Chapter 6

The Socio-Economic Impact of Massive Infrastructure Development in Indonesia

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As a response to Indonesia's infrastructure gap, the Widodo Administration initiated the *Proyek Strategis Nasional* (PSN). Today, many projects under the PSN have been completed, providing an opportunity for an ex-post evaluation of their performance in accomplishing the objectives of providing equitable access to infrastructure and promoting welfare. This chapter selected a few case studies to examine, including a toll-road project and two water projects. It also highlights how the Widodo Administration leveraged limited direct public spending to improve socio-economic outcomes by prioritising State Budget contributions for projects with high socio-economic impact albeit limited financial feasibility. Nonetheless, State Budget contributions for financially feasible projects remain substantial, and thus the private sector should be more involved.

1. Background

Infrastructure development is crucial to Indonesia's structural reform and competitiveness. Prior to the initiation of the *Proyek Strategis Nasional* (PSN) in 2016, Indonesia's infrastructure suffered from prolonged underinvestment (Kim, 2023; Ray and Ing, 2016), resulting in a substantial infrastructure gap that impeded the country's overall development objectives. Joko Widodo's administration responded to the growing need for infrastructure development by launching numerous projects under the PSN. The aim of the PSN, as laid out in Presidential Regulation No. 3 of 2016, is to fulfil basic infrastructure needs. The regulation also established that projects eligible under the PSN should be characterised by their strategic value in stimulating economic growth and promoting equitability and welfare, as well as development at the sub-national level.

After almost 8 years since the initiation of the PSN, many projects have been completed and are operational, providing the opportunity for an ex-post evaluation of how their objectives – of promoting equitable access to infrastructure and improving welfare – are being met. This chapter attempts to empirically assess the impact of PSN projects completed during 2016–2020 on socio-economic outcomes that are relevant to the objectives stated in the Presidential Regulation. Limiting observations to infrastructure projects completed as of 2020 allows for adequate post-completion assessment. More specifically, a pragmatic approach is used to assess the impact of the PSN on observable and readily available measures of socio-economic outcomes, such as the equitability of access to basic infrastructure. Relevant household-level data were sourced from the national socio-economic survey and project-specific information from technical documents. An empirical estimation of the impacts of PSN projects on wider, aggregate-level socio-economic outcomes is also conducted, such as economic growth, poverty incidence, and income inequality as measured by the Gini coefficient. Due to the relatively localised nature of infrastructure benefits, the aggregate-level estimation is conducted at the sub-national level (i.e. districts and municipalities).

As the PSN consists of hundreds of different projects – 200 as of 2022 – a comprehensive and holistic evaluation is unfeasible. Instead, a more practical approach is taken by selecting a few case studies; sections of the chapter are based on the cluster subjected to evaluation.

In the next section, the impacts of PSN projects are estimated on aggregate socio-economic outcomes by examining a toll-road development case study. In the third section, the socio-economic impact of the PSN on equitable access to basic services is detailed by reviewing two water projects. The fourth section highlights how the Widodo Administration leveraged limited public spending through alternative financing modalities and focussed direct contribution of public spending through the State Budget on infrastructure, which has had significant socio-economic impact. The last section summarises the findings of the previous sections and offers concluding remarks.[1]

2. Aggregate Socio-Economic Impact of the PSN: Toll-Road Case Study

For this section, an empirical estimation is conducted on the impact of 28 completed toll roads under the PSN on socio-economic outcomes. In total, there are at least 71 toll-road projects in the PSN, amounting to the addition of 5,315 kilometres. As a means of connecting Indonesia's regions, road infrastructure can have far-reaching direct and indirect economic benefits. A vast body of literature has shown that one channel through which road infrastructure benefits the economy is its productivity-enhancing effect resulting from the agglomeration of economies (Yusupov, 2020; Graham, 2007; Gibbons and Overman, 2009; Fedderke and Bogetić, 2009). Moreover, the development of significant new lengths of toll roads in Indonesia can help alleviate the congestion that currently suffocates the national economy. Indeed, decades of underinvestment have left Indonesia's existing road infrastructure under immense pressure, leading to the deterioration of logistics systems performance, declining quality of life, and constrained overall growth (World Bank, 2014; Ray and Ing, 2016).

The impacts of road infrastructure on productivity, logistics performance, and enablement of agglomeration economies are relatively direct and observable. Another socio-economic benefit of road infrastructure is its ability to alleviate isolation, allowing households to access

[1] Showcasing the impact of a toll road is based on the consideration of its potentially far-reaching impact on aggregate socio-economic outcomes because of its productivity-enhancing characteristics, as well as its ability to improve access and connectivity. The other technical consideration for using the toll road is that many have been completed and operational for several years, allowing for a preliminary empirical assessment. The water supply projects were chosen because they have a direct impact on the population; many have been completed, allowing for a more straightforward assessment.

more expansive economic activity centres and essential public services, which, in turn, drive improvement in household income and reduce the incidence of poverty (Chambers, 2014; Minot, Baulch, Epprecht, 2006; Hensley et al., 2018; Loo and Banister, 2016; Olsson, 2009; Šťastná, Vaishar, Stonawská, 2015). Warr (2010) showed that road development increases the livelihoods of people under the poverty line by improving their capacity to access markets. Taking the case of the Lao People's Democratic Republic, Warr conducted a counterfactual microsimulation analysis to examine how access to road infrastructure impacts the real consumption of households, finding that it decreased the incidence of poverty by 3.32 percentage points (from a baseline of 33%).

The other channel through which road construction may have an impact on an aggregate socio-economic indicator is through the intermediary impact on broader economic growth that, in turn, can reduce the incidence of poverty. This is evident in China, where the increase of road density has led to falling poverty rates, with the magnitude of the impact proportional to the grade of the constructed road (Zhou, Tong, Wang, 2022).

Despite the unequivocal impact of road infrastructure development on poverty alleviation, there are still risks. One study in Cameroon found that the overall efficiency of road infrastructure development in reducing poverty depends on appropriate design according to the needs and governance capacity of communities (Gachassin, Najman, Raballand, 2010), for instance.

Estimating the impact of toll roads built under the PSN on the economy and broader socio-economic indicators is constrained by the limited availability of observations on the state of outcomes after the start of operation of the PSN toll roads. Despite this limitation, an ex-post assessment of the impact of the PSN toll roads through a more rudimentary analysis of the operation of the trans-Java segment in Central Java suggested a positive impact on aggregate economic indicators, including economic growth (Ahmad, 2022). A similar preliminary conclusion can be drawn in the case of the Trans-Sumatra network, where the road operation has been shown to have coincided with an improvement in several headline indicators, such as number of firms, unemployment, and housing development (Lubis and Silviana, 2023).

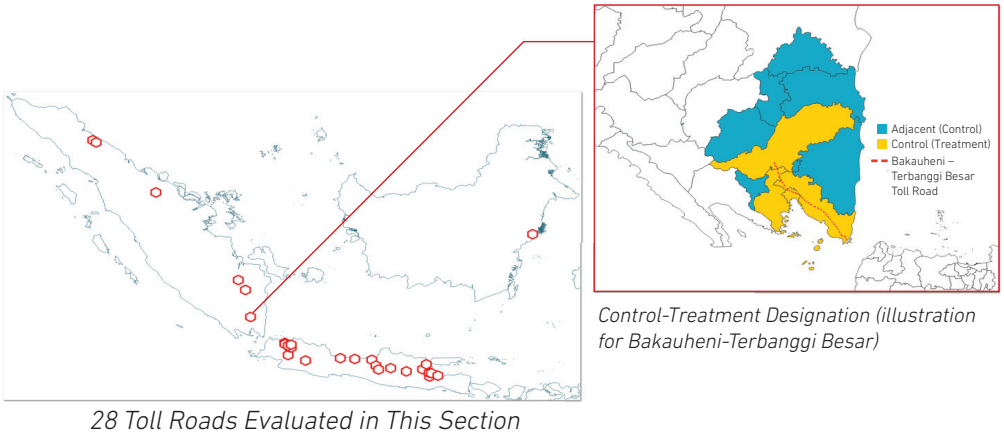
While the aforementioned studies provide insight into how toll roads have had a positive impact on growth, further investigation requires an empirical approach that allows for a more controlled natural experimental setting. A previous study by Prospera (2018) estimated the impact of the Trans-Java Toll Road on economic growth using a quasi-experimental setting. It showed that road network development through the addition of toll roads has had a positive impact on regional growth and competitiveness. From a longitudinal observation at the sub-national level, Prospera constructed a dataset of control and treatment groups of districts and municipalities centred on the time of commissioning of various toll roads built since 2004. From the resulting dataset, an impact assessment – using a difference-in-differences approach – was conducted, finding an

increase of 0.6 percentage point of economic growth in districts with a new toll road compared to adjacent districts without a toll road. A similar approach, using village-level data, also showed that villages connected by the Trans-Java Toll Road witnessed significantly higher growth of modern retail compared to the control group (Putra, 2023).

Using the same empirical strategy, this chapter aims to broaden the estimation of the impact of the PSN through the development of toll roads on broader socio-economic indicators, including the impact of toll road development on poverty incidence and the Gini coefficient (a measure of inequality). In implementing the framework, the most significant challenge is that an implicit assumption of the difference-in-differences model is the need for a reasonable number of observable data points before and after the operation of a PSN project to be able to make any inference about its impact.

The empirical strategy employed in this chapter, which can be traced back to Card and Krueger (1994), is to create a quasi-experimental setting that sets the operational phase of each PSN toll-road project as a treatment in regions along its route as illustrated in Figure 6.1 for the Bakauheni–Terbanggi Besar Toll Road. The control group consists of regions adjacent to the core regions that had considerable similarities in outcome achievements before the PSN project. The strategy of setting adjacent regions as a control group is based on the consideration that neighbouring regions share the same baseline characteristics due to the homogeneity of the population, level of economic development, and geographical properties. Control and treatment groups are designated to districts and municipalities around the 28 segments of toll road in the dataset.

Figure 6.1. A Quasi-Experimental Setting: Illustration from the Bakauheni–Terbanggi Besar Toll Road

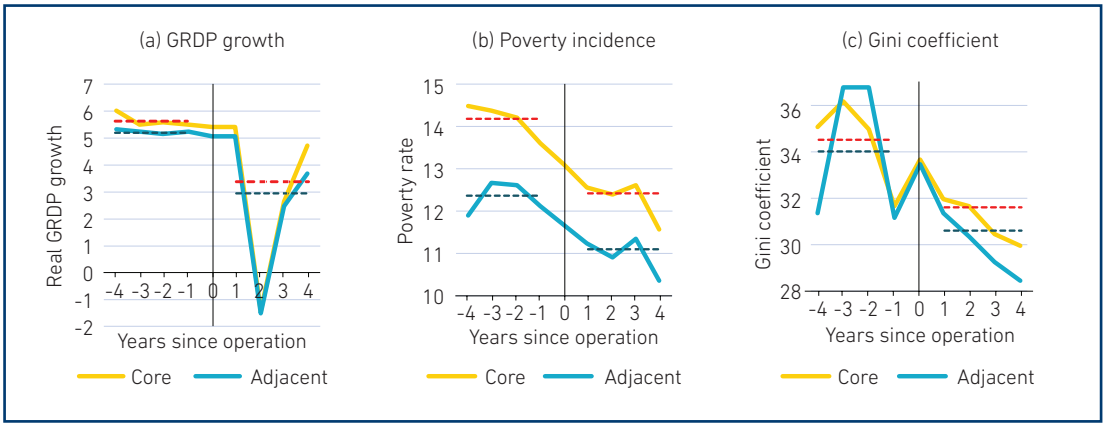


Source: Author's identification based on lists of PSN toll roads from Committee for the Acceleration of Priority Infrastructure Provision (KPPIP).

