Indonesia case study

Giga in collaboration with Boston Consulting Group (BCG)

September 2021

Country profile | Indonesia

Key figures

- Population: 270 m
- GDP: $1139 B
- GDP per capita: $4,221
- GDP growth: 7.6%
- Investments/GDP: 31.3%
- Urban population: 57%
- Total population under 18 years: 31.1%
- Secondary completion rate: 87.9%
- Adult literacy rate: 95.7%
- % of schools connected: 76.3%
- Connectivity starting point: 76.84%
- Electricity penetration: 98.9%

Demography of schools

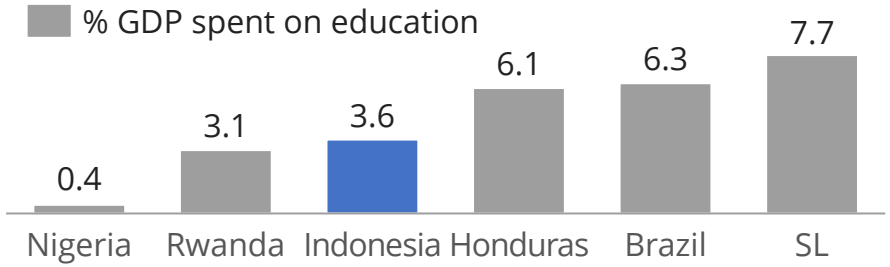
- # of schools in country: 218k
- Average no. of students per school: 198
- Current % of schools with internet connectivity: 81%

> The proportion of unconnected school is much higher in the sparsely populated islands, like Papua (lowest population density). The Ministry estimates 71% of schools in Papua are not connected to the internet

Low **GDP per capita** High

Challenge: Large populations separated by islands with significant socio-demographic differences

Government involvement



- Government debt: 43.5% of GDP
- Government's education budget on a per-student basis: $87.6
- Broadband a universal service: No
- Operational USF available: Yes
- Total amount allocated: $ 228m annually

Source: UNICEF, ITU, government websites, BCG analysis

Indonesia’s geography forms a barrier to be able to connect all schools, different funding models apply for the less developed regions

Context: The mobile segment in Indonesia plays a major role. Mobile internet is widespread and penetration is over 130%. However, only 14% of households are subscribed to the fixed segment, with the many islands being a major obstacle. ~19% of schools in Indonesia are not connected to the internet. 70% of these unconnected schools covered by a base transceiver station, while 12,600 (30%) schools are not, meaning the schools are completely removed from connectivity. Additionally, the unconnected school proportion is much higher in sparsely populated areas. A five-year plan made in 2019 aims to provide 20 Mbps service to 30% of the population, including 71% of urban households. Still, 13M people across 12,500 remote villages have no internet access

Technology

To connect schools in Indonesia, funding is required on the four technologies. Given low penetration of fixed broadband in the country, WISP, 4G and satellite are expected to hold higher relevance. The share of funding is determined as follows:

- Fiber: 30%
- WISP: 30%
- 4G: 38%
- Satellite: 2%

Cost structure

A total annualized investment of $168M is needed to fund school connectivity in Indonesia.

An additional $20 will have to be spent per unconnected student on an annual basis to fund school connectivity.

For an average school that is not connected to electricity, $4,450 is required on an annualized basis

Funding structure

Different funding models are considered for the well-developed versus less developed. For the well-developed regions the following models are considered:

- Demand-side subsidy
- Prerequisite in upcoming 5G spectrum auction
- Build, Operate and Transfer by BAKTI
- Revenue-sharing

For the less developed regions:

- Demand-side subsidy
- USO financing
- Regulated advertising model
- Community contribution
- Govt co-invest alongside SPs

Operating model

In terms of operating model, the following is advised:

- Private company/consortium for coverage as a service (revenue-sharing)
- State/gov't driven for the gov't budget increase
- Turnkey (+ Lease) for one-off gov't subsidies
- Cooperative and Voluntary set-ups for community contribution

Multiple funding models (private, PPP, state and community) can be used, thereby involving different stakeholders in the process of improving connectivity

Funding model		Explanation	Operating model
A	Coverage as a service – revenue-sharing	The revenue-sharing model falls within the commercial-provided archetype. It is guided by the private company/consortium operating model. This model is more relevant for well-developed regions e.g., Java, Bali and Sumatra. Private individuals have already set up their own networks covering ~20 households – a formal model connection local businesses and main operators must be established	Private company/ consortium
B	Government increases school funding	Falls within the government-contributed archetype and therefore the state/government driven operating model is advised. As no new infrastructure would be needed in this model, the operating model would be focused on optimal use of funding, rather than infrastructure development.	State/government
C	One-off government subsidy	Spectrum auctions and USF financing are (implicit) one-off subsidies. USF financing is gov't-driven, however can be conducted in a wide variety of methods (e.g., BAKTI owns infrastructure, or outsources to commercial parties). The spectrum auction is an implicit PPP model given the need for agreement both the gov't as well as commercial parties. Another subsidization model is Build-Operate-Transfer (BOT) where BAKTI licenses rights to operate in an auction, which includes a mandate subsidization of school connectivity	Turnkey (+ Lease)
D	Community contribution	The community contribution model builds on the community-based archetype. It is more appropriate for less-developed regions e.g., Kalimantan, Sulawesi, Nusa Tenggara and Papua. Local ownership is based on supporting community-based micro-enterprises. Village ownership may be more successful, as the NPO or local gov't provides continuous guidance and training in addition to initial funding	Cooperative and Voluntary

Source: BCG analysis

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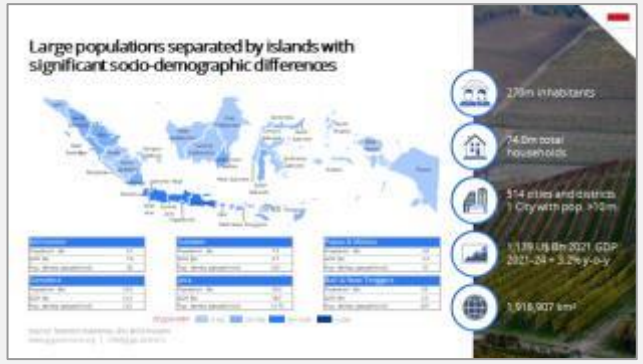
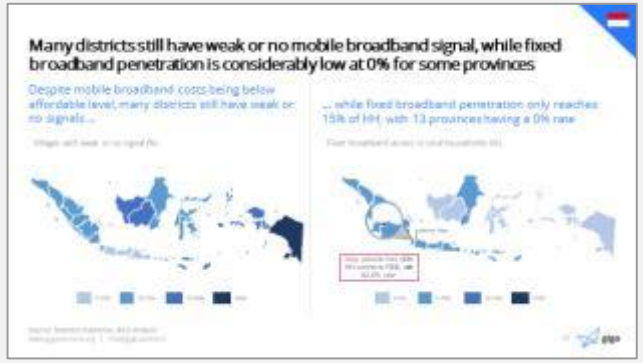
Significant regional differences in socioeconomic status in Indonesia lead to ~20% of schools being unconnected

Deep-dives on next pages

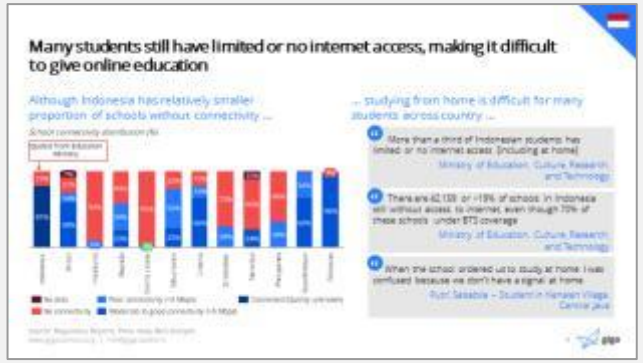
There are large socioeconomic differences between islands



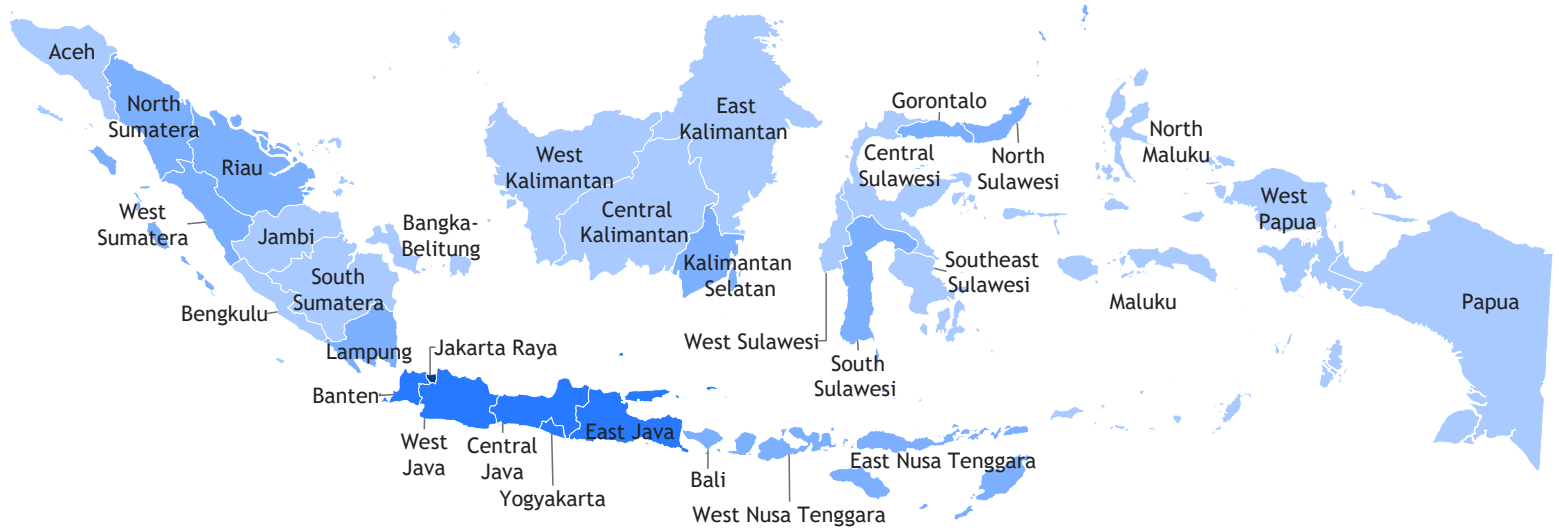
Meaning that several districts have weak or no mobile broadband signals



With an estimated 19% of schools that are not connected to the internet yet



Large populations separated by islands with significant socio-demographic differences



Kalimantan	
Population (%)	6.1
GDP (%)	7.9
Pop. density (people/km2)	30

Sulawesi	
Population (%)	7.3
GDP (%)	6.7
Pop. density (people/km2)	105

Papua & Maluku	
Population (%)	2.8
GDP (%)	2.3
Pop. density (people/km2)	15

Sumatera	
Population (%)	22.0
GDP (%)	21.4
Pop. density (people/km2)	123

Java	
Population (%)	56.2
GDP (%)	58.7
Pop. density (people/km2)	1,172

Bali & Nusa Tenggara	
Population (%)	5.6
GDP (%)	2.9
Pop. density (people/km2)	207

People/KM^2 0-100 101-500 501-1,500 >1,500

Source: Statistics Indonesia, EIU, BCG Analysis

Indonesia

270m inhabitants

74.0m total households

514 cities and districts
1 City with pop. >10 m

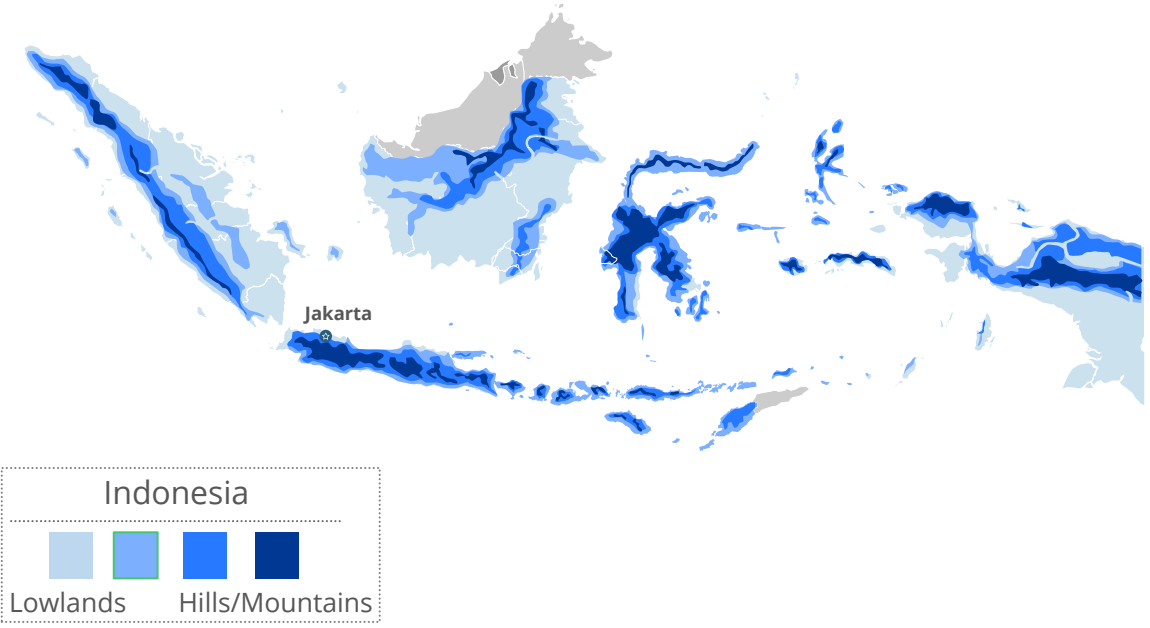
1,139 U$ Bn 2021 GDP
2021-24 + 3.2% y-o-y

1,916,907 km^2

Indonesia is the world's largest island country, with significant variances in connectivity set up

