:

$$\frac{ICOR_{it}}{l_{it}} = \frac{\Delta K_{it}/l_{it}}{\Delta Y_{it}/l_{it}} = \frac{sy_{it} - \partial_{it} k_{it}}{\Delta y_{it}} = \frac{sy_{it} - \partial_{it} {y_{it}}^2}{\Delta y_{it}}$$

$$\frac{\Delta y_{it}}{y_{it}} = \frac{s_{it} - \partial_{it}\, y_{it}}{icor_{it}} = \frac{s_{it} - \partial_{it} \sqrt{k_{it}}}{icor_{it}}$$

$$y_{it(k_{it})} = (\partial_{it} + n_{it} + g_{it}) k_{it}; \; MPK_{it} = \partial_{it} + n_{it} + g_{it}$$

$$MPK_{it} - \partial_{it} - n_{it} = g_{it} \quad \text{(D)}$$

where MPK is the marginal productivity of labour, n is population per labour, g is labour productivity, and $ICOR$ is the incremental capital output ratio.

Open Economy:

$$Y_{it} = C_{it} + I_{it} + G_{it} + (X_{it} - M_{it})$$

$$Y_{it}/l_{it} = C_{it}/l_{it} + I_{it}/l_{it} + G_{it}/l_{it} + \left(X_{it}/l_{it} - M_{it}/l_{it}\right)$$

$$y_{it} = c_{it} + i_{it} + g_{it} + (x_{it} - m_{it})$$

$$(y_{it} - t_{it} - c_{it}) + (t_{it} - g_{it}) = i_{it} + (x_{it} - m_{it})$$

$$s_{it} = i_{it} + (x_{it} - m_{it}) \quad \text{(E)}$$

where G is government expenditure, X is exports, and M is imports.