Another challenge in empirically estimating the impact of PSN projects is the limited observation period, as most PSN projects have been completed recently. To ensure adequate data points before and after the treatment (i.e. the operational phase of the project), the time variable in the dataset is recentred to the distance-to-operation period for each treatment and control group as the pre- and post-treatment period, and the estimation is conducted as a pooled cross-section regression. The outcomes evaluated when assessing the impact of the PSN toll road are gross regional domestic product (GRDP) growth, poverty rate, and inequality (i.e. the Gini coefficient).

Figure 6.2 illustrates the re-centring of the time variable in the dataset to capture the periods before and after the start of operations of the Bakauheni–Terbanggi Besar Toll Road. The road went into operation in 2018, so this year is at the centre, thus becoming t = 0. As can be seen in the figure, the condition of outcomes on either side of t = 0 can be compared. The same re-centring strategy is applied to the rest of the toll roads in the dataset.

Figure 6.2. Before and After Differences in Socio-Economic Outcomes for Core and Adjacent Regions of the Bakauheni–Terbanggi Besar Toll Road



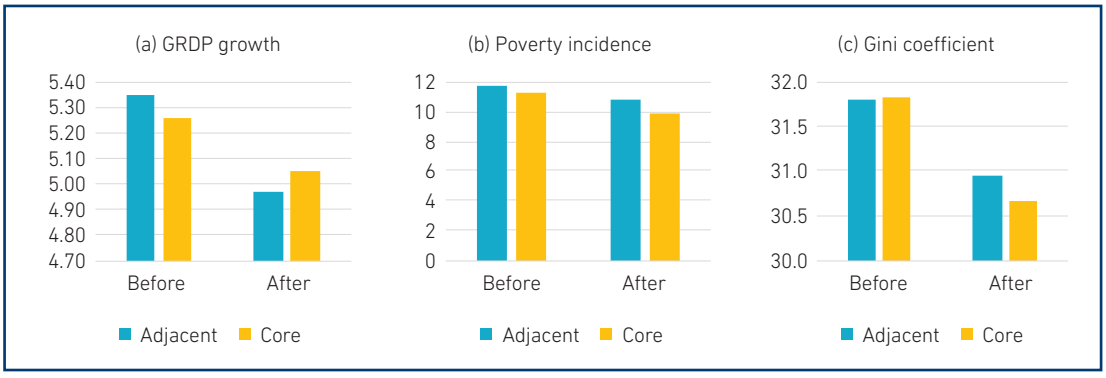
GRDP = gross regional domestic product.

Source: Author's calculation based on data from Statistics Indonesia (BPS).

From the resulting re-centred dataset – which consists of 1,629 observations – 73 treatment groups and 120 control groups are associated with 28 unique toll roads. Figure 6.3 shows the in-sample average of socio-economic outcomes in the control and treatment groups before and after the beginning of operation of the corresponding toll road.

Regarding GRDP growth, prior to the treatment period, growth in the control group was higher by 0.095 percentage point than in the treatment group. This gap then narrows in the post-treatment period, with the treatment group experiencing higher GRDP growth, on average, than the control group. Yet overall growth rates for both groups were considerably lower in the post-treatment period, which can largely be attributed to the economic slowdown induced by the COVID-19 pandemic. Assuming homogeneity in the characteristics of the control and treatment groups, the fact that the treatment group shows a more moderate decline indicates that the operation of the PSN toll road provided an edge for regions in the treatment group by dampening the economic impact of the pandemic. For both poverty incidence and the Gini coefficient, a marked improvement (i.e. reduction) is noted in the treatment group compared to the control group.

Figure 6.3. Before and After Differences in Socio-Economic Outcomes for Sampled PSN Toll Road Core and Adjacent Regions in the Difference-in-Differences Analysis



GRDP = gross regional domestic product.

Source: Author's calculation based on data from Statistics Indonesia.

More detailed results can be seen in Table 6.1. The operation of the PSN toll road had a significant positive impact on regional economic growth, leading to an estimated improvement in GRDP growth of 0.173 percentage point. Operation contributed to reducing poverty by 0.320 percentage point for regions along the route compared to adjacent areas. Inequality, as measured by the Gini coefficient in areas along the route, decreased. However, the magnitude is relatively limited at only 0.324 units for a Gini coefficient on a scale of 0 to 100. Although limited, the impact of this reduction is statistically significant and consistent with the impact of increased economic growth, which is accompanied by a reduction in poverty.

Table 6.1. Difference-in-Differences Estimation of the Socio-Economic Impact of the PSN Toll Road

Outcome Var.	GRDP Growth		Poverty		Inequality	
Before						
Adjacent	5.348		11.780		31.787	
Core	5.253		11.190		31.832	
Difference	–0.095	***	–0.590		0.045	
	(0.034)		(0.138)	***	(0.180)	
After						
Adjacent	4.967		10.820		30.941	
Core	5.045		9.910		30.662	
Difference	0.078		–0.910	***	–0.279	*
	(0.062)		(0.136)		(0.153)	
Diff-in-Diff.	0.173	***	–0.320	*	–0.324	***
	(0.029)		(0.180)		(0.117)	
R-square	0.690		0.340		0.190	
Obs.	1,629		1,629		1,629	

GRDP = gross regional domestic product.

Notes:

1. Means and standard errors are estimated by linear regression.
2. A clustered robust standard errors calculation is used.
3. Covariates are used, comprising a COVID-19 dummy, time fixed effect, island fixed effect, and urban characteristics.
4. Inference: *** p<0.01; ** p<0.05; * p<0.1.

Source: Authors.

Despite the encouraging result, the impact of the toll road on sub-national economic growth, poverty, and inequality in this chapter must be treated as an indicative result at best with several limitations. The first limitation is the inability of the estimated model to explicitly take into account the spill-over effects of the toll road on neighbouring regions; addressing this limitation requires a more sophisticated approach, which may include a spatial analysis and a non-discrete treatment assignment for the treated group. This calls for more thorough future research. The other limitation is on the narrow observation period, particularly for the post-operational phase of the toll road, recognising that most of the toll road has only been operational for a short time, which potentially undermines benefits that may only materialise in the medium to long term.

3. Role of the PSN in Providing Equitable Access to Basic Services: Water Supply Project Case Study

3.1. Strategic Importance of Water Supply Projects

One of the goals of the PSN is to ensure the provision of infrastructure needed to fulfil basic needs, including access to clean water. Clean water is water used for daily purposes and can be drunk after being boiled.[2] Recognising the importance of clean water, the government – under the PSN – initiated at least eight clean water supply projects across Indonesia, with an estimated cost of Rp13.9 trillion.[3]

Lack of access to clean water and adequate sanitation is a serious impediment to inclusive growth because of its repercussions on public health and the environment (Fawell and Stanfield, 2001). Diarrheal and digestive diseases are the most common health consequences of unsafe drinking water consumption, ranking amongst the top 10 causes of death in 2019 globally (Ritchie, Spooner, Roser, 2019). For example, a cholera outbreak that began in Peru in January 1991 and later spread to South and Central America resulted in 1.2 million cases and nearly 12,000 deaths (Cotruvo, Hearne, Craun, 1999).

Figure 6.4 shows that from 2011 to 2016, access to clean water in Indonesia increased only marginally, with low-income households consistently lagging. After the PSN, a significant improvement in access to clean water is observed, particularly for the lowest-income group. The percentage of households in the lowest income decile having access to clean water increased from around 72% in 2016 to over 85% in 2022, meaning that about 13 households out of 100 in the lowest decile gained access to clean water in that period.

Figure 6.4 also shows that access to clean water improved from 2016 to 2021 across all income levels. However, high-income groups benefited disproportionately. Only 4.4% of members of the highest-income decile lacked access to clean water in 2021, whereas over 12.0% of people in the first decile – with the lowest income – lacked access. Thus, the equitability of access to clean water still needs to be improved.

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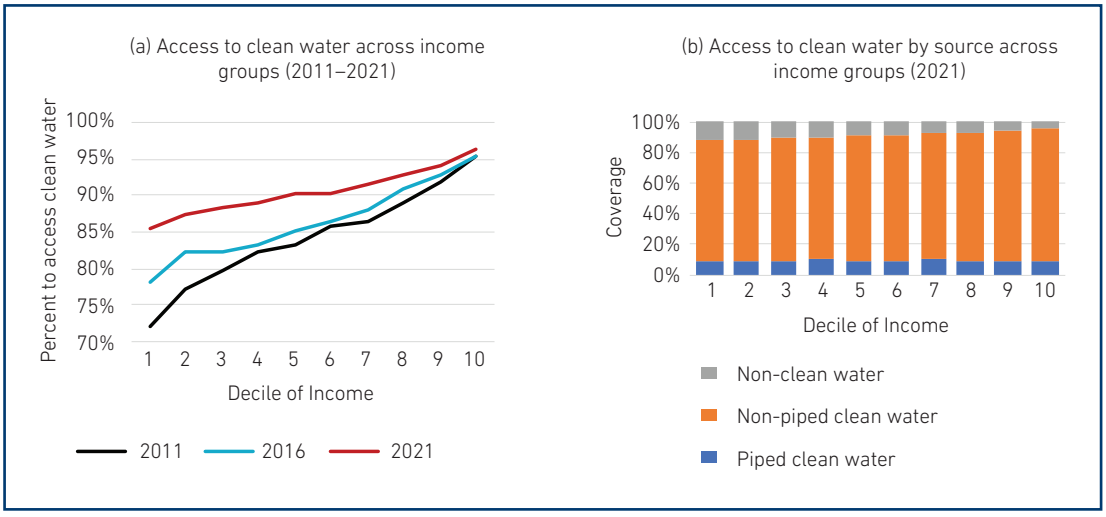
[2] Minister of Health, Decree No. 1405/MENKES/SK/XI/2002.

[3] SPAM West Semarang, Regional Jatigede, Umbulan, Bandar Lampung, Regional Mamminasata, Regional Jatiluhur, Regional Wasusokas, and Regional Mebidang (later excluded from the PSN list).

Figure 6.4. Access to Clean Water at the Household Level in Indonesia



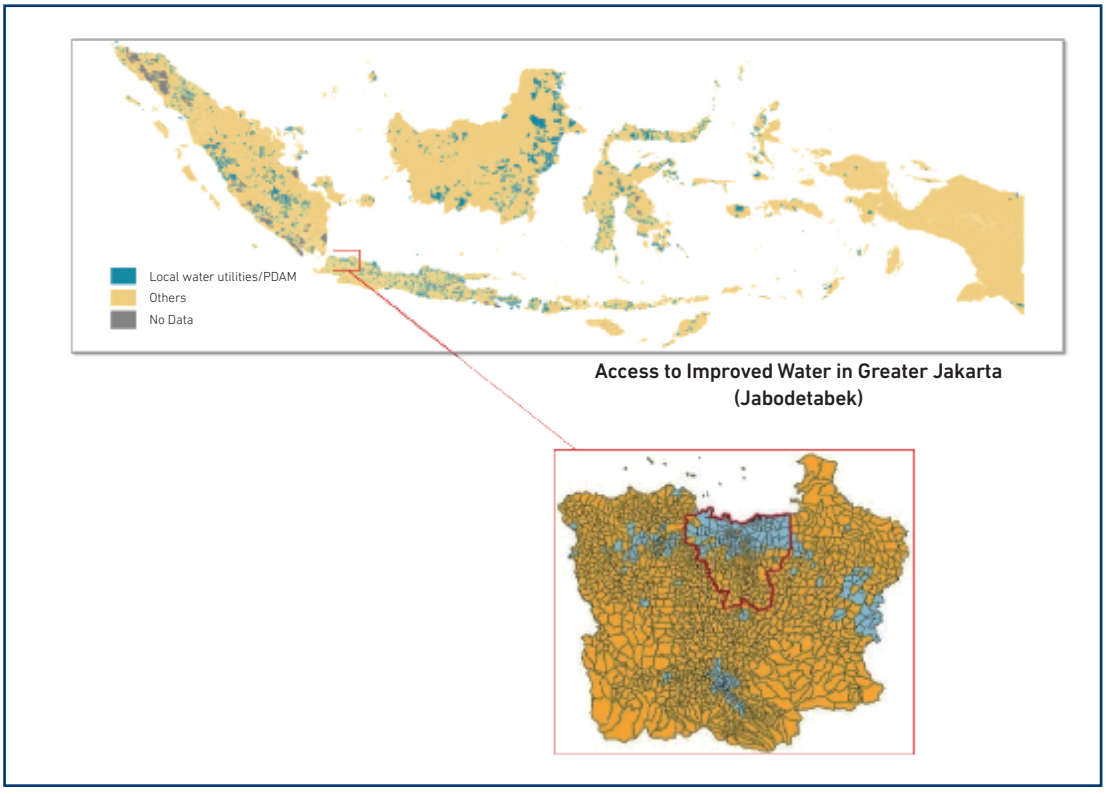
Source: Author's calculations based on *Susenas* data.