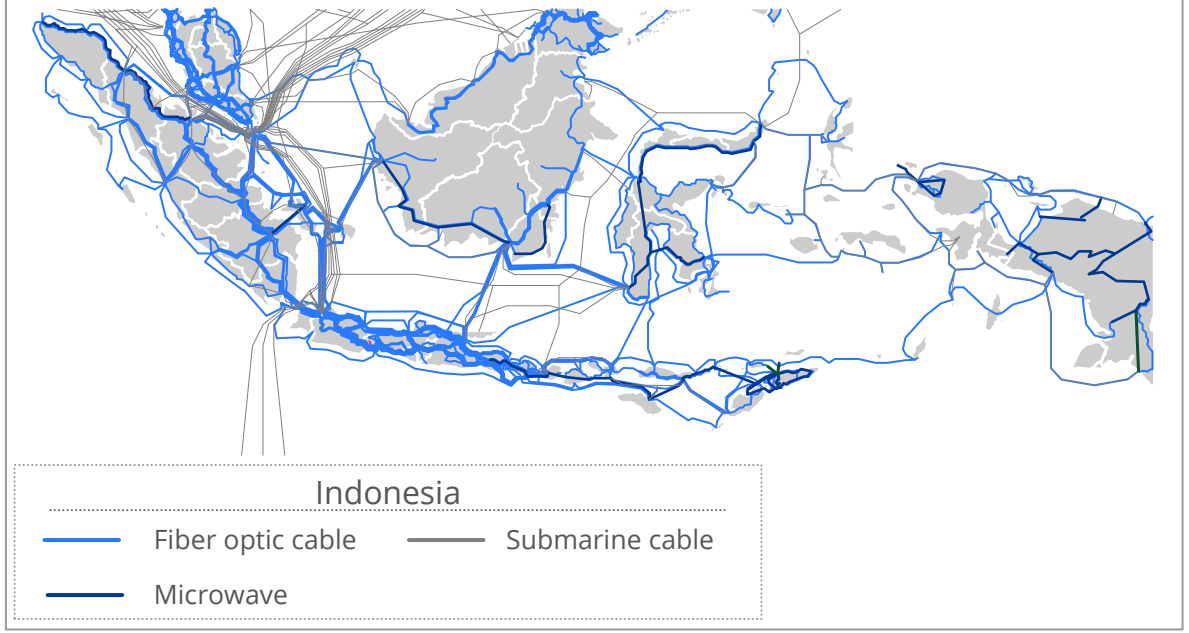
The world's largest island country, it consists over 17 thousand islands, with 4 distinct topographical regions…

One of the main challenges to developing ICT Infrastructure in Indonesia is its geography. This includes the number of islands, size of the territory to cover, the numerous remote and difficult to reach areas, and the number of low-income and uneducated inhabitants



… and significant variances in connectivity set up, with the East being less connected

Due to the limited funding capability of both the government and the private sector, infrastructure development cannot fully meet the demand in Indonesia. Thus, isolated and impoverished parts of the country are unconnected

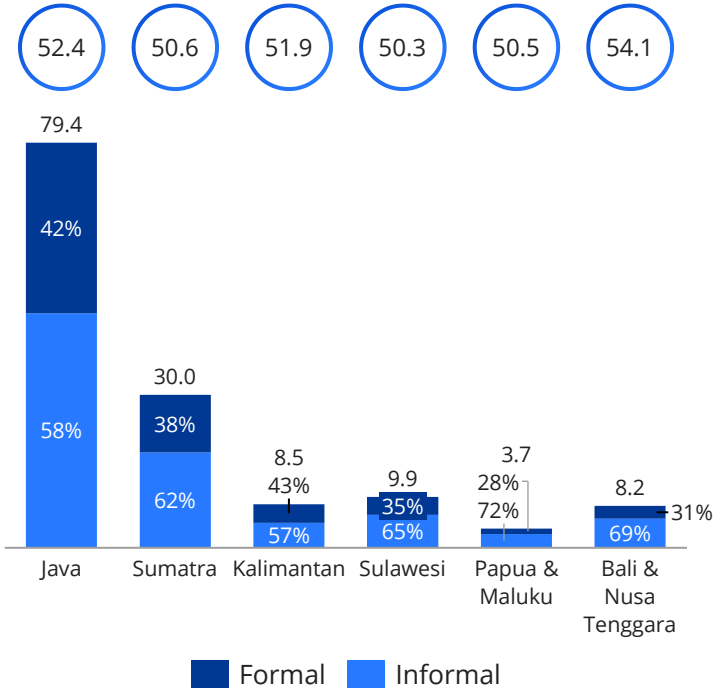


Sources: World Atlas, ITU Broadband maps, ITU digital regulation platform, GSMA

Different economic set-ups of regions must be taken into consideration in rolling out school connectivity

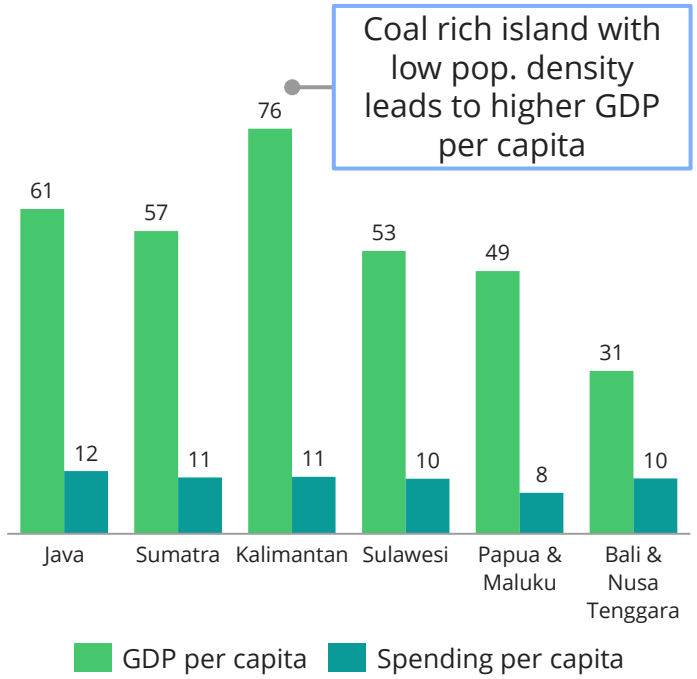
High labor force has made Java to be the epicenter of manufacturing and economic development …

Labor force (m), split formal/informal labor (%), labor force/total population (%)



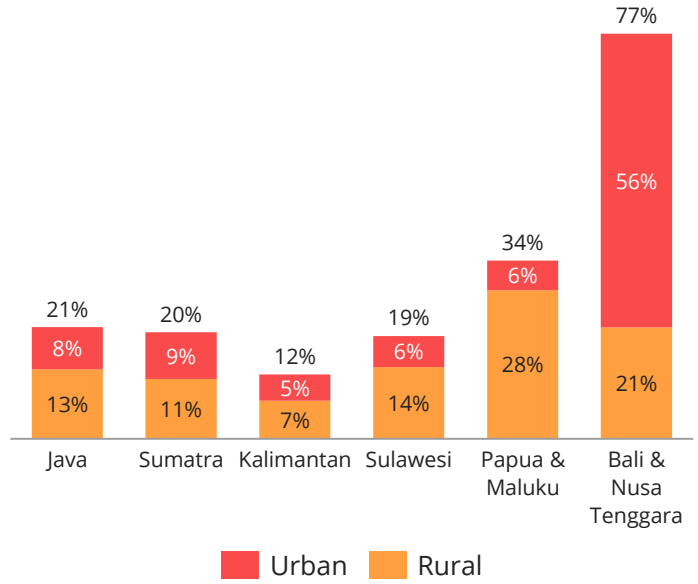
… which leads to higher GDP & spending per capita …

GDP per capita (IDR m) and spending per capita (IDR m)



… and lower poverty rates…

Poor people to total population (%) and split urban/rural(%)

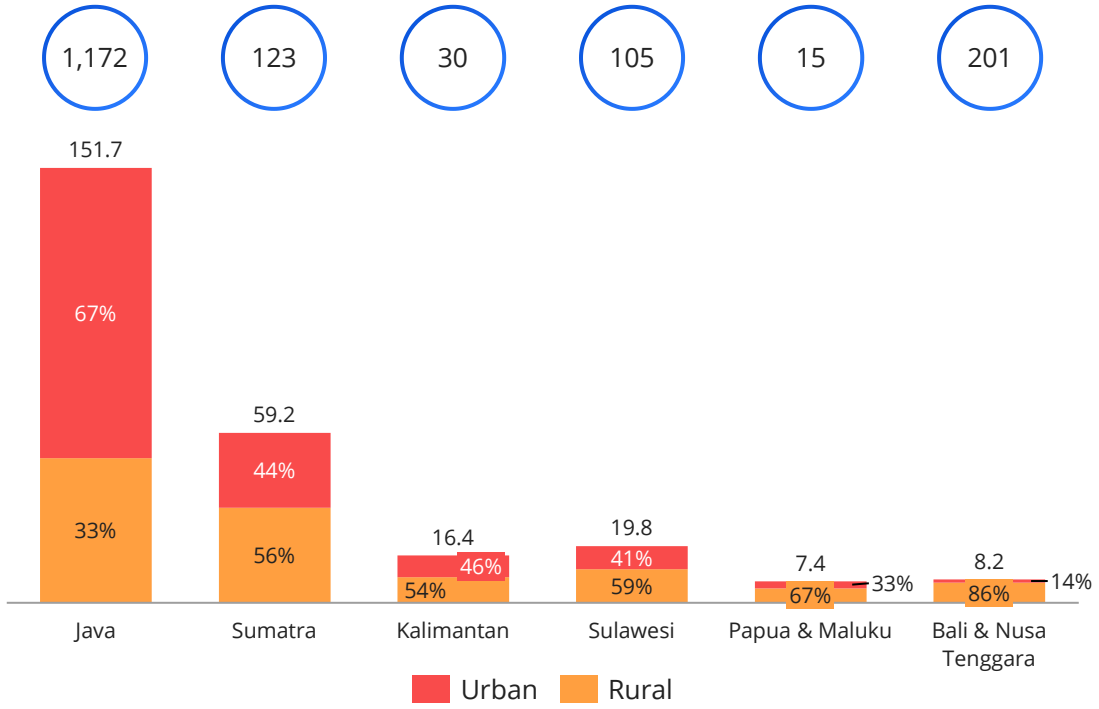


Source: Statistics Indonesia, BCG Analysis

Differences in population density leads to variances in school set up

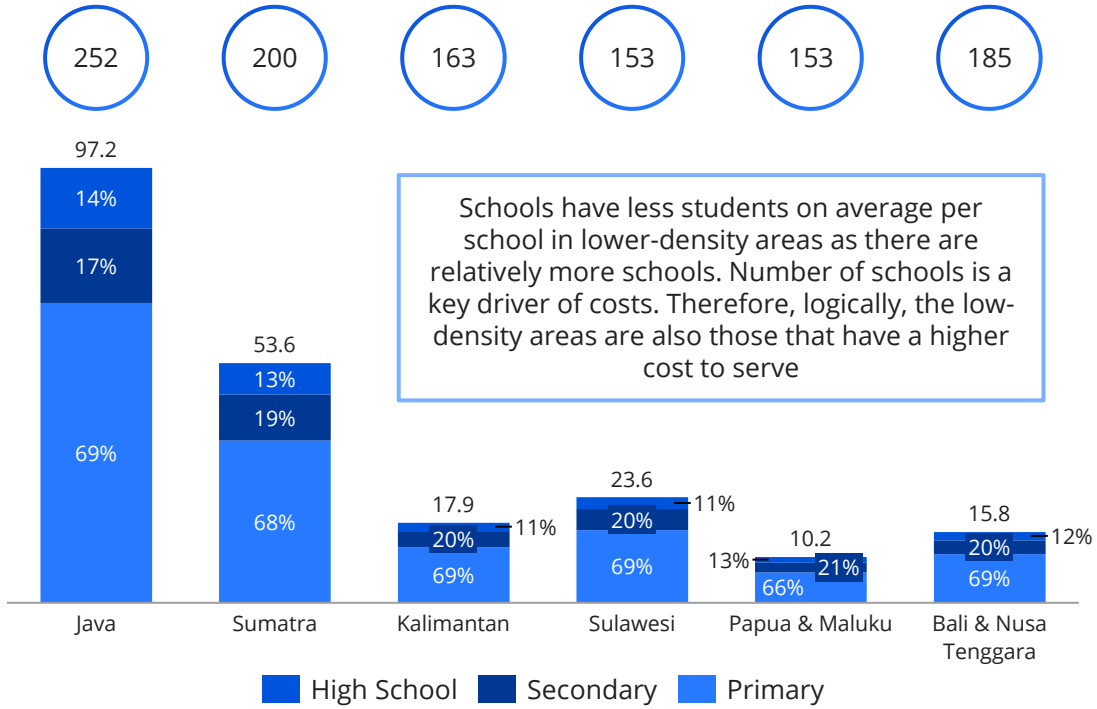
Population is concentrated in two islands, with one island having an extremely high population density

Total population (m), split urban/rural (%), and population density (people/km2)



...leads to higher number of schools in the two islands despite little variability in students per school

No. of schools per region ('000), split primary/secondary/high school (%) and students per school



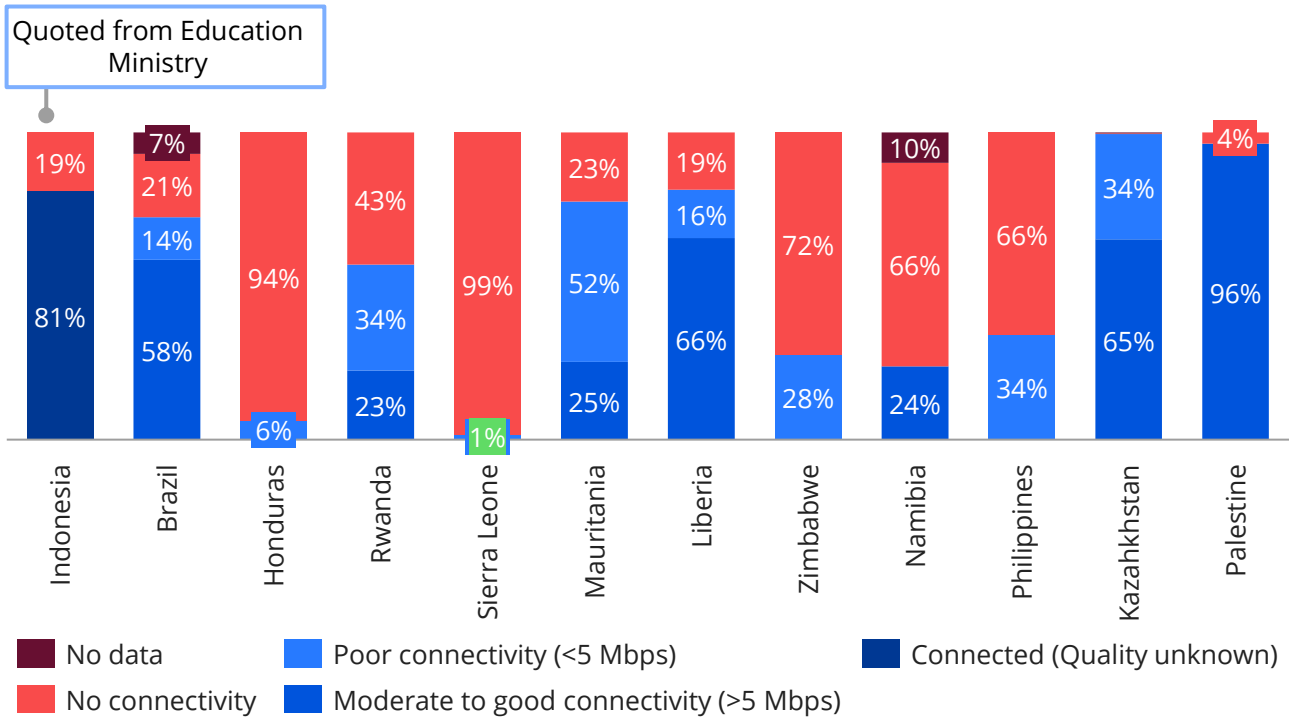
Schools have less students on average per school in lower-density areas as there are relatively more schools. Number of schools is a key driver of costs. Therefore, logically, the low-density areas are also those that have a higher cost to serve

Source: Statistics Indonesia, BCG Analysis

Many students still have limited or no internet access, making it difficult to give online education

Although Indonesia has relatively smaller proportion of schools without connectivity …

School connectivity distribution (%)



… studying from home is difficult for many students across country …

> More than a third of Indonesian students has limited or no internet access [including at home]
>
> Ministry of Education, Culture, Research, and Technology

> There are 42,159 or ~19% of schools in Indonesia still without access to internet, even though 70% of these schools under BTS coverage
>
> Ministry of Education, Culture, Research, and Technology

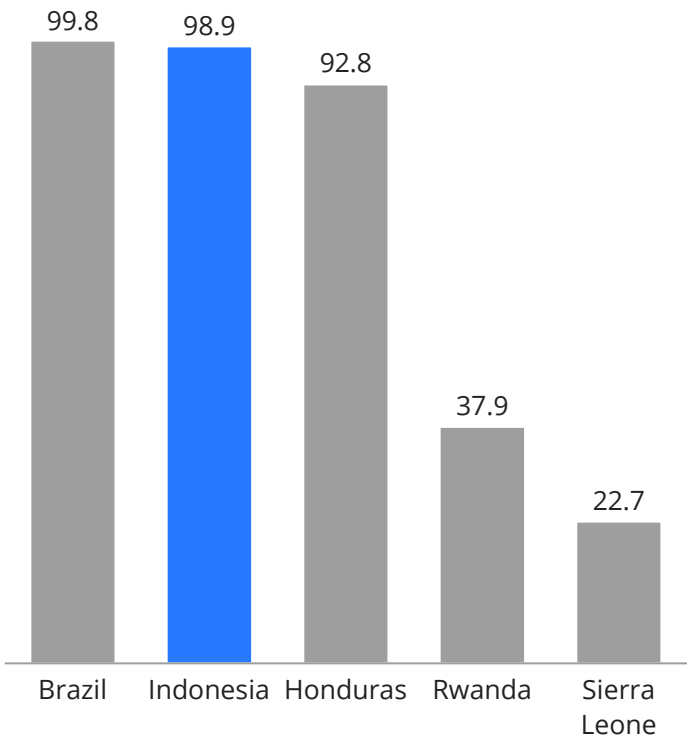
> When the school ordered us to study at home I was confused because we don't have a signal at home
>
> Putri Salsabila – Student in Kenalan Village, Central Java

Source: Regulatory Reports, Press news, BCG Analysis

Indonesia has a 99% electrification rate with almost equal access for both urban & rural, however ~9,500 schools still operating with no electricity

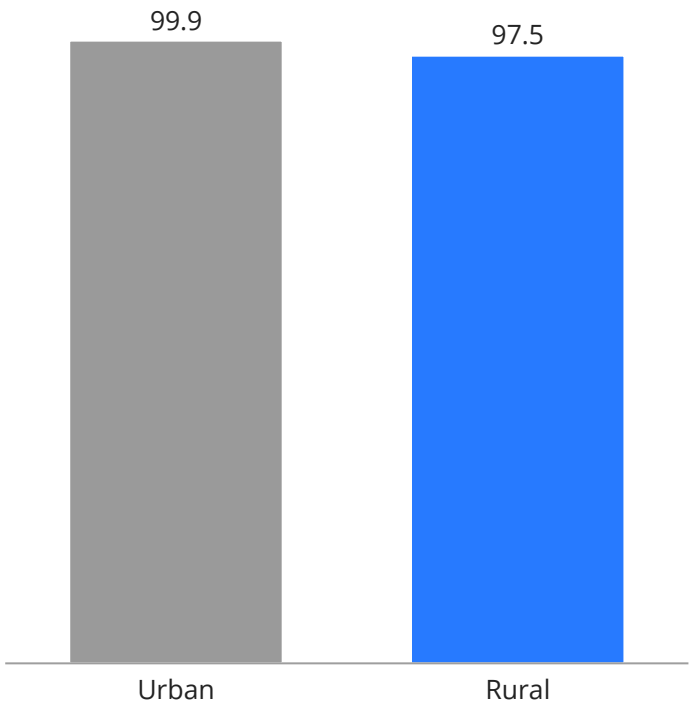
~99% of the Indonesian population has access to electricity …

Access to electricity (% of population)

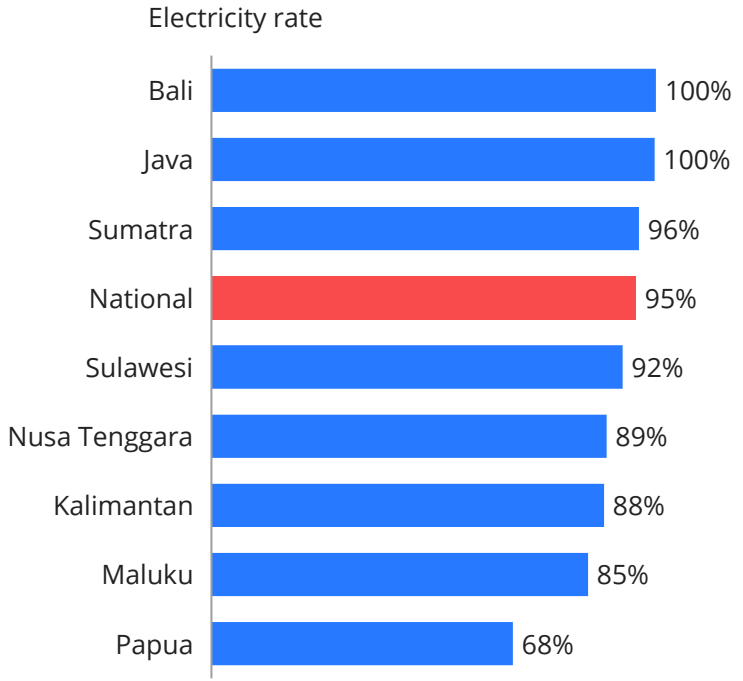


… with low variance between urban and rural …

Access to electricity (% of population)



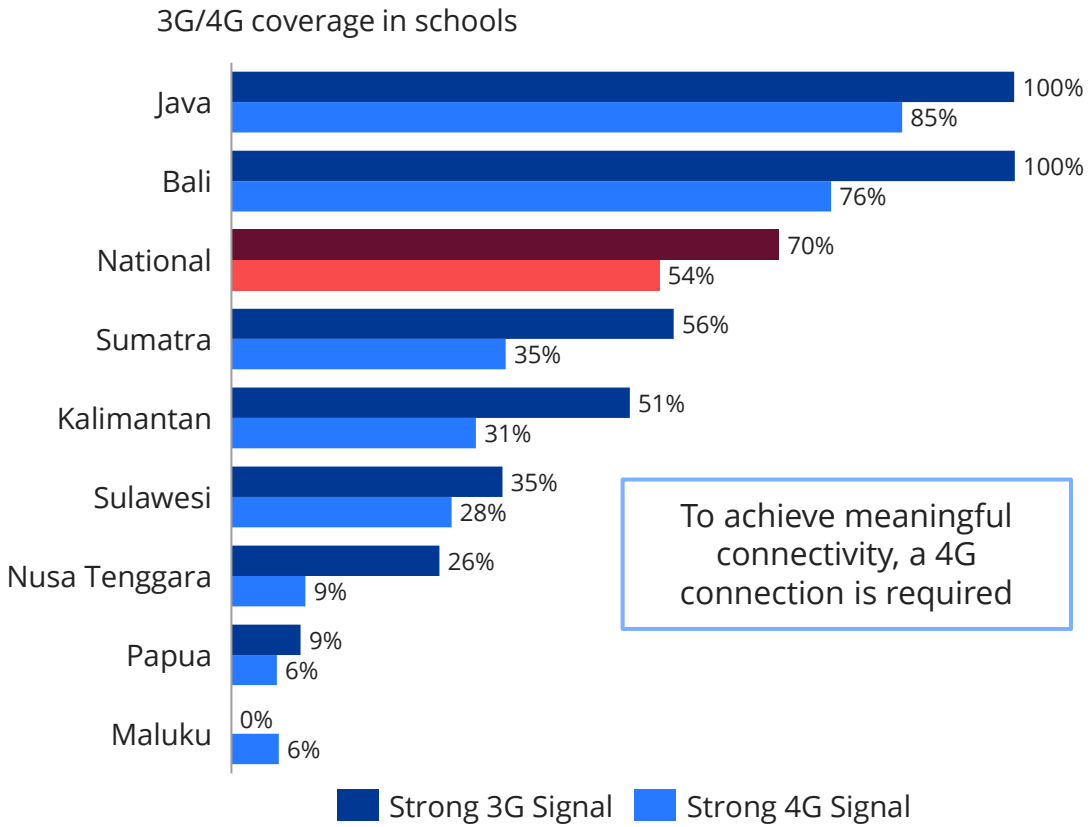
… however, electricity remains a problem for ~9,500 schools



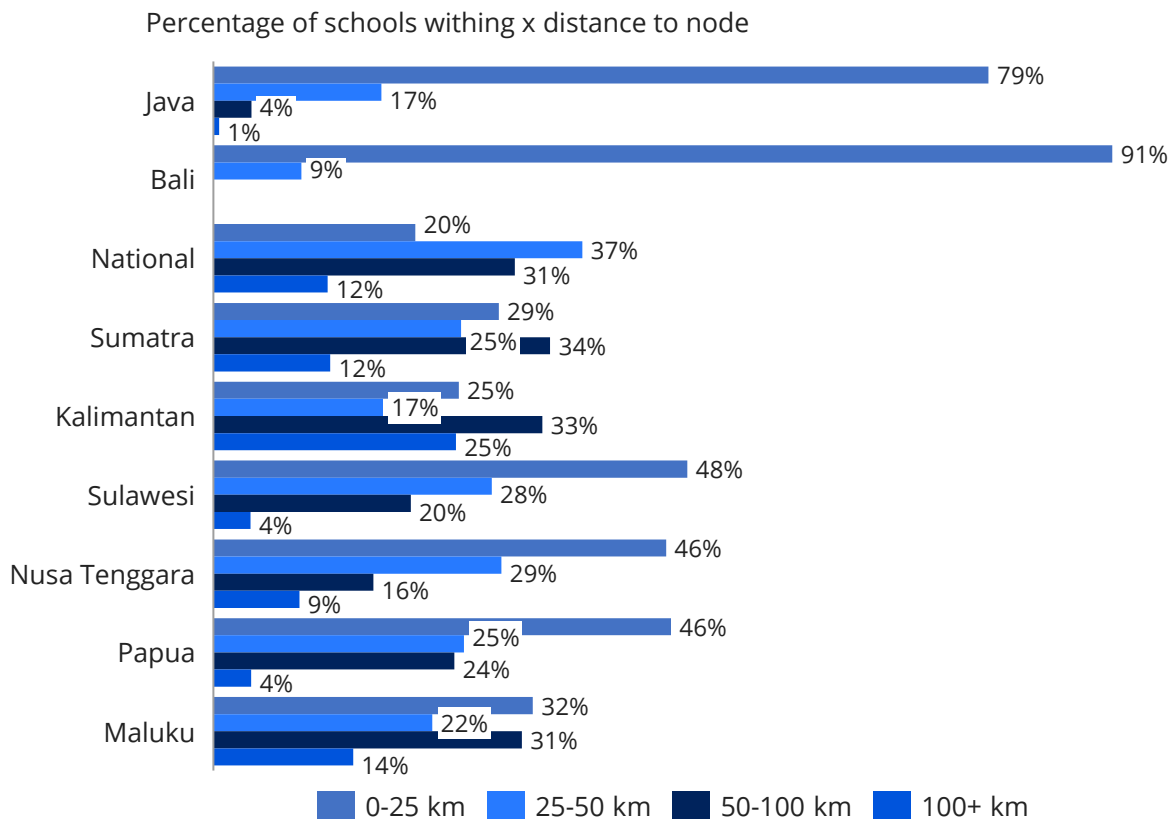
Source: Giga school data, Worldbank, MECRT, Press search, BCG Analysis