Looking at the different types of clean water sources by household, sources other than piped water are more prevalent. Using the same dataset, Figure 6.4 shows that the use of non-piped clean water is extensive, ranging from 79% to almost 88% across income groups in 2022. This means that most Indonesians are drinking from artesian wells, covered wells, covered springs, or rainwater catchment – sources of clean water based on a definition set by Statistics Indonesia. This situation is not necessarily bad, as self-sourced drinking water implies self-reliance, lessening the burden of public efforts to provide water resources as shown by Fustec (2019) for the Tuamotu Archipelago.

However, this finding also points to a threat to sustainability; water is a scarce resource, and without proper control, the overuse of groundwater poses an environmental challenge. Cotruvo, Hearne, and Craun (1999) warned that by the middle of this century, the number of people residing in water-stressed areas would increase three to fivefold due to the misuse and overuse of groundwater. Therefore, PSN projects to enhance the drinking water supply system – known as *sistem penyedian air minum* (SPAM) projects – can play a strategic role in overcoming lack of access to clean water and alleviating environmental problems caused by the overuse of groundwater.

Access to clean water is an even more complex issue in highly populated urban areas, as urbanisation puts pressure on water access and distribution (Cotruvo, Hearne, Craun, 1999). Major urban areas such as 'Jabodetabek', which serves as the economic powerhouse of Indonesia and spans three provinces, have limited tap water. Even in Jakarta – the wealthiest city in Indonesia – only some neighbourhoods have good, piped water infrastructure, mostly in the central and northern parts of the city (Figure 6.5).

Figure 6.5. Access to Improved Water at the Village Level by Source



Source: Author's calculations based on 2019 Village Potential Data.

Another considerable challenge in the provision of clean water is the complexities of governance, as there are multiple levels of governments sharing responsibilities in Indonesia, with each operating under various legal frameworks that do not necessarily conform. There are at least two regulations regarding water supply governance. One regulates extraction of the water supply to utilities, and another regulates pricing mechanisms for the end-user. On the former, Rachman and Syamsumardian (2020) showed that such arrangements have undergone several changes, starting from Law No. 11 of 1974 on Irrigation, Law No. 7 of 2004 on Water Resources, to Law No. 17 of 2019 on Water Resources. The latest law stipulates that each level of government may charge water resource management service fees – known as *biaya jasa pengelolaan sumber daya air* (BJPSDA) – to water utilities.

In the regulations previously mentioned, higher-level governments oversee interregional water resources and management. However, any lower-level government can relinquish its management, and this becomes mandatory if the absence of capability harms the public interest or sparks disputes between local governments (Law No. 7 of 2004). Complexities have arisen when responsibilities became intertwined between different entities.

Another law specifically regulates clean water pricing through the Minister of Home Affairs (MOHA) Regulation No. 21 of 2020 on amendments to MOHA Regulation No. 71 of 2016 on the Determination of Drinking[4] Water Tariffs. The law mentions that tariffs should be (i) based on full cost recovery (FCR) principles, (ii) subsidised from the local budget if lower than the FCR, (iii) not exceed 4% of average income, and (iv) determined by the regional government head with the possibility of delegating authority to local water utility directors. As shown by the experience of Lamongan Regency – the best regional model for an FCR-adjusted tariff (Yusuf, 2023) – BJPSDA are included in the formula as the cost of purchasing bulk water (Istichori, Wiguna, Masduqi, 2018). Moreover, the government of Lamongan Regency participated in funding the construction of pipeline infrastructure that connects the water supply to homes. Therefore, in the context of SPAM projects, local governments must also play a significant role in advanced stages.

In the following sub-section, two PSN SPAM projects in Umbulan and Bandar Lampung are examined.

3.2. Case Studies from the Umbulan and Bandar Lampung SPAM Projects

3.2.1. Potential Benefits and Coverage of Service

The Umbulan SPAM was built to distribute spring water in Umbulan, a village in Pasuruan Regency, East Java. Because of its high capacity – estimated at 5,000 litres per second in 1980 – Umbulan's spring was seen as a potential primary source of drinking water for a large part of East Java, including the cities of Pasuruan and Surabaya. However, attempts to build a drinking water treatment facility in 1988, 1996, and 2005 failed due to asynchronous general and technical regulations regarding public–private partnerships (PPPs) and limited local fiscal capacity (Sofi, 2022). The lack of guaranteed capital from the local government dissuaded any potential local water companies – *perusahaan daerah air minum* (PDAM) – from connecting the water source to customers. Eventually, after nearly 30 years of planning, the Umbulan SPAM project began its construction phase in 2017. Once fully operational, the facility was expected to serve 310,000 households, equivalent to 1.3 million people (Simantu, 2021). The project was finally completed in 2020.

[4] Note that the use of 'drinking water' is often misleading as it is not potable without extra treatment like boiling. From this point on, the term is still used but should only be understood as clean water.

Another SPAM project is in Bandar Lampung, a municipality in Lampung. The municipality has worked to develop its drinking water infrastructure, including under this project. It taps the Sekampung River – which flows through the city – as its primary source of water. The project will produce 750 litres of treated water per second and serve 60,000 new connections, equivalent to 300,000 people (GOI, Commission V, 2022). These efforts aim to meet the increasing demand for water due to population growth and urbanisation in the area.

A reliable drinking water supply system offers numerous benefits to individuals and communities, such as (i) savings in annual expenditure for water access, (ii) savings related to time efficiency, and (iii) savings related to public health (EJPG, 2013). Other benefits include the opportunity to develop new businesses associated with water treatment, such as refillable water stations and laundries and carwashes (PDAM Way Rilau, 2017). As limited information is available, especially for the Bandar Lampung SPAM project, the following discussion is based primarily on the Umbulan SPAM project's feasibility study (EJPG, 2013). The benefits of all drinking water supply system projects are similar.

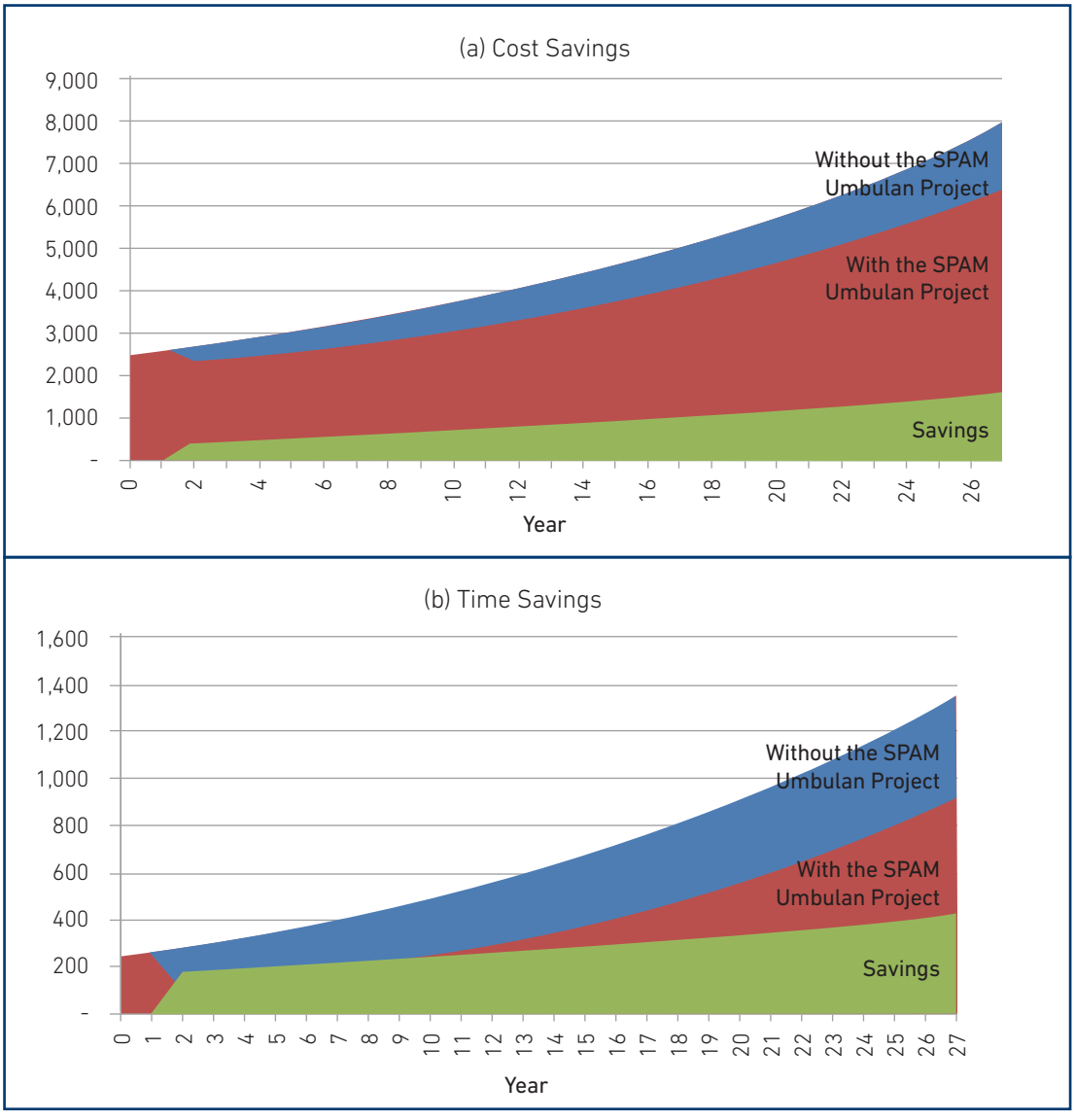
First, water provided by a SPAM is expected to substitute other sources of water used by households if the project were not developed. The identified expenditures for other sources of water include (i) costs of digging shallow wells and purchasing digging equipment or services, (ii) installation and maintenance costs of boreholes equipped with either electric or hand pumps, (iii) cost of electricity to operate pumps, (iv) cost of purchasing water in refillable containers from individual sellers or PDAM, and (v) cost of fuel to boil water.