Java, Bali & Sumatra also have the best 4G coverage in schools, and are relatively closer to nodes which would allow them to connect more easily

The three well-developed islands have relatively better 4G coverage



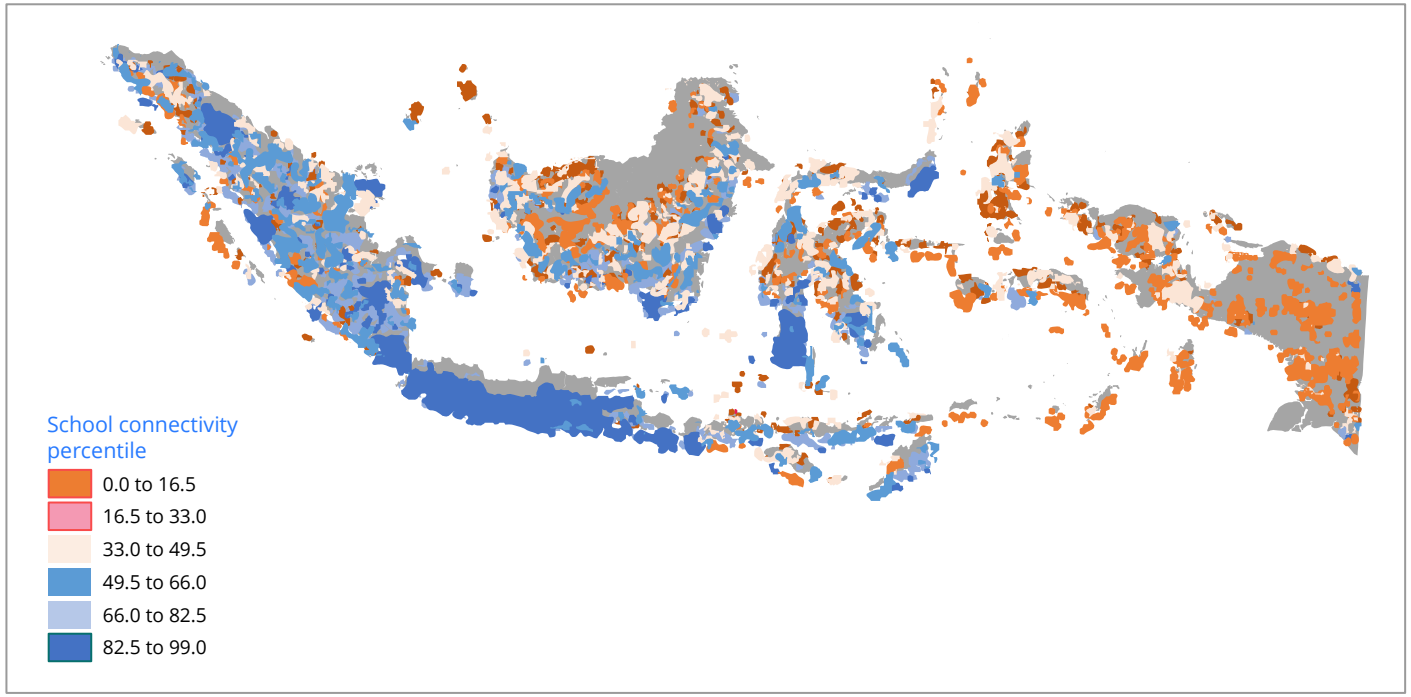
And in Java and Bali nearly all schools are within 25 km of a node, thus within easier connection reach



Source: Giga school data; BCG Analysis

Increasing the school connectivity might face major structural challenges in the sparsely populated islands

School connectivity varies between islands, it's estimated that ~19% schools across Indonesia are not connected to internet ...



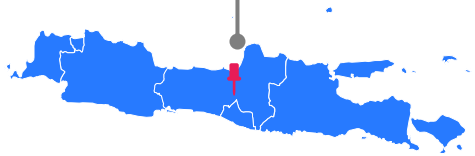
MECRT– Ministry of Education, Culture, Research and Technology
Schools - Include primary, secondary and high school
Source: Unicef, Press search, BCG Analysis

... while no connectivity is more intense in the sparsely populated islands ...

- According to MECRT, there are ~42,000 or 19% schools across Indonesia that are not connected to internet
- 70% of these unconnected schools covered by a base transceiver station, while the 12,600 (30%) schools are not, which means the schools are completely removed from connectivity
- The unconnected school proportion is much higher in the sparsely populated islands, like Papua where it has the lowest population density, the Ministry estimates 71% of schools in Papua are not connected to the internet
- Moreover, in the sparsely populated islands, where overall connectivity coverage is low, schools have more structural challenges to connect and higher cost to serve

Example | Inside Java, the most connected island, connectivity gap still exist in rural areas, with limited device available to connect

Kenalan village, Central Java

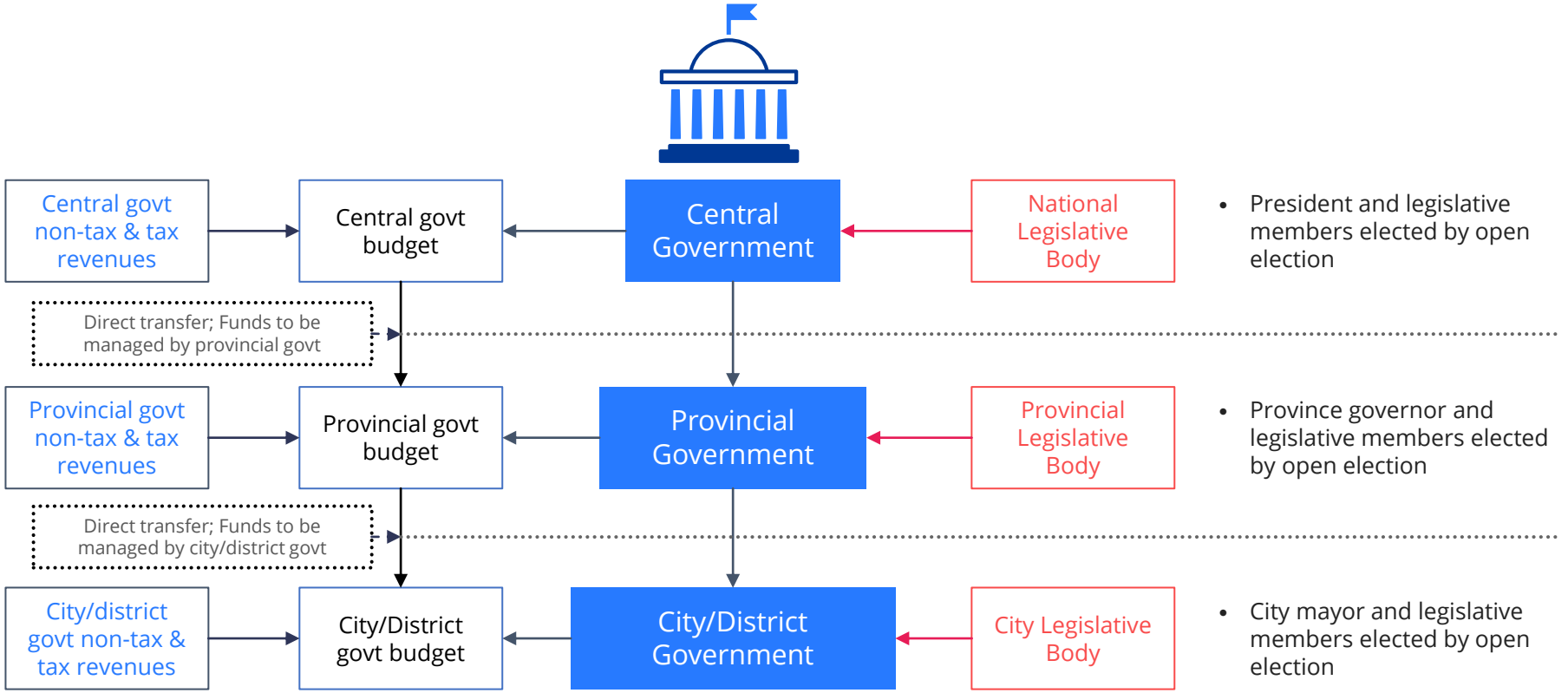


Students check for school assignments on a smartphone, studying from home with limited devices available ...

... while some students study from the side of a road in Kenalan village, due to weak signals at home

Source: Press news, BCG Analysis

The multilayer administration structure with its own autonomy might bring more complexity for project coordination and funding set up



- Since the early 2000s, Indonesia has implemented a decentralization policy by giving regional govt more power in determining the uses of budget and agenda
- However, the administration and fiscal viability of decentralized governance are restricted by its social capacity, resource base, investment and infrastructure
- More autonomy also brings more complexity to align the strategic national agenda and its implementation
- Minister of Education stated that, only 15% of IDR ~550 Tn education budget is managed under the ministry, while the rest is managed by local government and other ministry

Central govt non-tax and tax revenues – VAT, income tax, luxury tax, share profits from SOE, oil & gas, etc.
Provincial govt non-tax and tax revenues – Vehicle tax, fuel tax, share profits from regionally-owned ENT., etc.
City/district govt non-tax and tax revenue – Hotel, restaurant, entertainment taxes, other retribution, etc.

Source: Ministry of Finance, Press search, BCG Analysis

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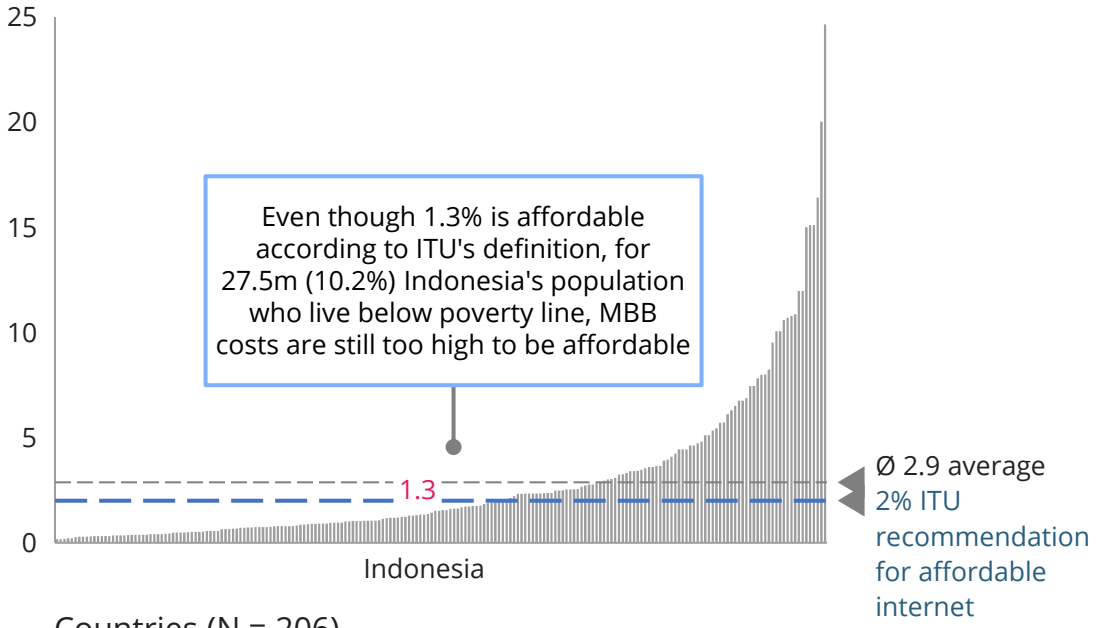
Costs of a mobile broadband data basket are below affordable level, yet income spent on fixed broadband is still considerably high

1.3% of GNIpc spent on 1.5 GB mobile broadband data basket, which is below ITU recommendation for affordable internet …

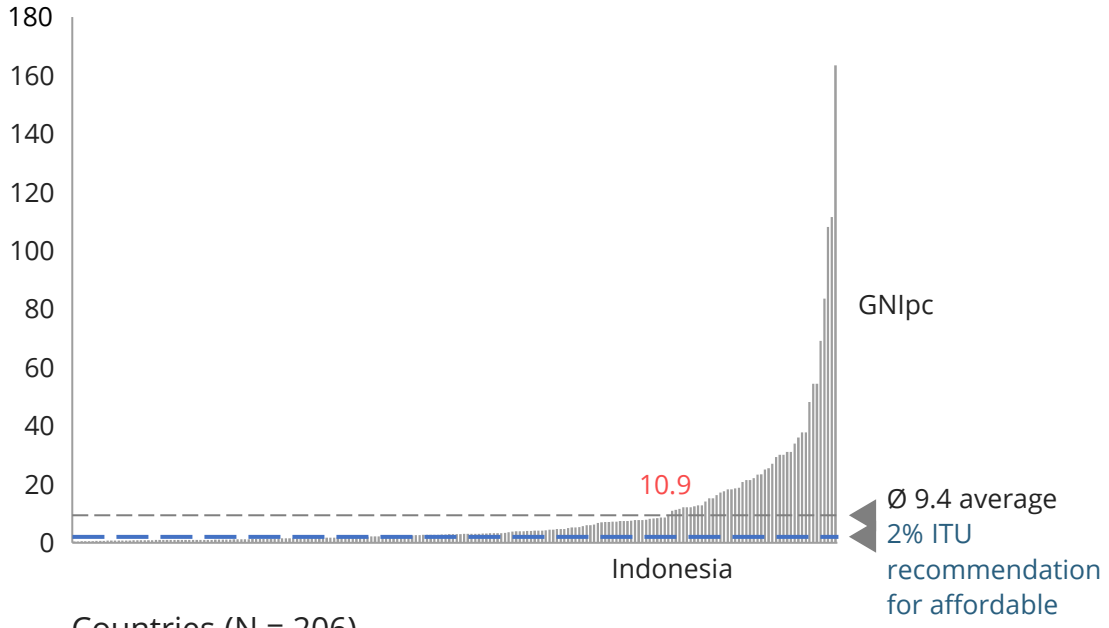
Spent on data-only mobile-broadband (1.5GB) as % of gross national income per capita-2020