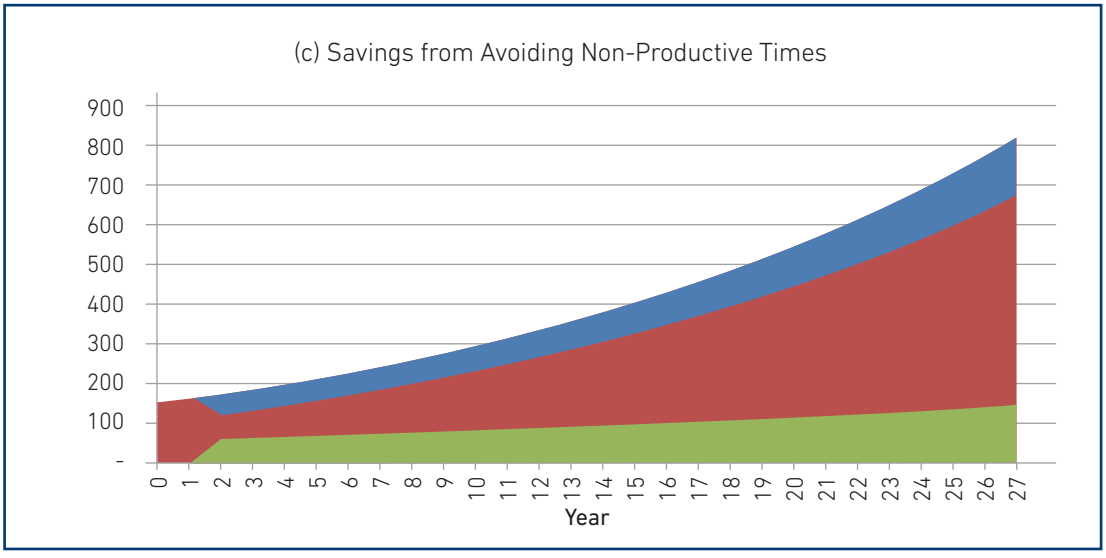
Second, a SPAM may reduce the time required to access clean water. Based on the opportunity cost of time principle, users may reduce the time taken to procure clean water; the additional time made available by this change can, in theory, be used to earn additional income. Opportunity costs were computed by measuring the time spent to source water from shallow wells and wells with electric/hand pumps, purchase water from water sellers, or boil water, and then multiplying it by the value of the regional minimum wage for each jurisdiction. In the end, this cost is considered a time-savings measure.

Third, the main criterion used to define the goals of a SPAM is savings in health expenditures. The greater the availability of clean water, the greater the reduction in the incidence of waterborne diseases. The monetary savings can be achieved through two channels: (i) reduction in disease treatment costs, and (ii) avoidance of lost wages based on the number of days that workers are absent from work due to illness.

The benefit projections made by EJPG (2013) for the Umbulan SPAM project showed that substantial savings began to emerge after the first year of the facility's operation (Figure 6.6). The amount of savings increased year by year, keeping the cost of accessing water through PDAM to be below the cost in the scenario if there were no such infrastructure. The increases were steep during the initial ramp-up period (i.e. years 0–2) when the number of new PDAM service connections grew quickly. Starting in the second year, however, the growth of those benefits was more gradual.

Figure 6.6. Potential Savings Generated by Drinking Water Supply System Projects
(Rp billion)





Source: SPAM Umbulan feasibility document (EJPG, 2013).

For the Bandar Lampung SPAM project, the only discussion found about its benefit projection touched upon an indirect one. According to the results of the environmental impact analysis, the project could generate new businesses and thus create new jobs (PDAM Way Rilau, 2017). Unfortunately, this impact is weak, as the project was estimated to create only 135 new job openings in a total population of 600,000.

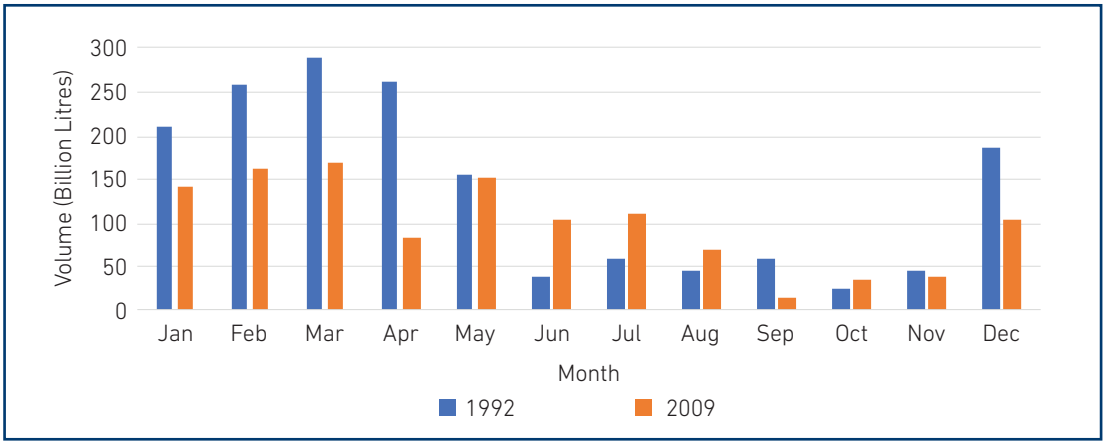
3.2.2. Benefits and Challenges of SPAM Operations

In evaluating the benefit and impact of SPAM projects, a framework from Van Engelenburg (2020) is borrowed that identifies three criteria for assessing water projects: (i) availability of drinking water, which can be approximated by quantifying the percentage of households connected to the drinking water supply; (ii) water governance, which must be assessed using institutional capacity in service delivery; and (iii) local land and water use, which comprises activities carried out by economic actors at both the surface and sub-surface levels that impact the availability and quality of water.

Both the Umbulan and Bandar Lampung SPAM projects face water stock availability issues and distribution network challenges, which, in turn, impact their production capacity. As determined by EJPG (2013), Umbulan Spring was able to provide 5,000 litres of water per second in 1980. However, its capacity decreased to 4,000 litres per second by the time of the feasibility analysis (2013). More recently, a study by Rengganis and Seizarwati (2017) found that the stock has decreased further to 3,278 litres per second.

The Bandar Lampung SPAM project's water source is still relatively abundant, despite signs of decreasing supply. Based on Balitbangda Lampung Province (2018), the Sekampung River's debit is still 10,000 litres per second or 16.01 billion litres in the driest month of September 2009. However, the monitored volume of water in 1992 was more than three times the latter measurement. The river's water capacity dropped by 50%, on average, between 1992 and 2009 (Figure 6.7). Based on that rate, it is much likely to continue. For both the Umbulan and Bandar Lampung SPAM projects, continuous control and monitoring over water catchment regions should go hand in hand with the maintenance of water supply facilities (Apriadi, 2008).

Figure 6.7. Monthly Water Volume at Pujorahayu Way Sekampung Monitoring Station in Lampung Province
(billion litres)



Source: Balitbangda Lampung Province (2018).

Another impediment to achieving the projected benefits is the incompleteness of the pipe network. Commission V (2022) reported that the Bandar Lampung SPAM project's realised water network connection is 'far from [the] target'. Meanwhile, Aryono (2022) indicated that the number of new connections did not change significantly, as there were only 4,934 new home connections (i.e. 35% of the 14,000 target).

A well-functioning institution is vital for managing a reliable drinking water supply system with minimum disruption. However, Sofi (2022) found that in the case of the Umbulan SPAM project, PDAMs in five regencies/cities are not ready to distribute water due to limited funding for the construction of new distribution networks, undermining the overall socio-economic impact of the project. Even the provincial-level water utility, Perusahaan Daerah Air Bersih Jawa Timur, admitted that it does not have the financial capacity to expand the existing capacity of distribution pipes to the five municipalities to be served by the SPAM (Ginanjar, 2023).

Moreover, there are many instances of service disruption resulting in a sub-standard level of water delivery:

(i) 'The water doesn't flow [from the pipe]. [Because of that,] I've been buying water from a seller twice a week, [so in] a month I spent around Rp320,000. [To make matters worse,] I am still billed for monthly subscription payments' (Anam, 2021).
(ii) 'People in several areas in Surabaya complain that water from PDAM has stopped flowing for at least 2 days' (Hasana, 2021).
(iii) 'The situation within PDAM Pasuruan City is getting out of control. Complaints have been coming, primarily problems of no water at all reaching customers' homes, even for a matter of months. This has further worsened the current image of PDAM Pasuruan City' (Rahmawati, 2023).

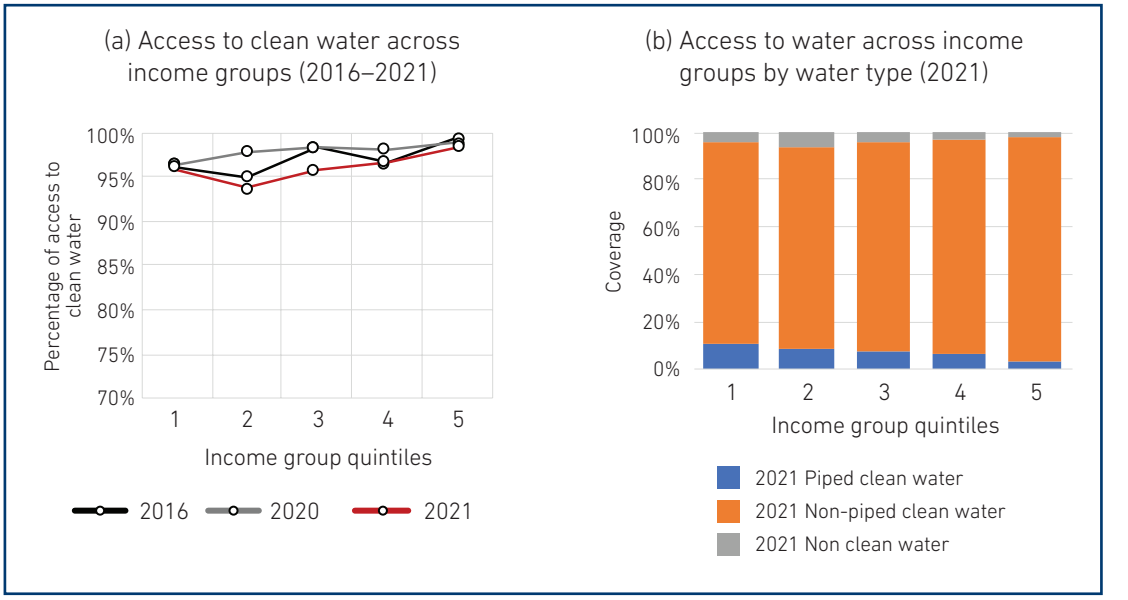
Similar problems were found in Bandar Lampung. Construction of pipelines financed by the regional government stopped due to budget refocussing to address the COVID-19 pandemic, resulting in a utilisation rate of only 20% (Aryono, 2022). As a result, some customers chose to cancel their subscriptions, causing even greater losses for PDAMs, putting PDAM Way Rilau under more financial pressure since charges for the water supply and other operational costs continue despite declining revenue.

Moreover, the areas around both SPAM projects are facing pressure from environmental change. Seizarwati (2017) found that there were massive reductions in forest coverage in water catchment areas within 100 kilometres of Umbulan Spring. Based on satellite images, these were estimated at 75.21% between 1990 and 2003, and another 2.14% between 2003 and 2006. In Lampung, significant land-use change has been detected in Wan Abdurrahman Community Forest Park, which is the water catchment area for the Sekampung River (ACCCRN, 2010). The situation requires significant attention from central or local authorities as well as the public, as the sustainability of the drinking water supply system in both locations is under threat.

The challenges faced by both SPAM projects have hindered the effort to close the access inequity gap. Meanwhile, the benefits projected at the start of the two projects will only materialise if the above criteria are fulfilled. As a result, the benefits achieved by both the Umbulan and Bandar Lampung SPAM projects are not easily discernible.

In the five service areas of the Umbulan SPAM project, access to clean water deteriorated from 2020 to 2021 for all income groups except the fourth quintile (Figure 6.8). One of the reasons for this pattern is the coincidence of the data timeframe with the pandemic, which may have lowered customer incomes and induced customers to stop using metered water from PDAM. Another reason is that people in these service areas have managed to access clean water. More than 90% of users across all groups have access to clean drinking water. Movement of data around particular averages between periods is reasonable, especially when their collection was always randomised like in the national socio-economic surveys.