Countries (N = 206)

… on the other hand, fixed broadband costs are still considerably high, with 10.9% of GNIpc spent on a 5 GB FBB data basket

Spent on fixed broadband (5GB) as % of gross national income per capita-2020



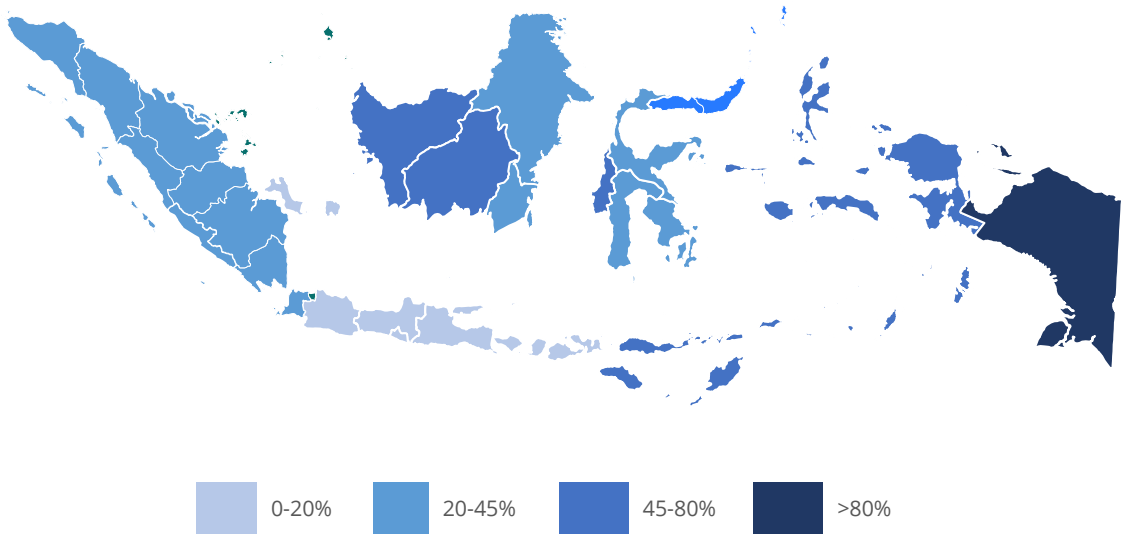
Countries (N = 206)

Source: : ITU, BCG analysis

Many districts still have weak or no mobile broadband signal, while fixed broadband penetration is considerably low at 0% for some provinces

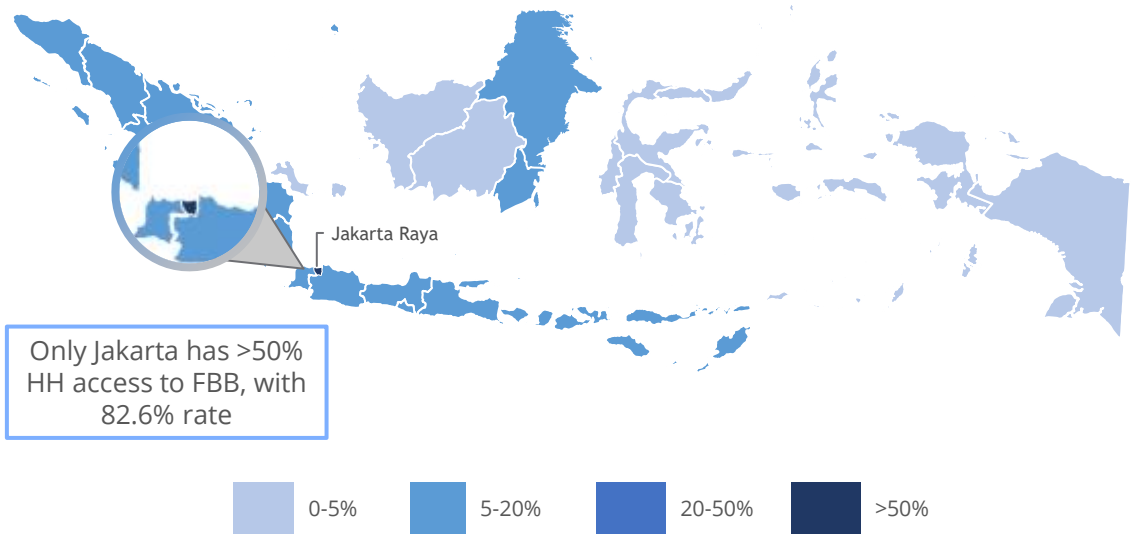
Despite mobile broadband costs being below affordable level, many districts still have weak or no signals …

Villages with weak or no signal (%)



… while fixed broadband penetration only reaches 15% of HH, with 13 provinces having a 0% rate

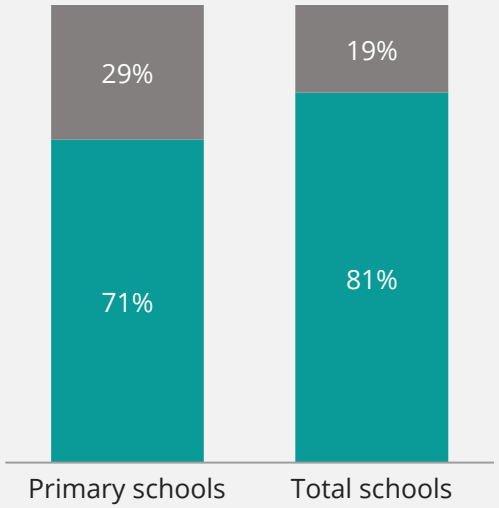
Fixed broadband access to total households (%)



Source: Statistics Indonesia, BCG Analysis

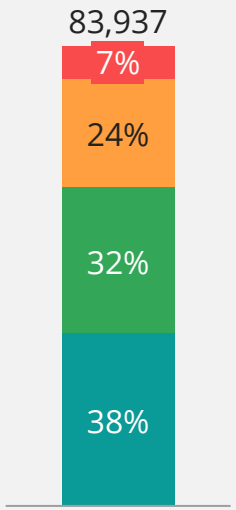
Solutions are required to improve coverage quality to reach better (school) connectivity

29% primary schools remain without internet ...



... and 56% of Indonesian districts still receiving low quality networks ...

The mobile internet coverage by no. of districts



Connectivity access	Needs
Coverage Gap No signal	• Fund internet coverage
Investment Gap Weak signals on all network	• Upgrade network quality
Investment Gap Strong signal on 2G/3G	• Upgrade to allow for meaningful connectivity
Connected Strong signals on 4G	• Fuel the digital economy

... showing we need a clear focus on 2 topics

Fund internet coverage

Upgrade network quality and connectivity

Note: Strong signals split 4G/3G/2G using BTS types proportion from the top 3 telco operators; Telkom, XL, Indosat
Source: Statistics Indonesia, Company Data, MECRT, BCG Analysis

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Overview of telco landscape in Indonesia

Characteristics	Description
Current status of fiber and 4G, WISP, and of satellite coverage in country	• Despite the high penetration of mobile services in Indonesia, there is still a connectivity gap between sparsely populated island and densely populated island in Indonesia, mainly outside Java • In 2019, Statistics Indonesia reports that only 41.8% out of ~84,000 districts in Indonesia have BTSs, and ~30% of districts in Indonesia having weak/no signal • Significant improvement in connectivity has been shown in the last 3 years after the Indonesian government initiated the Palapa Ring project under national strategic agenda in 2016. The goal was to lay 36,000 km of fibre optic cable connecting from the west to the east part of Indonesia to provide high-speed internet • The number of fixed broadband connections remains relatively low, with penetration only ~18% of households. The country's geography, consisting of 17,000 islands, is an obstacle for operators' deployments that have focused on fiber • The regulator launched different initiatives to improve the capacity and reach of fixed-broadband services. The five-year plan, publicized in 2019, aimed at providing a 20 Mbps service to 30% of the population, including 71% of urban households
Competitive landscape	• Indonesian telecommunication sector has been increasingly competitive after the removal of monopoly regimes in the early 2000s and increase of the 49% foreign ownership cap to 95% • Currently there are 5 major players in mobile services, with Telkom as market leader covering almost 50% of total ~355m mobile subscription in 2020 • In fixed broadband, where there is even lower penetration, market share concentration is more pronounced with Indihome (part of Telkom) accounting ~85% of total ~ 11.8m fixed broadband subscriptions in 2020
Spectrum auction for 5G won by 2 players	• 3 blocks of 2.3GHz frequency auction that will be used for 5G networks has been conducted this year and won by 2 telco player, Telkomsel (2 blocks) and Smartfren (1 block) • The 2.3GHz frequency auction was divided into three blocks in the range 2360-2390 MHz with a capacity width of 10MHz each

Source: Press search, Kominfo, BCG Analysis

Overview of major upcoming changes in telco landscape and resulting school connectivity expected

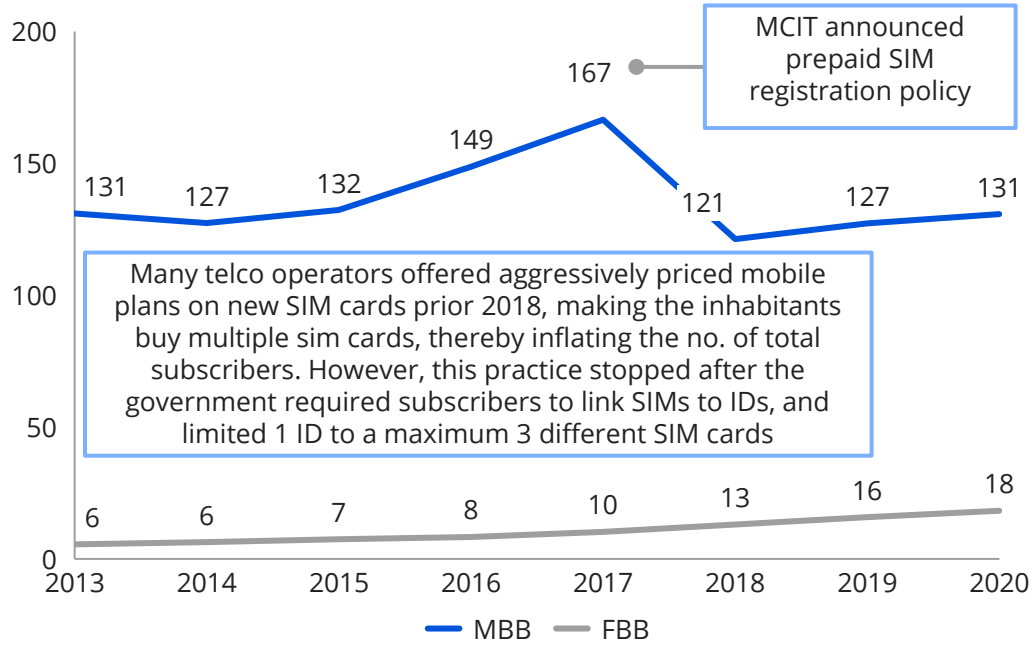
Major changes	Description
Joint Service Operation (JSO) to provide 4G mobile services in remote areas	• In June 2021, the Telecommunication and Information Accessibility Agency (BAKTI KemKominfo) opened a joint service operation (JSO) for telco operators to participate in providing 4G mobile services in remote/underdeveloped regions across Indonesia, to alleviate some of the financial burdens. • Under this JSO, BAKTI will be responsible to provide base transceiver station (BTS) and other supporting infrastructure including the land site for the BTS that can be used by telecom providers to provide 4G cellular services. • This arrangement will incentivize telco operators to penetrate the low economic scale regions with lower capex. As a result, there will be wider network coverage to the regions and more schools will be connected
IDR 17 Tn of 2021 state budget to improve internet connectivity	• Ministry of Finance Indonesia stated that Indonesian government allocates IDR 17 Tn ($ 1.2 Bn) of 2021 state budget to improve connectivity across Indonesia mainly for ~9,000 remote / underdeveloped villages • This budget is a part of government 5 year agenda to improve Indonesia's connectivity inclusion especially in Indonesia's outermost, frontier, and underdeveloped areas (3T) • Together with improving the connectivity, it will allow more equalization of internet access to schools and the community
Next frequency auction to increase available spectrum for 5G	• Another frequency auction to be set in 2022 for mmWave (26 – 28 GHz) and 700 MHz after the expiry from the current band usage in TV services • KemKominfo also plans to offer 3.3 GHz and 3.5 GHz in 2023, and possibly 2.6 GHz in 2025 • These additional frequencies will help telco providers roll out 5G services as currently there is limited spectrum for it
2020 Omnibus Law to increase telco sector efficiency	• The Omnibus Law allows telecommunications operators to share and transfer spectrum with prior approval from the central government. This flexibility could potentially pave the way for mobile industry consolidation • Sharing passive infrastructure with other telecommunications operators became mandatory under the new law. This potentially will allow smaller players in the industry to expand networks at slightly lower capex

Source: Press search, Kominfo, BCG Analysis

Penetration levels of fixed broadband has room for improvement, whilst increasing uptake in fixed broadband subscribers

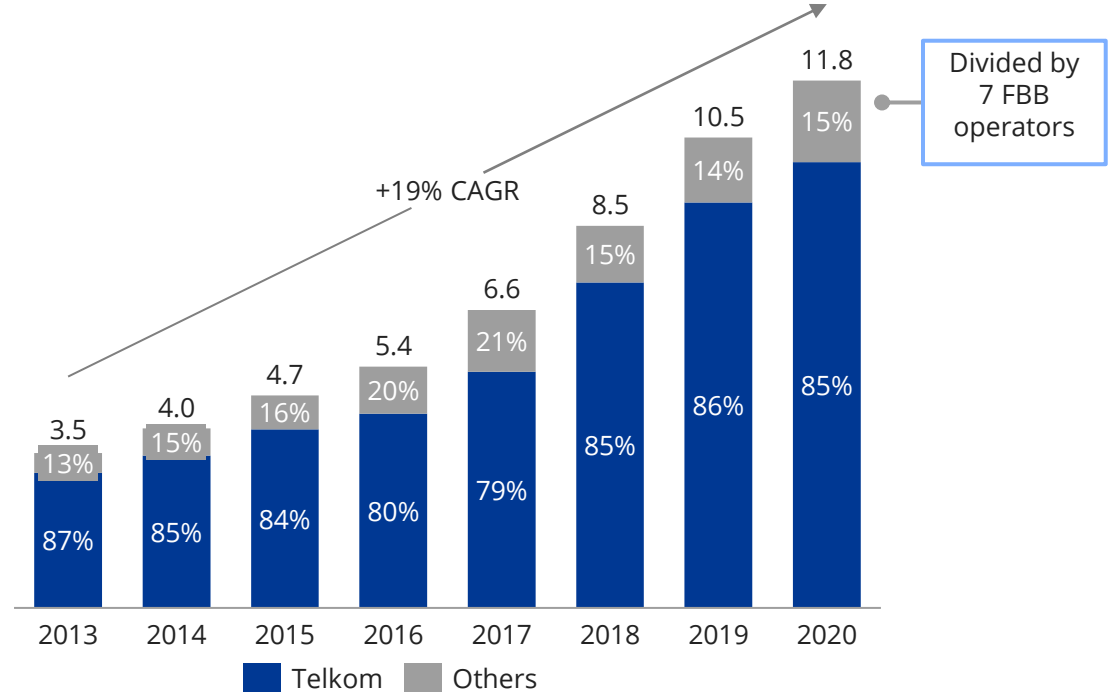
Mobile broadband (MBB) declined post identity registration requirement; fixed broadband (FBB) needs wider infrastructure deployment

Mobile broadband penetration to population (%) and Fixed broadband penetration to households (%)



Increasing fixed broadband subscribers driven by the rollout of infrastructure by Telkom, which currently has ~85% FBB market share

Fixed broadband subscriptions (in m)

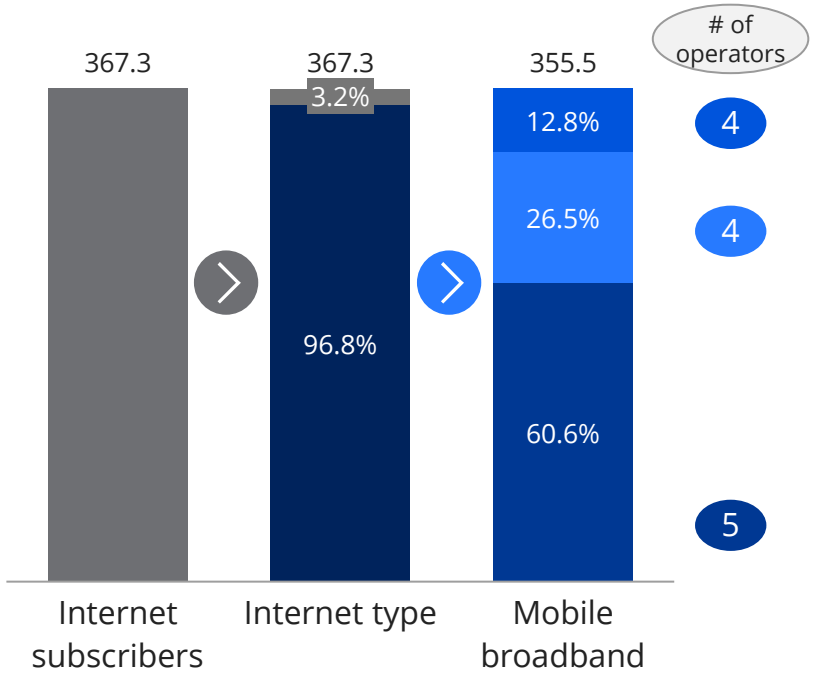


Source: Omdia, BCG analysis

60% mobile broadband subscribers have access to 4G, with three telco players controlling 80% of market share

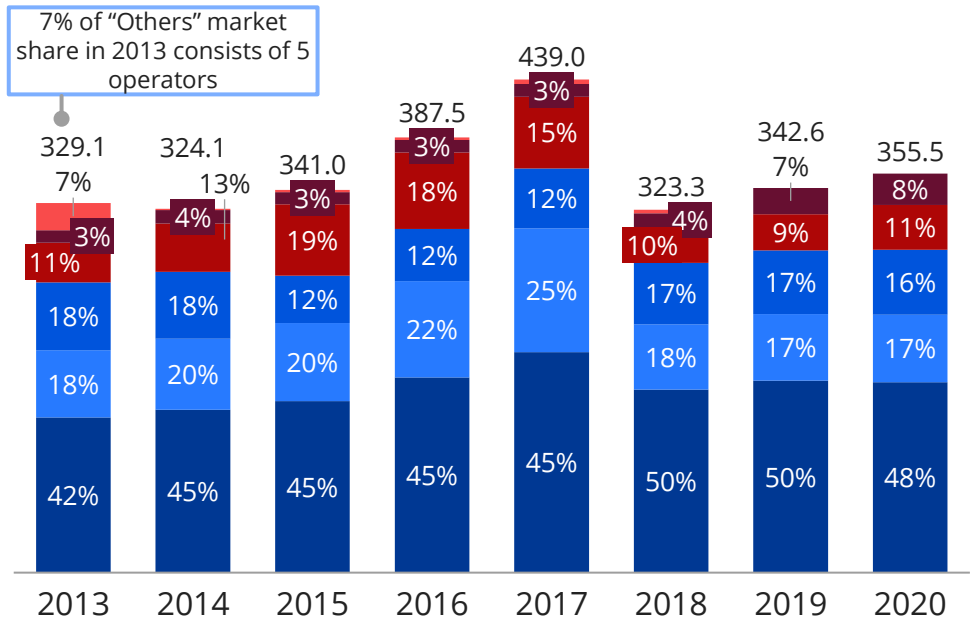
~97% internet subscription using mobile broadband, while nearly ~40% MBB subscribers still cannot access 4G

2020 internet subscribers (in m)



Telco industry has consolidated from ten operators in 2013 to five operators in 2020

Mobile broadband subscriptions (in m), split by market share (%)



- Mobile subscriptions declined in 2018 after the government imposed the requirement that prepaid SIM card users need to register their SIM with their national identity
- Telco industry has undergone consolidation process in the last ten years; from ten operators to now five key players, with three players controlling ~80% of market share

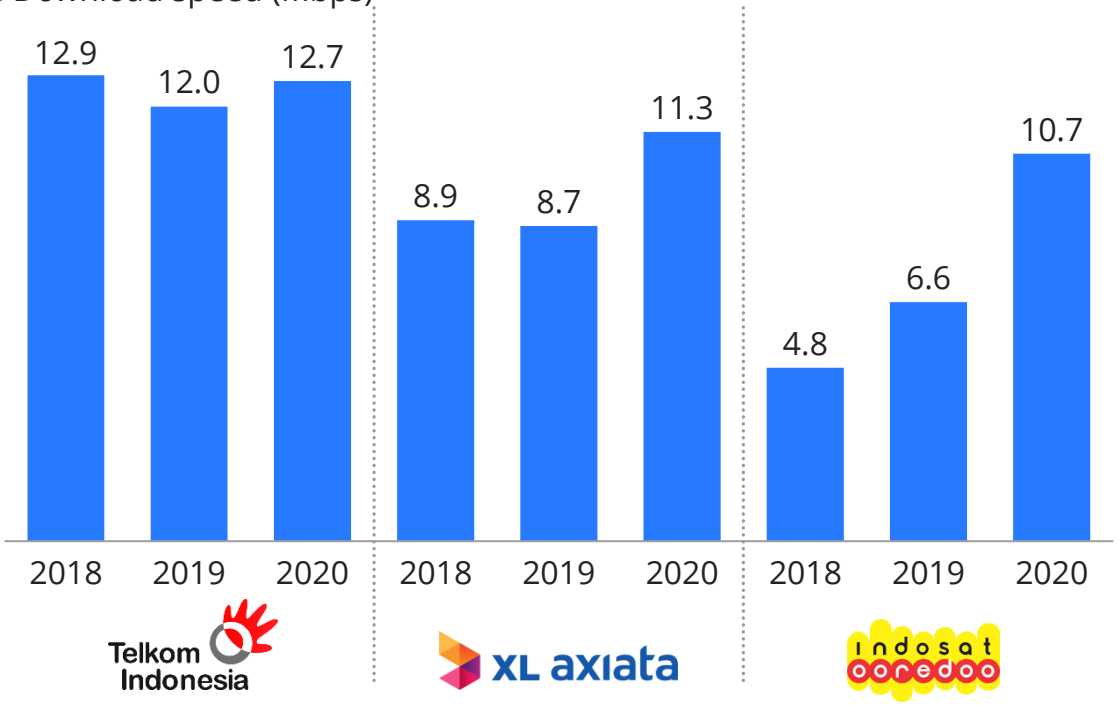
Fixed broadband | Mobile broadband | 2G | 3G | 4G | Telkom | Indosat | XL Axiata | 3 Indonesia | Smartfren | Others

Source: Omdia, BCG analysis

Significant difference in 4G download speeds observed across operators despite similar 4G availability

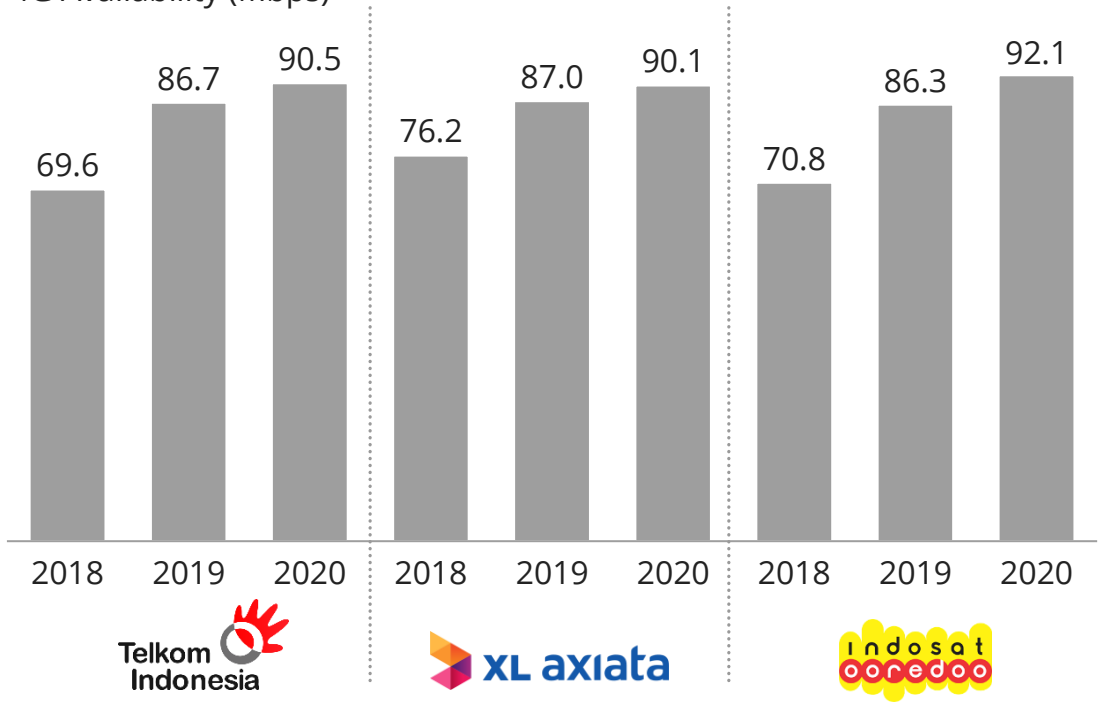
Smaller players continue increasing their network quality to compete with the market leader …

4G Download speed (Mbps)



… While increasing the availability of 4G over time

4G Availability (Mbps)



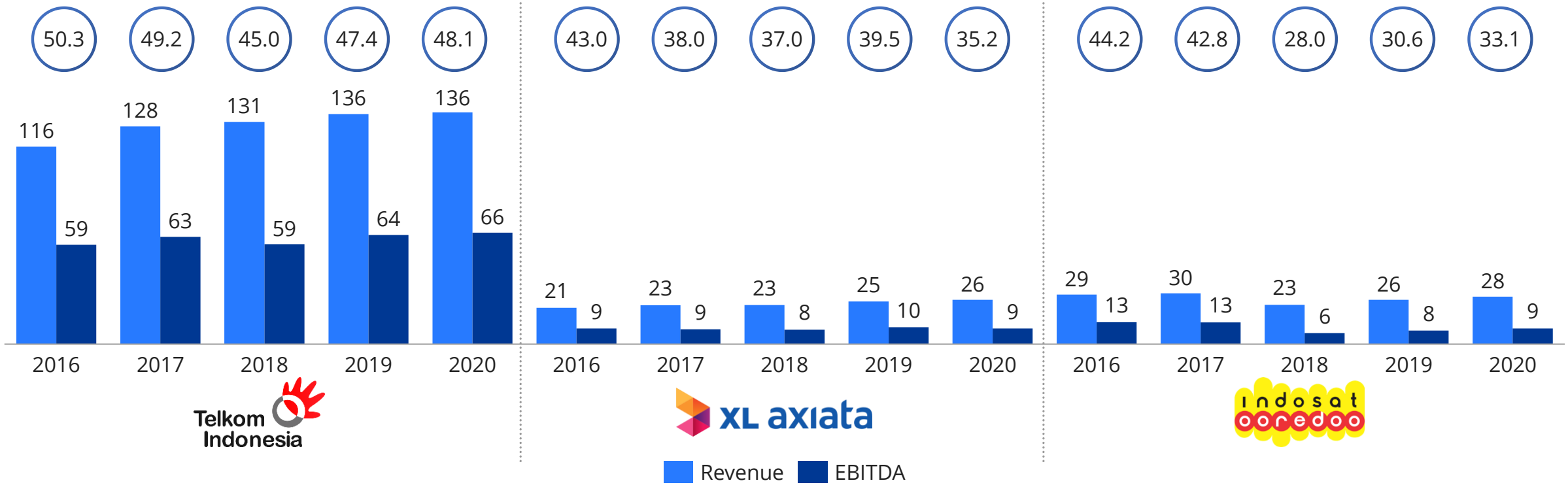
4G Download speed – This metric shows the average download speed for each operator on LTE connections as measured by users
4G Availability – The proportion of time users have an LTE connection available to them on each operator's network. It's measure of how often users can access the 4G network