Figure 6.8. Water Access across Income Groups: Umbulan SPAM Project Service Area

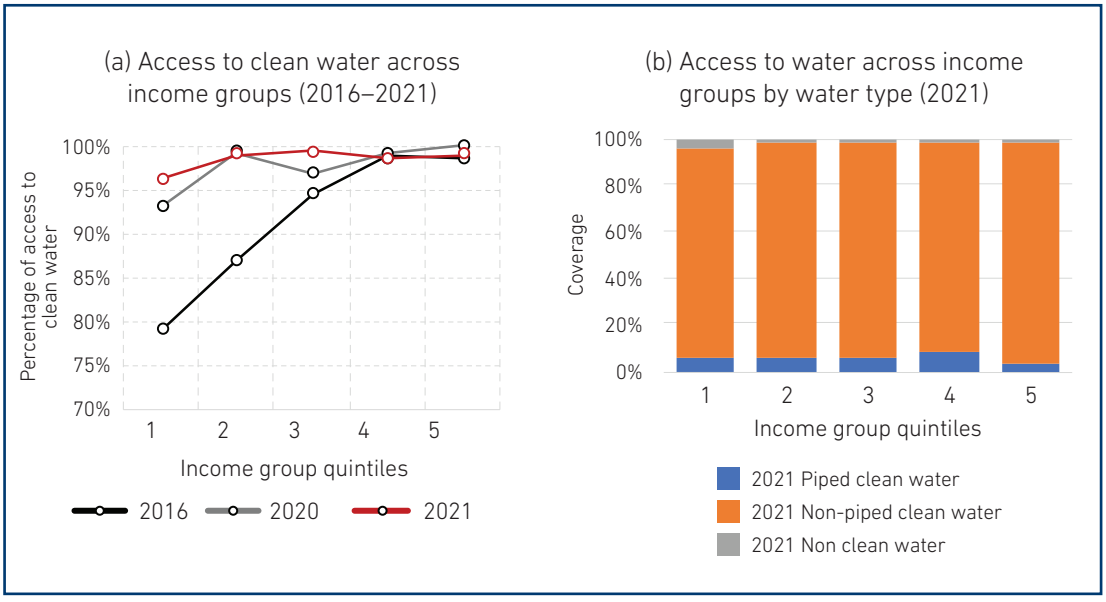


Source: Author's calculations based on *Susenas* data.

By 2021, the largest proportion of access to piped clean water was observed in the poorest communities. This could be an indication that piped clean water is important for low-income groups, as the upfront cost of obtaining clean water individually is too high. Therefore, conversion to piped networks should continue to be pursued to lower the cost of access to clean water.

The change in access to clean drinking water in Bandar Lampung is significant (Figure 6.9). Access to clean water in the first, second, and third income groups increased significantly, with the lowest quintile rising from just below 80% in 2016 to over 96% in 2021. This could be due to the government's efforts to provide a drinking water supply system as well as the community's efforts to improve access independently.

Figure 6.9. Water Access across Income Groups: Bandar Lampung SPAM Project Service Area



Source: Author's calculations based on *Susenas* data.

The latest data for 2021 show an unclear pattern of access to piped clean water in Bandar Lampung. The group with the most extensive access to piped clean water (7.9%) is the fourth quintile. Meanwhile, only 5.8% of people in the lowest income group accessed piped clean water. This disparity suggests that policies to equalise access to clean water are not sufficiently targeted.

4. Leveraging Public Spending to Optimise the Socio-Economic Impacts of Infrastructure

Limited availability of public spending has always been a challenge in infrastructure development in Indonesia. Realising the challenges of constrained public spending, former President Susilo Bambang Yudhoyono rolled out an ambitious plan for infrastructure investment, with several high-profile infrastructure summits held to attract private investment, but the outcomes of these summits were not according to expectation (McCawley, 2015). The impetus for massive infrastructure investment gained more traction and translated into more concrete projects and outcomes under the PSN during the Widodo Administration, as it moved away from energy subsidies and reallocated fiscal space for infrastructure development (Salim and Negara, 2018). Although in the later term of Widodo's presidency the increasing price of commodities – including fuel – forced the administration to increase energy subsidies, his decisiveness early in his term on subsidies played a consequential role in creating momentum for massive infrastructure investment.

To further leverage the contribution of the State Budget, the Widodo Administration also capitalised on innovative fiscal policies such as availability payments and government guarantees. To increase financial viability, the government could directly contribute to specific projects through viability gap financing (VGF) for those that are not necessarily meeting financial viability criteria (Salim and Negara, 2018). An example of the implementation of VGF is the Bandar Lampung SPAM project, to which the government contributed Rp258.8 billion (GOI, Coordinating Ministry of Economic Affairs, 2020). The Widodo Administration understands the underlying impediments to private sector investment, using innovative solutions to signal strong commitment while minimising direct public spending; this has translated well into increasing the private sector appetite to undertake projects under the PSN.

From a socio-economic impact standpoint, this section assesses how well the Widodo Administration has optimised the available financing mechanisms to leverage the limited public spending to maximise PSN socio-economic impact, recognising that the State Budget still holds an essential role for high socio-economic impact projects that may not be commercially feasible.

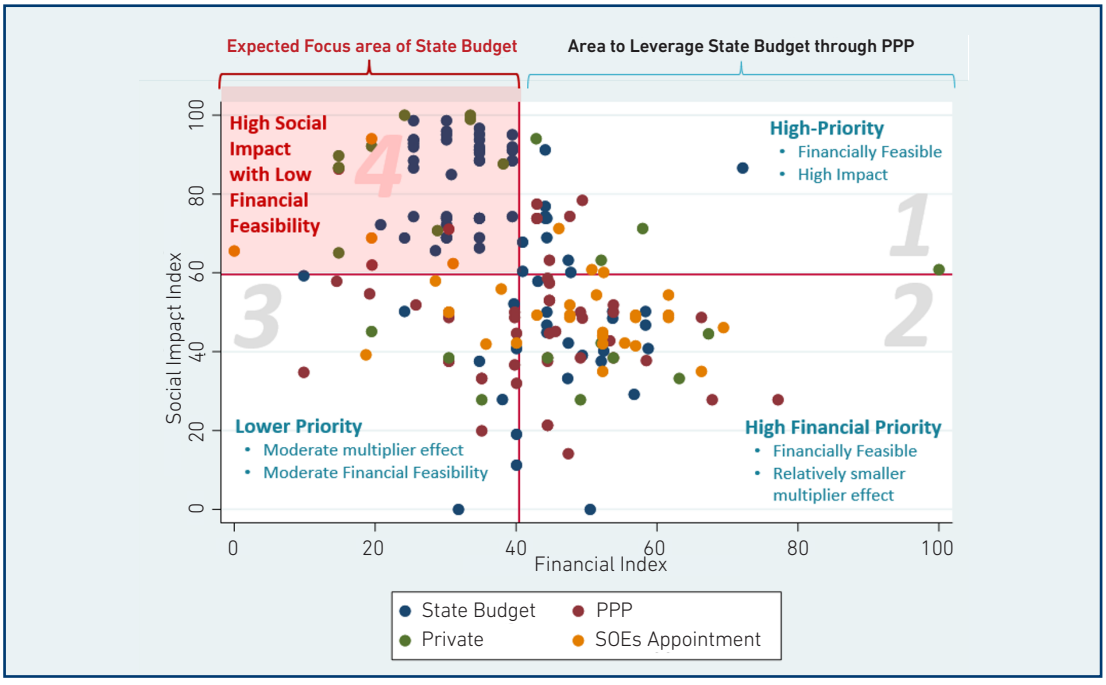
Conducting a socio-economic impact assessment of an infrastructure project ideally involves the estimation of the direct and indirect impacts of each project through a robust mixed method of qualitative and quantitative assessment. An example of such an assessment can be seen in Purwoto et al. (2019), which evaluated the socio-economic impact of four PPPs.[5] Scaling up the robust analysis in Purwoto et al. (2019) to cover broader PSN projects is challenging due to the fragmentation of detailed information on PSN projects across different sources, which prevents a more elaborate assessment using traditional cost–benefit analysis for all PSN projects. To overcome the challenges in conducting the assessment, the infrastructure financing prioritisation framework (IPF) is borrowed from Prospera (2022), which was developed as a stylised version of a more comprehensive framework from Marcelo et al. (2016). The stylised IPF is a multicriteria assessment tool used to evaluate the socio-economic impact and financial feasibility properties of a project and to assess the appropriateness of State Budget contribution in financing infrastructure.

The IPF has two criteria for assessing a PSN project. The first is the Socio-Economic Index, a composite index comprising (i) the economic multiplier impact extracted from Indonesia's 2016 Interregional Input–Output Table; and (ii) a strategic alignment factor that provides a favourable score for projects that are based on affirmative regional selection and type of infrastructure to address the basic infrastructure gap (e.g. infrastructure that is developed in regions outside of Java, particularly in remote areas, is scored higher compared to project in a more developed area). The second is the Financial Index, a composite index that is constructed from two components: (i) the internal rate of return (IRR) if a project has the ex-ante information of such a rate; in the event that there is no information on the IRR of a specific project, the IRR is set with similar projects in similar localities; and (ii) the multi-year commitment of the infrastructure project, with a shorter project prioritised over a longer-term project.

One immediate benefit of the stylised IPF is that it allows for a quick assessment based on limited project-level information. For the construction of an IPF for Indonesia, information was gathered, and assessments were conducted on a sample of 186 PSN projects. Inference is drawn from a quadrant analysis to compare socio-economic impact and financial feasibility across the 186 PSN projects. The resulting socio-economic impact and financial feasibility indexes are plotted together, and the average values of each index are then set as the cut-off points at each axis of the indexes to group the PSN projects by four quadrants of priority level (Figure 6.10).

[5] Railroad Project Makassar-Parepare, Preservation of Sumatra's East Sumatra National Road, Murhum Baubau Port Development Project, and Tower Project in Dharmais Cancer Hospital.

Figure 6.10. Stylised Infrastructure Financing Prioritisation Framework for 186 PSN Projects



PPP = public–private partnership.

Source: Source: Author's calculation from KPPIP lists of PSN Projects.

The first quadrant contains high-priority projects with high social impact and high financial feasibility. Most of these projects consist of strategic projects addressing connectivity needs from a growing region, such as the toll road from Balikpapan to Samarinda, and the toll road from Manado to Bitung. Other high-profile projects include the Indonesia Deepwater Development Project, a massive liquified natural gas exploration project.

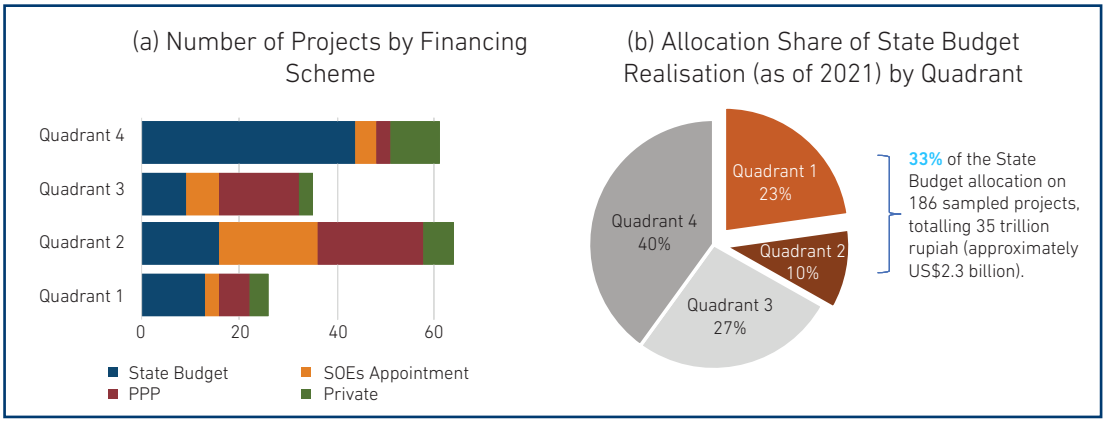
The second quadrant features projects with high financial feasibility but a rather moderate socio-economic impact. Projects consist of an inner-city toll road in Jabodetabek, some segments of the Trans-Java and Trans-Sumatra toll roads, and the Jakarta–Bandung high-speed train.

The third quadrant is the lower-priority quadrant, consisting of projects that on average have lower financial feasibility and moderate social impact. Projects range from those that have current limited benefits due to scalability issues, such as the Light Rail Transit (LRT) in Palembang and Jakarta. These projects were built to support the last Asian Games and are currently operating on a limited scale. Expansion of the route of the two LRT projects to connect with the larger LRT

network, serving more areas, may lead to a more favourable socio-economic impact.
The fourth quadrant captures projects with high social economic impact but low financial feasibility. Most of the projects respond to the need for basic infrastructure, such as dams and irrigation.

As the figure shows, most are either financially feasible (quadrants 1 and 2) or not financially feasible but have significant social impact (quadrant 4). A complete list of all projects by quadrant can be seen in Appendix 5.1.

Figure 6.11. Projects in Each Infrastructure Financing Prioritisation Framework Quadrant by Financing Scheme



PPP = public–private partnership, SOE = state-owned enterprise.

Notes:

1. Quadrant 1: High priority due to high socio-economic impact and high financial feasibility.
2. Quadrant 2: High financial priority, albeit moderate socio-economic impact.
3. Quadrant 3: Lower priority.
4. Quadrant 4: High social impact with limited financial feasibility.
5. Sample of 186 projects.

Source: Author's calculation from KPPIP lists of PSN Projects.

Figure 6.10 and Figure 6.11 reveal an encouraging finding – only a handful of the sampled projects are in the lower-priority quadrant, that is, have below-average social impact and financial feasibility compared to the rest of the PSN projects. The State Budget contribution in this quadrant is contained to a limited number of projects.

From an equitability standpoint, projects in the fourth quadrant are highly desirable due to their significant socio-economic impact, but State Budget financing is necessary because these projects are not appealing to the private sector. The contribution of the State Budget in this quadrant is already in line with the IPF; it directly financed 44 out of 61 projects in this quadrant, and most involve irrigation and water supply. This prioritisation is also observed by evaluating the complete list of PSN project clusters based on State Budget contributions, as clusters that received exclusive public funding are essential basic services that have substantial potential socio-economic impacts but may not be commercially feasible (Table 6.2).

Table 6.2. PSN Projects Based on State Budget Contribution

No.	Sectors	Number of Planned Projects under the PSN	
		Without State Budget Contribution	With State Budget Contribution
1	Roads (inc. toll) and bridges	11	43
2	Harbours	3	10
3	Airports	6	2
4	Railways	5	10
5	Industrial and economic zones	9	9
6	**Housing**		**2**
7	**Dams and irrigation**		**57**
8	**Clean water and sanitation**		**12**
9	**Sea embankment**		**1**
10	Energy	11	4
11	**Technology**		**5**
12	**Education**		**1**

Source: Author's calculation from KPPIP's lists of PSN Projects.

However, when projects that receive support from the State Budget are evaluated in all quadrants, projects that are financially viable (i.e. quadrants 1 and 2) are still receiving support from the State Budget either through direct financing, contribution through PPPs, or support from state-owned enterprises (SOEs). The amount of this support is substantial, with 33% of the State Budget allocation for the PSN allocated to these financially viable projects, amounting to about Rp35 trillion (Figure 6.11).

While State Budget funding is still expected for these projects, the sizeable number of projects receiving this contribution indicates that there is still room to invite the private sector to this area to better leverage the direct contribution of public spending and to avoid the crowding out of private investment in otherwise financially viable projects. Some good examples where the government has invited private investors to finance PSN projects include the Jakarta–Bandung high-speed train (quadrant 2), which is a joint venture between Indonesian SOEs through PT Pilar Sinergi BUMN and a consortium of Chinese railroad companies through Beijing Yawan HSR. However, unprecedented cost overruns in the end did require additional support from the State Budget.

In other instances, government support is instrumental to a project's overall feasibility. Complicated land acquisition issues, like that for the Semarang–Demak Toll Road (quadrant 2), necessitated direct support from the State Budget for the first segment of Rp10 trillion. As the first segment was also designed as multi-functional infrastructure to control floods in the area, this further complicated the technical arrangement and added to the State Budget need. The land acquisition issues and technical difficulties have been less imminent in the second segment, and the private sector (i.e. SOEs and private sector syndication) is involved in the construction of this segment through a build–operate–transfer arrangement.

Scaling up the targeted use of the State Budget to improve financial feasibility and to mitigate technical risk and challenges is crucial to allow for a more conducive environment for private sector involvement, as can be seen in the case of the Jakarta–Bandung high-speed train and Semarang–Demak Toll Road to broader PSN projects. However, the planning and implementing process of PPPs is more complicated than direct spending from the State Budget. Furthermore, the limited capacity of the government contracting agency is often a challenge in the preparation and procurement of PPPs (ADB, 2020). Addressing this fundamental constraint is essential to ensure that the State Budget contribution can be better leveraged to improve socio-economic outcomes through private sector involvement.

5. Summary and Conclusion

In response to Indonesia's massive infrastructure gap, the government rolled out the PSN. Its objectives are clear – to fulfil basic infrastructure needs and to improve citizens' welfare. This chapter assessed how effective PSN projects are in meeting these objectives.

The positive impact of PSN projects can be observed in the improvement of broader aggregate-level socio-economic indicators. On average, sub-national economic growth accelerated in regions traversed by a PSN toll road, poverty incidence declined, and income distribution improved, albeit modestly. This result is reflective of the findings in various project-level evaluations that showed positive impacts of toll roads on growth in the number of retail businesses, number of firms, and headline labour market indicators.

Drawing an inference from household-level data and selected project technical documents, PSN projects have contributed to more equitable access to basic infrastructure. In the specific case of two water projects, the ex-post evaluation found that household access to piped water in the project areas is improving, particularly for households in the lowest income decile. Challenges remain, however, particularly in capacity optimisation and maintaining the quality of services. As the last-mile deliverers of piped water, local governments are struggling to secure adequate post-construction operational funding to install pipelines from water treatment facilities to end-users. The fact that tariffs are often set not solely on economic and financial considerations exacerbates the issue. The lack of adequate operational funding has led to lacklustre service coverage increases and less-than-ideal service disruption management. This finding highlights the importance of coordination between the central and local governments on the construction and operation of PSN projects. This is particularly important for basic infrastructure projects where, in most cases, the local government has a significant role in handling operational technicalities.

For a massive undertaking such as the PSN – with different clusters of infrastructure types competing for allocation of public spending – optimising socio-economic impacts requires a prioritisation of public spending contributions based on multiple criteria (i.e. the magnitude of socio-economic impacts and financial feasibility). In evaluating the contribution of the State Budget to PSN projects, the Widodo Administration has managed to limit public spending on projects that are commercially feasible and instead focus on projects with a high socio-economic impact that may not be as feasible commercially. Still, the substantial number of projects that are financially viable and receiving support from the State Budget cannot be discounted. Further optimisation of the State Budget can still be achieved through more intensive involvement from the private sector to better leverage the contribution of public spending.

References

Ahmad, F.S. (2022), 'Dampak Pembangunan Jalan Tol Trans Jawa terhadap Pertumbuhan Ekonomi di Jawa Tengah', *Jurnal Ekonomi dan Kebijakan Pembangunan*, 11(1), pp.1–18.

Anam, S. (2021), 'Bupati Gresik Turun Respon Keluhan Pelanggan, Dirut Pdam PDAM Ditelepon Malah Tidak Diangkat', *Suara Indonesia*, 1 March, https://suaraindonesia.co.id/news/pemerintahan/603c762b01adf/bupati-gresik-turun-respon-keluhan-pelanggan-dirut-pdam-ditelepon-malah-tidak-diangkat

Anggraini, N., C.R. Priadi, and H. Herdiansyah (2021), 'Material and Life Service of the Septic Tank Have an Influence on the Biological Pollution of Groundwater (Case Study Kelurahan Pademangan Barat, North Jakarta)', *IOP Conference Series: Earth and Environmental Science*, 755(1), pp.1–5.

Apriadi (2008), Pelayanan PDAM Way Rilau Berdasarkan Pendapat Pelanggan di Kota Bandar Lampung, Semarang, Indonesia: Universitas Diponegoro, Unpublished master's thesis.

Aryono, S. (2022), 'Permasalahan Proyek SPAM Bandar Lampung Hingga Kerugian Miliaran PDAM Way Rilau', *Kumparan.com*, 27 January, https://kumparan.com/lampunggeh/permasalahan-proyek-spam-bandar-lampung-hingga-kerugian-miliaran-pdam-way-rilau-1xOEvYgcm65/full

Asian Cities Climate Change Resilience Network (ACCCRN) (2010), *Bandar Lampung City Resilience Strategy to Climate Change 2011–2030*, Bandar Lampung, Indonesia: ACCCRN, https://acccrnindonesia.files.wordpress.com/2012/08/4-strategi-ketahanan-kota-bandar-lampung-2011-20301.pdf

Asian Development Bank (ADB) (2020), *Public–Private Partnership Monitor: Indonesia*, Manila.

Balitbangda Lampung Province (2018), *SPAM Lampung 2018*, Lampung, https://balitbangda.lampungprov.go.id/uploads/POLICY%20PAPER%20SPAM%20LAMPUNG%202018%20chaptern%202.pdf

Cahyadi, R., D. Kusumaningrum, and A.Y. Abdurrahim (2021), 'Community-Based Sanitation as a Complementary Strategy for the Jakarta Sewerage Development Project: What Can We Do Better?', *E3S Web of Conferences*, 249, https://www.e3s-conferences.org/articles/e3sconf/abs/2021/25/e3sconf_css2021_01003/e3sconf_css2021_01003.html

Card, D. and A.B. Krueger (1994), 'Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania', *The American Economic Review*, 84(4), pp.772–93.

Chambers, R. (2014), *Rural Development: Putting the Last First*, London: Routledge.

Costa, D., P. Burlando, and C. Priadi (2016), 'The Importance of Integrated Solutions to Flooding and Water Quality Problems in the Tropical Megacity of Jakarta', *Sustainable Cities and Society,* 20, pp.199–209.

Cotruvo, J., N. Hearne, and G.F. Craun (2019), *Providing Safe Drinking Water in Small Systems: Technology, Operations, and Economics*, London: Routledge.

Dsikowitzky, L. et al. (2017), 'Evidence of Massive River Pollution in the Tropical Megacity Jakarta as Indicated by Faecal Steroid Occurrence and the Seasonal Flushing out into the Coastal Ecosystem', *Environmental Chemistry Letters*, 15(3), pp.703–8.

East Java Provincial Government (EJPG) (2013), *Pra Studi Kelayakan Proyek Kerjasama Pemerintah Swasta – Sistem Penyediaan Air Minum Umbulan*, Surabaya.

Fawell, J.K. and G. Stanfield (2001), 'Drinking Water Quality and Health', in R.M. Harrison (ed.), *Pollution: Causes, Effects, and Control*, London: Royal Society of Chemistry, pp.59–112.

Fedderke, J.W. and Ž. Bogetić (2009), 'Infrastructure and Growth in South Africa: Direct and Indirect Productivity Impacts of 19 Infrastructure Measures', *World Development*, 37(9), pp.1522–39.

Fustec, K. (2019), 'A Sociopolitical Analysis of Drinking Water Governance in French Polynesia: The Case of the Tuamotu Archipelago', *Water Alternatives*, 12(3), pp.975–92.

Gachassin, M., B. Najman, and G. Raballand (2010), 'The Impact of Roads on Poverty Reduction: A Case Study of Cameroon', *World Bank Policy Research Working Papers*, No. 5209, Washington, DC: World Bank.

Gibbons, S. and H. Overman (2009), *Productivity in Transport Evaluation Studies*, London: Government of the United Kingdom, Department for Transport

Ginanjar, D. (2023), 'Rp 113M untuk Proyek Pipanisasi SPAM Umbulan, Prioritas Surabaya Raya', *JawaPos.com,* 10 February, https://www.jawapos.com/surabaya-raya/01435696/rp-113-m-untuk-proyek-pipanisasi-spam-umbulan-prioritas-surabaya-raya

Government of Indonesia (GOI), Commission V (2022), *Laporan Kunjungan Kerja Spesifik Komisi V DPR-RI Dalam Rangka Peninjauan Pembangunan Sarana Penyediaan Air Minum (SPAM) di Provinsi Lampung Tanggal 27–29 Januari 2022*, https://www.dpr.go.id/dokakd/dokumen/K5-12-53a3add68e47a284e78e75a6948605e0.pdf

GOI, Coordinating Ministry of Economic Affairs (2020), 'Pemerintah Resmikan Proyek Sistem Penyedian Air Minum Bandar Lampung', press release, 3 November, https://ekon.go.id/publikasi/detail/675/pemerintah-resmikan-proyek-sistem-penyediaan-air-minum-bandar-lampung

Graham, D.J. (2007), 'Agglomeration, Productivity and Transport Investment', *Journal of Transport Economics and Policy*, 41(3), pp.317–43.

Hasana, K. (2021), 'Air Mati Sejak Kamis, PDAM Surya Sembada: Masih Proses Perbaikan', *Times Indonesia*, 13 February, https://timesindonesia.co.id/peristiwa-daerah/327593/air-mati-sejak-kamis-pdam-surya-sembada-masih-proses-perbaikan

Hensley, C. et al. (2018), 'Poverty, Transportation Access, and Medication Nonadherence', *Pediatrics*, 141(4).

Istichori, I., I.P.A. Wiguna, and A. Masduqi (2018), 'Analisis Penentuan Tarif Air Minum PDAM Kabupaten Lamongan Berdasarkan Prinsip Full Cost Recovery', *Journal of Civil Engineering*, 33(1), pp.10–19.

Kim, K. (2023), 'Analysing Indonesia's Infrastructure Deficits from a Developmentalist Perspective', *Competition and Change*, 27(1), pp.115–42.

Loo, B.P. and D. Banister (2016), 'Decoupling Transport from Economic Growth: Extending the Debate to Include Environmental and Social Externalities', *Journal of Transport Geography*, 57, pp.134–44.

Lubis, F.A. and A. Silviana (2023), 'Construction of the Bakauheni-Terbanggi Besar Toll Road to Improve the Community's Economy', *Eduvest-Journal of Universal Studies*, 3(3), pp.573–85.

Maharani, A.S.A. (2021), 'Jakarta Sewerage System Akan Dibangun Tahun 2023, ini Sebarannya', *Kompas.com*, 23 August, https://www.kompas.com/properti/read/2022/08/23/100000321/jakarta-sewerage-system-akan-dibangun-tahun-2023-ini-sebarannya

Marcelo, D., C. Mandri-Perrott, S. House, and J.Z. Schwartz (2016), *An Alternative Approach to Project Selection: The Infrastructure Prioritization Framework*, Washington, DC: World Bank.

McCawley, P. (2015), 'Infrastructure Policy in Indonesia, 1965–2015: A Survey', *Bulletin of Indonesian Economic Studies*, 51(2), pp.263–85.

Minot, N., B. Baulch, and M. Epprecht (2006), *Poverty and Inequality in Vietnam: Spatial Patterns and Geographic Determinants*, Washington, DC: International Food Policy Research Institute.

Olsson, J. (2009), 'Improved Road Accessibility and Indirect Development Effects: Evidence from Rural Philippines', *Journal of Transport Geography*, 17(6), pp.476–83.

PDAM Way Rilau (2017), Analisis Dampak Lingkungan Hidup (ANDAL), Lampung, https://iif.co.id/wp-content/uploads/2018/12/XBCK-ATL432-05WATD-Amdal-Bag-1.pdf

Prospera (2018), Economic Outlook 2018: Higher Growth in the Midst of Political Uncertainty, Jakarta, unpublished.

––––– (2022), Infrastructure Spending Review, Jakarta, unpublished.

Purwoto, H. et al. (2019), 'Analysis of Socio-Economic Impacts of Infrastructure Projects with PPP Scheme', *Journal of Infrastructure Policy and Management*, 2(1), pp.1–15.

Putra, A.P. (2023), 'Impact of Toll Road Development on Modern Retail Growth in Indonesia', *Journal Research of Social, Science, Economics, and Management*, 2(8), pp.1759–78.

Rachman, C.I. and L. Syamsumardian (2020), 'Dimensi Kewenangan Pengelolaan Sumber Daya Air Antara Pemerintah Pusat Dan Pemerintah Daerah Dalam Sistem Otonomi Daerah di Indonesia', *Konferensi Nasional Online: Hak Asasi Manusia*, Universitas Pancasila, Jakarta, 27–28 June.

Rahmawati, L. (2023), 'Pelanggan PDAM Kota Pasuruan: Jedingnya Juga Resik Tanpa Air', *Harian Disway*, 17 March, https://harian.disway.id/read/690550/pelanggan-pdam-kota-pasuruan-jedingnya-juga-resik-tanpa-air

Ray, D. and L.Y. Ing (2016), 'Addressing Indonesia's Infrastructure Deficit', *Bulletin of Indonesian Economic Studies*, 52(1), pp.1–25.

Ritchie, H., F. Spooner, and M. Roser (2019), Causes of Death, OurWorldInData.org, https://ourworldindata.org/causes-of-death (accessed 5 June 2023).

Rositha, A.S., D.P.E. Putra, L.D. Setijadji, and H. Hendrayana (2022), 'Porosity and Hydraulic Conductivity of Volcanic Rocks on the Northern Slope of Bromo-Tengger Volcano Complex', paper presented at the 51st IAGI, Makassar, 25–27 October.

Salim, W. and S.D. Negara (2018), 'Infrastructure Development under the Jokowi Administration: Progress, Challenges and Policies', *Journal of Southeast Asian Economies*, 35(3), pp.386–401.

Seizarwati, W. (2017), Penyebab Penurunan Debit Mata Air Umbulan, Bandung: Institut Teknologi Bandung, unpublished master's thesis.

Simantu (2021), SPAM Umbulan Jawa Timur, Kementerian Pekerjaan Umum dan Perumahan Rakyat, https://simantu.pu.go.id/content/?id=3244

Sofi, I. (2022), 'Pelaksanaan Pembangunan Infrastruktur di Daerah Melalui Pemanfaatan Skema Kerja Sama Pemerintah Daerah Dan Badan Usaha', *Defis – Jurnal Desentralisasi Fiskal, Ekonomi, dan Keuangan Daerah*, X(10), pp.27–44.

Štastná, M., A. Vaishar, and K. Stonawská (2015), 'Integrated Transport System of the South Moravian Region and Its Impact on Rural Development', *Transportation Research Part D: Transport and Environment*, 36, pp.53–64.

Syarizka, D. (2016), 'Proyek Jakarta Sewerage System: Investor Asing Tertarik', Bisnis.com, 4 August, https://ekonomi.bisnis.com/read/20160804/45/572206/proyek-jakarta-sewerage-system-investor-asing-tertarik

Utomo, W. (2017), 'Tantangan Pembangunan Infrastruktur di Indonesia', KPPIP, press release, 6 November, https://kppip.go.id/opini/tantangan-pembangunan-infrastruktur-indonesia

Van Engelenburg, J. (2020), Towards Sustainable Drinking Water Supply in the Netherlands, Wageningen: Wageningen University, unpublished PhD thesis.

Warr, P. (2010), 'Roads and Poverty in Rural Laos: An Econometric Analysis', *Pacific Economic Review*, 15(1), pp.152–69.

World Bank (2014), *Indonesia: Avoiding the Trap*, Jakarta: World Bank Office Jakarta, https://www.worldbank.org/content/dam/Worldbank/document/EAP/Indonesia/Indonesia-development-policy-review-2014-english.pdf

Yusuf, D.M. (2023), 'Kesuksesan Pemda Dan PDAM Kabupaten Lamongan Dalam Meningkatkan Pelayanan Akses Air Minum, NUWSP, 5 April, https://nuwsp.web.id/artikel/5463

Yusupov, N. (2020), 'Measuring the Impact of Road Infrastructure on Household Well-Being: Evidence from Azerbaijan', *ADB Institute Working Papers*, No. 1205, Tokyo: ADB Institute, http://hdl.handle.net/11540/12980

Zhou, Y., C. Tong, and Y. Wang (2022), 'Road Construction, Economic Growth, and Poverty Alleviation in China', *Growth and Change*, 53(3), pp.1306–32.

Appendix

Appendix 6.1. Projects by Stylised Infrastructure Financing Prioritisation Framework Quadrant

PSN Project	Financial Index	Socio-Economic Index	Quadrant
Rail-Based Mass Transport for the Badung Region – Buleleng	44.7	63.2	1
Bendo Dam	44.1	74.3	1
Gongseng Dam	44.1	74.3	1
Karalloe Dam	44.1	91.2	1
Karian Dam	44.1	76.9	1
Brass Dam	44.1	73.9	1
Marangkayu Dam	72.2	86.6	1
Tukul Dam	44.1	74.3	1
Balikpapan-Samarinda toll road	42.9	73.8	1
Makassar–Maros–Sungguminasa–Takalar (Mamminasata) Toll Road	42.9	77.5	1
Manado–Bitung Toll Road	47.6	74.3	1
Makassar–Parepare Train (Phase 1)	47.4	63.2	1
Purukcahu–Batanjung Train via Bangkuang	52.1	63.2	1
Bantaeng Industrial Area	42.8	94.0	1
Bontang Oil Refinery	50.7	60.8	1
Tuban Oil Refinery (Expansion)	46.1	71.3	1
Construction of New Nabire Airport	40.9	67.8	1
Construction of Siboru Fak Fak Airport	40.9	60.4	1
Construction of Samarinda–Bontang Toll Road	42.9	73.8	1
Development of Kupang Port	52.4	60.1	1
Development of Gendalo, Maha, Gendang, Gehem, and Bangka Fields (Indonesia Deepwater Development Project)	100.0	60.8	1
Development of the Jambaran Gas Unitisation Field – Tiung Biru	58.0	71.3	1
Glapan Irrigation Network Rehabilitation	44.4	68.9	1
Rehabilitation of Range Irrigation Networks	44.4	73.9	1
Labuan Bajo Multipurpose Terminal	47.8	60.1	1
Karian–Serpong Regional Drinking Water Supply System (SPAM)	49.4	78.4	1

PSN Project	Financial Index	Socio-Economic Index	Quadrant
Kediri Airport	45.6	45.1	2
Coal Gasification in Tanjung Enim	53.3	42.8	2
Jaian Toll Duri–Pulo–Kampung Melayu – part of the 6 DKI Jakarta toll roads	49.1	38.5	2
Jakarta MRT North–South (HI Roundabout–City–West Ancol)	58.7	40.8	2
Bukittinggi–Padang Panjang–Lubuk Alung–Padang Toll Road – part of the Trans-Sumatra	47.6	51.9	2
Kisaran Toll Road–Tebing Tinggi – part of the Trans-Sumatra	42.9	49.3	2
Pekanbaru–Kandis–Dumai Toll Road – part of the Trans-Sumatra	51.4	54.4	2
Ciaw–Sukabum–Ciranjang–Padalarang Toll Road	67.8	27.8	2
Cimanggis–Cibitung Toll Road	49.1	27.8	2
Kayu Agung Toll Road–Palembang–Betung	66.3	48.7	2
Kemayoran–Kampung Melayu Toll Road – part of the 6 DKI Jakarta toll roads	53.8	38.5	2
Langsa–Lhokseumawe Toll Road – part of the Trans-Sumatra	52.3	44.1	2
Lhokseumawe–Sigli Toll Road – part of the Trans-Sumatra	52.3	44.1	2
Medan–Binjai Toll Road – part of the 8 sections of the Trans-Sumatra	61.6	49.3	2
Muara Enim–Lubuk Linggau–Lahat Toll Road – part of the Trans-Sumatra	61.6	48.7	2
Probolinggo–Banyuwangi Toll Road	53.8	50.0	2
Rantau Prapat Toll Road–Kisaran – part of the Trans-Sumatra	57.0	49.3	2
Rengat Toll Road–Pekanbaru – part of the Trans-Sumatra	61.6	54.4	2
Semanan–Sunter Toll Road – part of the 6 DKI Jakarta toll roads	53.8	38.5	2
Semarang–Demak Toll Road	53.8	51.9	2
Serang–Panimbang Toll Road	44.5	58.6	2
Serpong–Balaraja Toll Road	58.5	37.8	2
Sigli–Banda Aceh Toll Road – part of the Trans-Sumatra	52.3	44.1	2
Indralaya–Muara Enim Simpang Toll Road – part of the Trans-Sumatra	57.0	48.7	2
Sunter–Pulo Gebang Toll Road – part of the 6 DKI Jakarta toll roads	44.5	38.5	2
Tebing Tinggi Toll Road – Pematang Siantar–Prapat–Tarutung–Sibolga – part of the Trans-Sumatra	47.6	49.3	2
Ulujami–Tanah Abang Toll Road – part of the 6 DKI Jakarta toll roads	44.5	38.5	2

PSN Project	Financial Index	Socio-Economic Index	Quadrant
Jambo Aye Kanan Irrigation Network	53.7	50.2	2
Lematang Irrigation Network	58.4	46.8	2
Lempuing Irrigation Network	44.4	46.8	2
Lhok Guci Irrigation Network	58.4	50.2	2
Swamp Telake Irrigation Network	44.4	44.9	2
Tebing Tinggi Train–Kuala Tanjung	56.7	29.2	2
Likupang Port	43.1	57.9	2
Port of Sanur–Nusa Ceningan/Lembogan	52.4	40.2	2
Development of Self-Help Home Assistance	50.5	0.0	2
Additional Scope of Bogor Ring Road Toll Road	77.2	27.8	2
Additional Scope of the Ngawi–Kertosono–Kediri Toll Road	49.1	50.0	2
Tangguh LNG Train 3 Project	67.3	44.5	2
Gumbasa Irrigation Network Rehabilitation	53.7	48.5	2
Karian Raw Water Facilities and Infrastructure	44.4	50.1	2
Benteng-Kobema Regional Drinking Water Supply System (SPAM) (Central Bengkulu, Bengkulu City, and Seluma)	49.4	39.1	2
Jatigede Regional Drinking Water Supply System (SPAM)	44.7	53.0	2
Jatiluhur Regional Drinking Water Supply System (SPAM)	44.7	53.0	2
Kamijoro Regional Drinking Water Supply System (SPAM) (Bantul, Kulon Progo)	49.4	48.5	2
Wasusokas Regional Drinking Water Supply System (SPAM).	44.7	44.7	2
Umbulan Drinking Water Supply System (SPAM)	44.7	57.4	2
Upgrading the Existing Refinery and the Balongan Petrochemical Industry	55.4	42.2	2
Jakarta–Bandung High-Speed Railway	52.1	42.2	2
Inland Waterways Cikarang–Bekasi–Sea	47.3	33.2	2
Bekasi–Cawang–Kampung Melayu Toll Road	44.5	21.3	2
Betung Toll Road (Sp Sekayu)–Tempino–Jambi – part of the Trans-Sumatra	52.3	35.0	2
Binjai–Langsa Toll Road – part of the Trans-Sumatra	52.3	42.0	2
Cibitung–Cilincing Toll Road	44.5	21.3	2
Cinere–Jagorawi Toll Road	63.1	33.2	2
Dumai Toll Road–Sp. Sigambal–Rantau Prapat – part of the Trans-Sumatra	47.6	48.7	2
Jambi–Rengat Toll Road – part of the Trans-Sumatra	52.3	44.9	2

PSN Project	Financial Index	Socio-Economic Index	Quadrant
Lubuk Linggau–Curup–Bengkulu Toll Road – part of the Trans-Sumatra	66.3	35.0	2
Pekanbaru–Bangkinan–Payakumbuh–Bukittinggi Toll Road – part of the Trans-Sumatra	57.0	41.5	2
Yogyakarta–Bawen Toll Road	44.5	37.6	2
Logistics Train Lahat–Muara Enim–Prabumulih–Tarahan/ Lampung and Prabumulih–Kertapait/Palembang	47.4	14.1	2
South Java Double Track	47.4	42.2	2
Jakarta–Surabaya Train	52.1	37.6	2
Upgrading Existing Refineries/Refinery Development Master Plan	69.4	46.1	2
Yogyakarta New Airport–Kulon Progo	18.7	39.2	3
Elevated Inner Loop Line Jatinegara–Tanah Abang Kemayoran	35.1	19.9	3
Pasar Minggu–Casablanca Toll Road – part of the 6 DKI Jakarta toll roads	30.4	38.5	3
Patimban Port Access Toll Road	30.4	48.7	3
Cileunyi–Sumedang–Dawuan Toll Road	39.8	48.7	3
Krian–Legundi–Bunder–Manyar Toll Road	30.4	50.0	3
Pandaan Toll Road–Malang	39.8	50.0	3
Pasuruan–Probolinggo Toll Road	30.4	50.0	3
Semarang Harbor Toll Road	25.8	51.9	3
Yogyakarta–Kulon Progo New Airport Access Train	40.1	19.1	3
Batang Integrated Industrial Estate	24.2	50.2	3
Wilmar Serang Industrial Area	19.5	45.1	3
LRT Jakarta International Stadium–Kelapa Gading and Velodrome–Manggarai	40.1	40.8	3
LRT South Sumatra (Metro Palembang)	40.1	11.2	3
Construction of flyover from and to Teluk Lamong Terminal	30.4	50.0	3
Additional Scope of Depok–Antasari Toll Road	35.1	27.8	3
Development of Adi Soemarmo Airport	35.7	41.9	3
Development of Bitung International Hub Port	14.5	57.9	3
Development of Kuala Tanjung International Hub Port	19.2	54.7	3
Development of Patimban Port	9.9	34.8	3
Development of the Existing Sorong and Arar Ports	28.5	58.0	3
Development of Palu Bay Port	9.9	59.3	3

PSN Project	Financial Index	Socio-Economic Index	Quadrant
Kijing Terminal Port Development	37.9	55.9	3
Technopark Development Acceleration	31.8	0.0	3
Sidan Dam Raw Water Supply System	39.7	52.1	3
Bandar Lampung Drinking Water Supply System (SPAM)	40.1	32.0	3
West Semarang Drinking Water Supply System (SPAM)	40.1	44.7	3
Real Dam	34.8	37.6	3
Cengkareng–Batu Ceper–Kunciran Toll Road	35.1	33.2	3
Gedebage–Tasikmalaya–Cilacap toll road	30.4	37.6	3
Jakarta–Cikampek II Toll Road South Side	35.1	33.2	3
Serpong–Cinere Toll Road	39.8	36.7	3
Prapat–Duri–Pekanbaru Railway	38.1	27.9	3
Integrated LRT Jakarta, Bogor, Depok, and Bekasi	40.1	42.2	3
Additional Scope of the Solo–Yogyakarta–Kulon Progo Toll Road	30.4	37.6	3
Komodo Airport–Labuan Bajo	19.5	62.0	4
Baliase Weir and Irrigation	39.5	91.2	4
Ameroro Dam	25.4	98.6	4
Bagong Dam	25.4	74.3	4
Banyan Sila Dam	25.4	93.8	4
Bano Star Dam	34.8	93.8	4
Budong-Budong Dam	25.4	92.8	4
Bulango Ulu Dam	34.8	96.7	4
Ciawi Dam	30.1	73.9	4
Cipanas Dam	34.8	73.9	4
Jlantah Dam	30.1	68.9	4
Jragung Dam	30.1	68.9	4
Keureuto Dam	34.8	91.9	4
Kuwil Kawangkoan Dam	30.1	95.1	4
Ladongi Dam	30.1	98.6	4
Lausimeme Dam	34.8	90.4	4
Leuwikeris Dam	34.8	73.9	4
Lolak Dam	39.5	95.1	4
Manikin Dam	25.4	88.5	4

PSN Project	Financial Index	Socio-Economic Index	Quadrant
Marga Tiga Dam	30.1	95.9	4
Mbay Dam	39.5	88.5	4
Meninting Dam	25.4	93.8	4
Napungete Dam	34.8	88.5	4
Pamukkulu Dam	34.8	91.2	4
Passeloreng Dam	34.8	91.2	4
Pidekso Dam	34.8	68.9	4
Randugunting Dam	30.1	68.9	4
Rukoh Dam	39.5	91.9	4
Sadawarna Dam	30.1	73.9	4
Semantok Dam	30.1	74.3	4
Seku Semoi Dam	25.4	86.6	4
Sidan Dam	30.1	72.2	4
Sukamahi Dam	34.8	73.9	4
Tamblang Dam	20.8	72.2	4
Tapin Dam	34.8	95.2	4
Temef Dam	39.5	88.5	4
Tiga Dihaji Dam	34.8	88.5	4
Tiro Dam	25.4	91.9	4
Tiu Suntuk Dam	30.1	93.8	4
Monument Dam	39.5	74.3	4
Way Apu Dam	39.5	91.1	4
Jakarta Sewage System (JSS)	30.8	84.9	4
Tanjung Api-Api Special Economic Zone	24.2	68.9	4
Jorong Industrial Area	19.5	92.2	4
Ketapang Industrial Area	14.8	86.7	4
Konawe Industrial Area	33.5	99.0	4
Kuala Tanjung Industrial Area	14.8	65.1	4
Hedgehog Industrial Area	14.8	86.7	4
Morowali Industrial Area	38.2	87.6	4
Obi Island Industrial Area	33.5	100.0	4
Takalar Industrial Area	19.5	94.0	4
Tanah Kuning Industrial Area	14.8	89.7	4

PSN Project	Financial Index	Socio-Economic Index	Quadrant
Tanggamus Industrial Area	28.8	70.7	4
Tanjung Enim Industrial Area	19.5	68.9	4
Bintuni Bay Industrial Area	14.8	86.3	4
Weda Bay Industrial Area	24.2	100.0	4
Makassar New Port	0.0	65.6	4
Harbor Special Economic Zone Maloy	28.5	65.6	4
Simpang Lima Underground Development	30.4	71.1	4
Development of Lombok Praya International Airport	31.1	62.4	4
Way Sekampung Dam	34.8	66.3	4

LRT = light-rail transit, SPAM = *sistem penyedian air minum* (drinking water supply system).

Notes:

1. The financial index and socio-economic index score are standardised using the minimum–maximum normalisation formula $\left(\frac{X-X_{min}}{X_{max}-X_{min}}\right)$ with X being the unstandardised financial index and socio-economic index.
2. The relative highest score for each index will receive a maximum standardised score of 100.
3. The relative lowest score will receive a minimum standardised score of 0.

Source: Authors.