Source: Open Signal, BCG Analysis

Telkom leads in terms of size and as a result of its scale advantage manages to have higher profitability levels

Telkom leads by controlling the largest market share both in MBB and FBB, followed by Indosat and XL whose revenues are mainly driven by mobile broadband services; Telkom managed the scale, yielding higher EBITDA margin compared to peers

Revenue and EBITDA (IDR Bn), EBITDA margin (%)

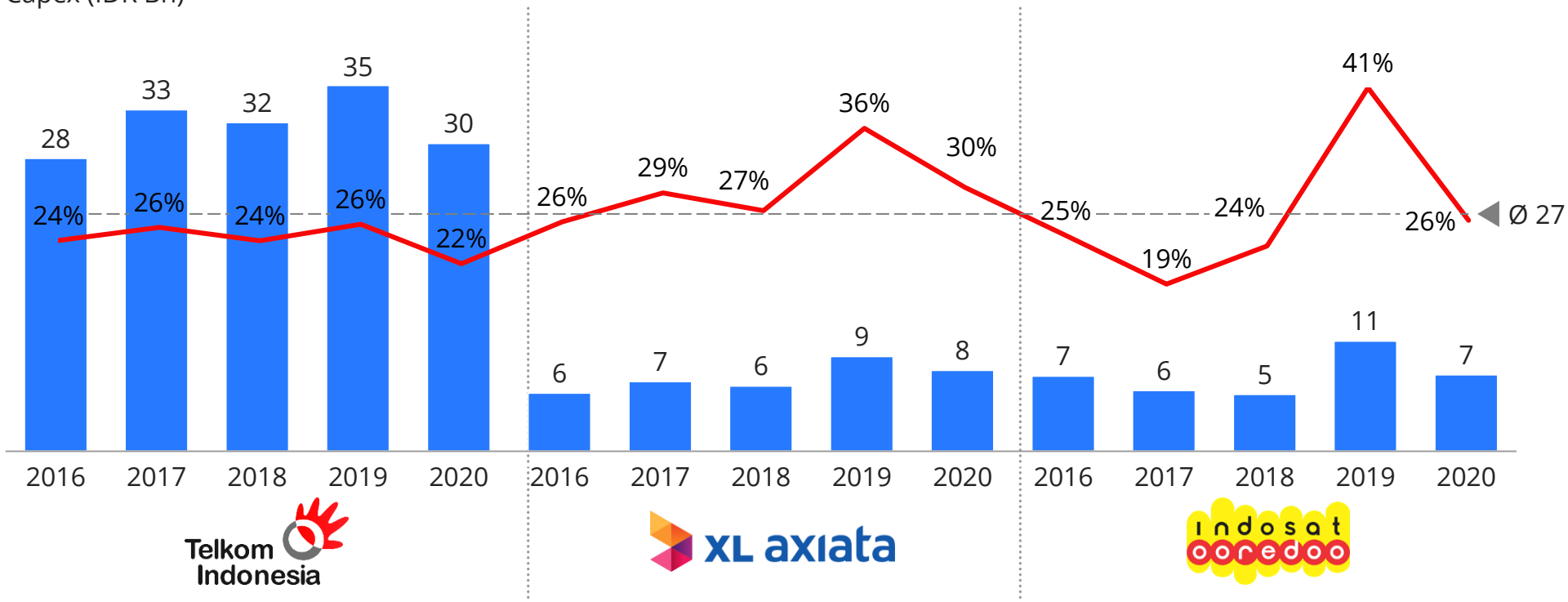


Source: Company Data, BCG Analysis

Telkom capex has remained constant, with smaller players investing slightly more to expand their 4G network

Telco players aggressively increased their capex in 2019 to expand 4G base stations nationwide; Capex/revenue intensity higher in the smaller players as they are trying to increase network coverage & quality

Capex (IDR Bn)



- XL and Indosat to continue 4G network expansion, especially outside Java and increase the network quality
- While Telkom has an established mobile network outside Java already, its CapEx remain constant to expand its fixed broadband network
- Passive infrastructure sharing requirement in new Omnibus Law provides long-term positive for the industry capex efficiency

Source: Company Data, BCG Analysis

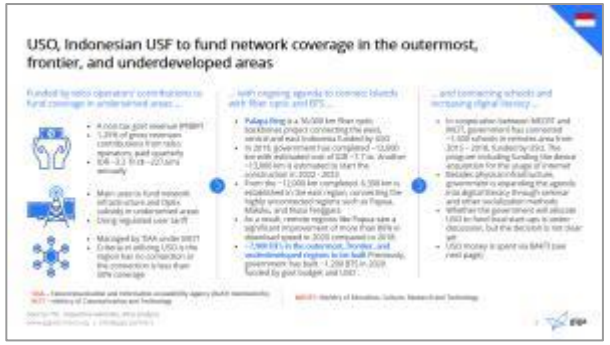
Several interesting partners exist in Indonesia to reach school connectivity, either in terms of funding potential, or in terms of operating model

IdREN

A dedicated network infrastructure that connects research and dedication institutions, IdREN could be an operational partner for connecting schools

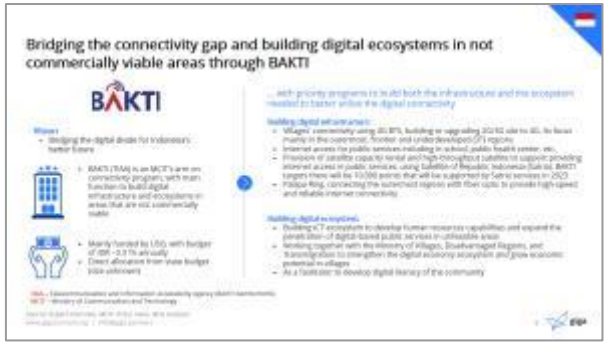
Universal Service Obligation Fund

Indonesian USF to fund network coverage in the outermost, frontier, and under-developed areas. USO is likely to be the main source of fund to help govt co-invest alongside service providers in remote areas



BAKTI

A MCIT's arm to bring digital infrastructure and ecosystems in areas that are not commercially viable, BAKTI is a good candidate to work with as operational partner for connecting school

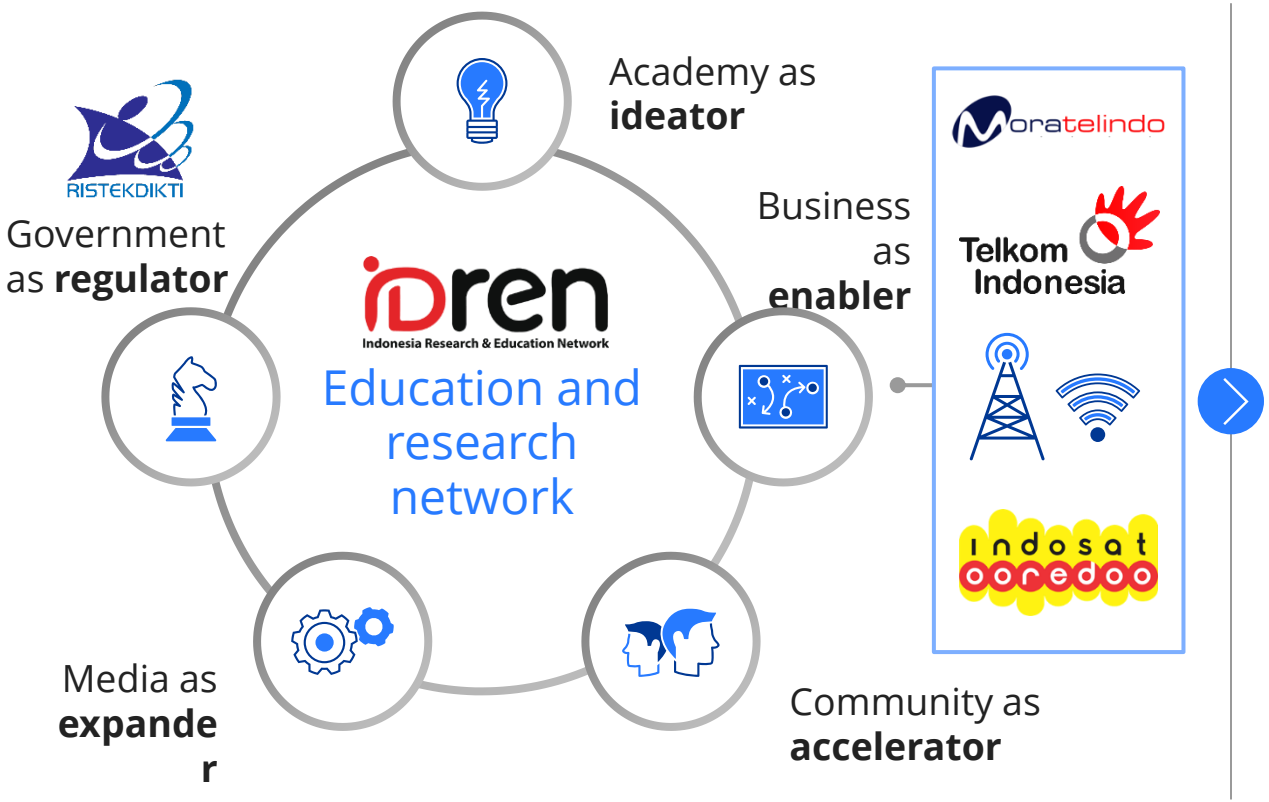


Deep-dives on next pages

Note: BAKTI is the sole government agency that manages the USO. There is however a case in which the ministry of education could indirectly get support from the USO fund (for connecting schools). BAKTI is working with the MoE to connect schools using the USO fund. Therefore, contacting only BAKTI is the most logical route. However, as theoretically another option does exist, both have been highlighted here

IdREN brings better connectivity for education and research, providing potential operating model for wider coverage

IdREN initiated close collaboration between stakeholders for better connectivity in education and research …



… and provides potential operating model to reach wider coverage into primary and secondary schools across country …

- Founded in 2017, IdREN is a dedicated network infrastructure that connects research and education institutions and community in Indonesia through national closed network that could bring faster and more reliable connectivity
- In this collaboration, telco providers help to provide network and communication services, colocation data center, and network backbone interconnected with Global Research & Education Network
- Although this infrastructure still limited to universities and research institutions, it provides potential operating model to connect basic education like primary/secondary schools. There is also no indication that IdREN would not be open to it, therefore it has a potential to open for discussions
- Working together with IdREN in connecting schools would allow for:
  - Reliable connectivity, through national closed network that currently in place
  - Access to funding & expertise, as IdREN has connected many institutions across country together with its partners from telco industry

Source: IdREN, Press Search, BCG analysis

USO, Indonesian USF to fund network coverage in the outermost, frontier, and underdeveloped areas

Funded by telco operators' contributions to fund coverage in underserved areas …

- A non-tax govt revenue (PNBP)
- 1.25% of gross revenues contributions from telco operators, paid quarterly
- IDR ~3.3 Tn ($ ~227,6m) annually

- Main uses to fund network infrastructure and OpEx subsidy in underserved areas
- Using regulated user tariff

- Managed by TIAA under MCIT
- Criteria in utilizing USO is the region has no connection or the connection is less than 50% coverage

… with ongoing agenda to connect islands with fiber optic and BTS …

- **Palapa Ring** is a 36,000 km fiber optic backbones project connecting the west, central and east Indonesia funded by USO
- In 2019, government has completed ~12,000 km with estimated cost of IDR ~7.7 tn. Another ~13,000 km is estimated to start the construction in 2022 - 2023
- From the ~12,000 km completed, 6,300 km is established in the east region, connecting the highly unconnected regions such as Papua, Maluku, and Nusa Tenggara
- As a result, remote regions like Papua saw a significant improvement of more than 80% in download speed in 2020 compared to 2018.
- **~7,900 BTS in the outermost, frontier, and underdeveloped regions to be built** Previously, government has built ~ 1,200 BTS in 2020 funded by govt budget and USO

… and connecting schools and increasing digital literacy …

- In cooperation between MECRT and MCIT, government has connected ~1,500 schools in remotes area from 2015 – 2018, funded by USO. The program including funding the device acquisition for the usage of internet
- Besides physical infrastructure, government is expanding the agenda into digital literacy through seminar and other socialization methods
- Whether the government will allocate USO to fund local start-ups is under discussion, but the decision is not clear yet
- USO money is spent via BAKTI (see next page)

TIAA – Telecommunication and Information Accessibility Agency (BAKTI KemKominfo)
MCIT – Ministry of Communication and Technology

MECRT– Ministry of Education, Culture, Research and Technology

Source: ITU, respective websites, BCG analysis

Bridging the connectivity gap and building digital ecosystems in not commercially viable areas through BAKTI

Vision

- Bridging the digital divide for Indonesia's better future

- BAKTI (TIAA) is an MCIT's arm on connectivity program, with main function to build digital infrastructure and ecosystems in areas that are not commercially viable

- Mainly funded by USO, with budget of IDR ~3.3 Tn annually
- Direct allocation from state budget (size unknown)

… with priority programs to build both the infrastructure and the ecosystem needed to better utilize the digital connectivity

Building digital infrastructure:

- Villages' connectivity using 4G BTS, building or upgrading 2G/3G site to 4G. Its focus mainly in the outermost, frontier and underdeveloped (3T) regions
- Internet access for public services including in school, public health center, etc.
- Provision of satellite capacity rental and high-throughput satellite to support providing internet access in public services, using Satellite of Republic Indonesia (Satria). BAKTI targets there will be 10,000 points that will be supported by Satria services in 2023
- Palapa Ring, connecting the outermost regions with fiber optic to provide high-speed and reliable internet connectivity

Building digital ecosystem:

- Building ICT ecosystem to develop human resources capabilities and expand the penetration of digital-based public services in unfeasible areas
- Working together with the Ministry of Villages, Disadvantaged Regions, and Transmigration to strengthen the digital economy ecosystem and grow economic potential in villages
- As a facilitator to develop digital literacy of the community

TIAA – Telecommunication and Information Accessibility Agency (BAKTI KemKominfo)
MCIT – Ministry of Communication and Technology

Source: Expert interview, MCIT, Press news, BCG Analysis

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The key issue to be resolved in Indonesia, besides funding, is regional differences

Extreme regional differences exist between islands in Indonesia that lead to large discrepancies in educational standards between regions

While mobile broadband costs in GNI per capita is below the 2% recommendation, taking into consideration the regional differences, being online is unaffordable for many on the poorer islands because income levels are lower

These differences lead to the regions being less attractive to commercial parties, which exacerbates the problem. Low-hanging fruit, or the projects that have slightly positive NPV, have already been invested in, leaving only the areas with the worst prospects

Besides the relatively high costs in poor regions, digital literacy is likely to be low because of low connectivity, meaning that demand would for connectivity would be low even if coverage was expanded by telco operators. Thus, telco operators are again less likely to invest in these regions, as revenues will be low

For example, after the completion of the Palapa ring near Papua, the least densely populated island of Indonesia, mobile operators were still reluctant to broach the island because of low commercial viability

Innovative funding models will help address these regional differences, but in order to become fully sustainable in the long run, these issues need addressing

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Digitalization and school connectivity being top of mind of Indonesia leaders …

> I hope that the 2021 Digital Connectivity program will become an important momentum that can connect Indonesian people with new technologies, new mindsets, new global business opportunities, and a new future towards advanced Indonesia..
>
> Joko Widodo, (current) President of Indonesia
> Launching of 2021 Digital Connectivity program
> February 2021

> Those (in the outermost, frontier and undeveloped regions) who really need equal distribution of internet access (in schools) like we have in the cities. This equalization continues to be pursued by the government..
>
> Nadiem Makarim, (current) Minister of Education, Culture, Research, and Technology
> Bringing digitalization to schools
> February 2021

- Under his administration, Indonesia's President Joko Widodo, has launched several initiatives in bringing new era of digital disruption to citizens
- One of the main agenda points is bringing digital inclusive revolution, with three principles of access, affordability, and ability
- He emphasizes the importance of equal distribution for connectivity especially on the outermost, frontier, and underdeveloped regions
- By entering his second (last) period, the upcoming election in 2024 would again determine whether this strategic agenda still in place with the new elected leader

Source: Press news, BCG Analysis

… However, school connectivity gaps remain, especially in islands with lower population density, thereby requiring different funding solutions per region

Well-developed islands of Java & Sumatra with high population density that are generally easier to connect or have already been connected

Less developed islands of Kalimantan, Sulawesi, Nusa Tenggara & Papua with low population density and that are harder to connect

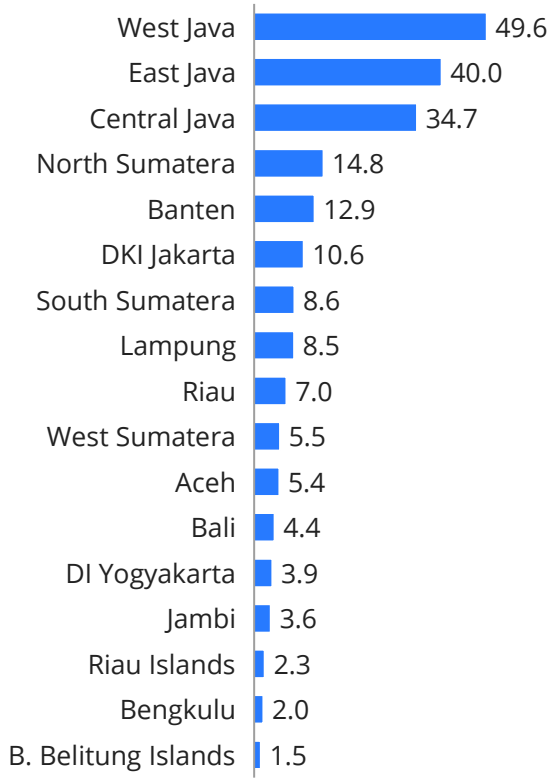
Regional focus: Java, Bali & Sumatra

Well-developed islands with good connectivity for general population and higher school connectivity levels

Most of schools are connected already, despite Sumatra still needing more equalization of internet access

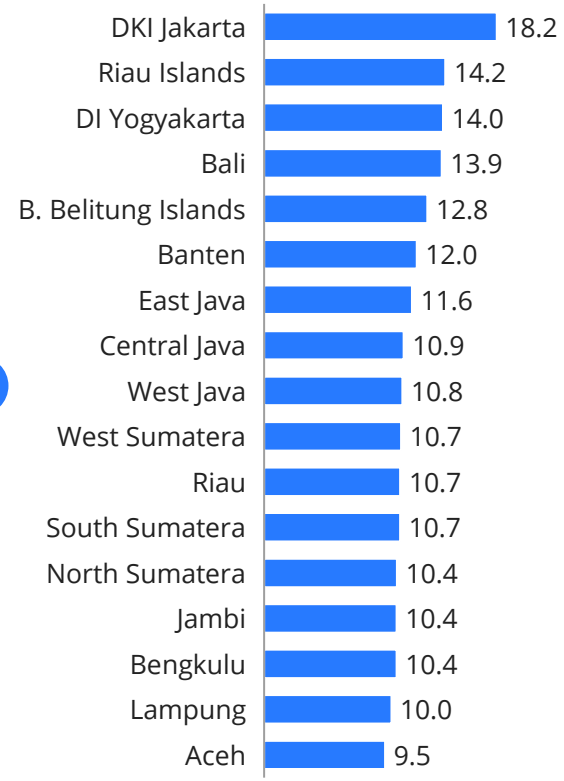
High concentration of population in Java ...

Population (m)



... and high variability in economic set up ...

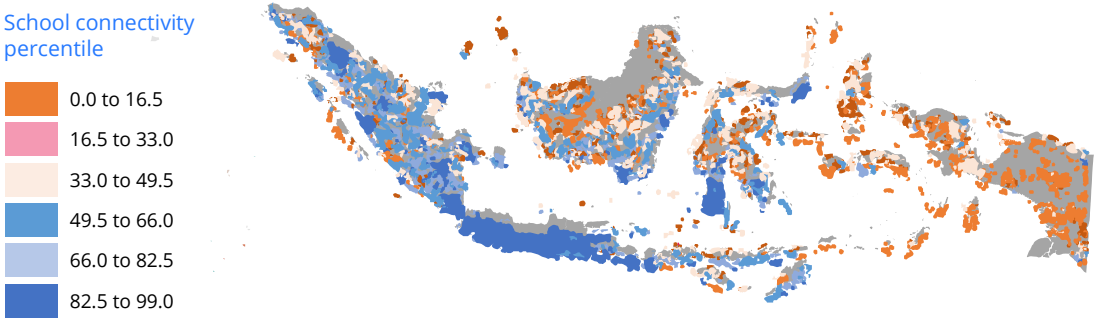
Spending per capita (IDR thousands)



... and more schools are connected, although connectivity gap still exist in Sumatra

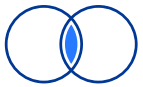
Schools per region map

School connectivity map



Source: Statistics Indonesia, Uniced, BCG Analysis

For the well-developed regions, we believe four funding methods would be especially suitable to reach 100% school connectivity of a meaningful standard

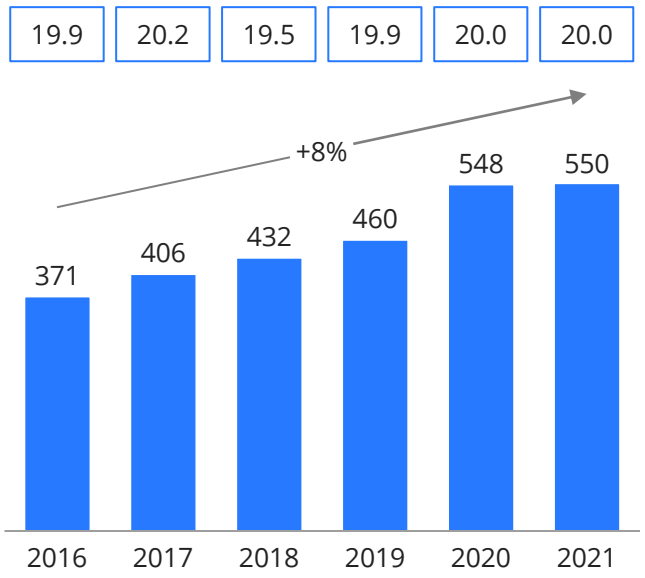
Funding method		Reason for suitability
 Demand-side subsidy	Overlaps with region 1	• Suitable because: Government of Indonesia has shown high willingness to work with service providers to connect unconnected regions. In addition, government has shown willingness to invest in education • Reason for concern: Government funding on education already very high vis-à-vis neighboring countries. Therefore, sustainability of solution in long-term likely not high. A combination of money from different, relevant ministries could work, so long as the total amount funded is a small increase
 Prerequisite in upcoming 5G spectrum auction		• Suitable because: Commercial sector is most efficient in rolling-out connectivity • Reason for concern: Commercial parties may have misaligned interests and provide lower quality service vs. intended government/project outcomes. In addition, making school connectivity for all of Indonesia a prerequisite may lead to undesired responses to the RFP. Therefore, we would suggest to only include slightly negative, break-even, and positive cases, but exclude those that are too hard-to-connect
 Build, Operate & Transfer by BAKTI		• Suitable because: BOT where BAKTI is the procuring partner setting up the networks. Right to operate is licensed through an auction, which then includes a mandate subsidization of school connectivity. • Reason for concern: Same as for '5G spectrum auction'
 Revenue-sharing		• Suitable because: Private individuals are currently setting up their own networks that cover about 20 households. As this is technically illegal, a formal version of this is a revenue-sharing model where local businesses set up their own network by connecting to the main operators. These entrepreneurs are more flexible than operators, thus can cover areas where it is unviable for large players. • Reason for concern: Licensing and upfront CapEx needs to remain affordable and not too complicated for local businesses.

Note: USO funding was removed from consideration for well-developed regions due to the maximum 50% coverage requirement
Source: BCG analysis

Demand-subsidy | Government's allocation to school funding is already high, making an increase from moe unlikely to be sustainable

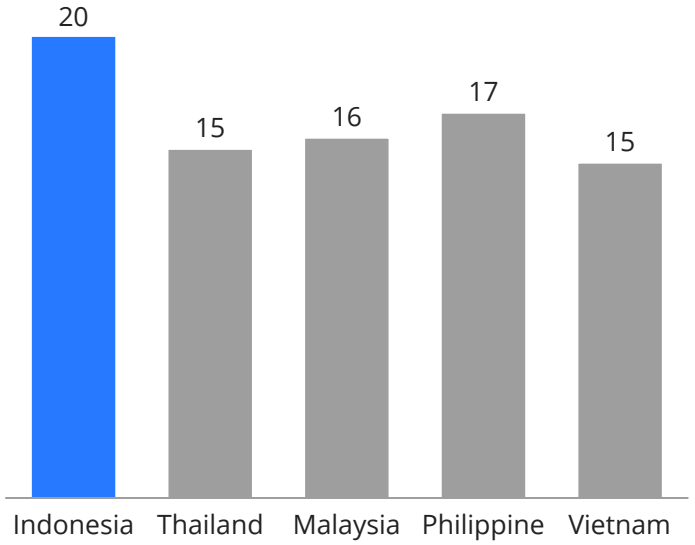
Education spending allocation has been maintained at ~20% from total spending in the last 6 years …

Government education spending (IDR Tn) and the allocation to total government spending (%)



… which is considerably higher allocation than neighbor countries …

Govt education spending allocation to total government budget (%)



… but a 1% increase can already make a large difference

- In 2021, government allocates IDR ~7.4 Tn (1.3%) to support digitalization and building connectivity infrastructure for public education services
- Only 15% of education budget is managed by MECRT, while a huge portion (54%) is directly managed by local governments (including the IDR ~7.4 Tn budget), bringing more complexity in aligning the government strategic agenda
- However, a 1% in education budget would already mean an IDR 5.5 Tn increase, which could be directly used to pay
for connectivity

MECRT– Ministry of Education, Culture, Research and Technology

Source: Ministry of Finance, Press news, BCG Analysis

Prerequisite in upcoming 5G spectrum auctions : Upcoming spectrum auctions could provide new possibilities for school connectivity in urban areas

Spectrum auctions can be used to sustainably connect schools, if regulator has enough mandate

When new spectrum auctions come up, include in the bidding process that winning party must connect a certain number of schools in certain regions

A fine system needs to be put in place to ensure that parties provide agreed service levels and maintenance

Auction revenues will likely be lower using this method, but it creates incentives to connect schools in a reliable and sustainable way – given that there is an effective regulator.

This is an urban, rather than rural solution, as 5G-enabled devices are more expensive and higher connectivity speeds are usually rolled out there first. Subsequently, funds from these auctions can be used in rural areas through cross-subsidization

Upcoming spectrum auctions in 2022 (26-28 GHz and 700 MHz), 2023 (3.3-3.5 GHz), and 2025 (2.6 GHz)

- Frequencies are suitable for 5G networks and therefore attractive for major commercial parties

Low frequency networks (e.g., 450 MHz) that are currently empty can be used for school connectivity

- Although these frequencies cannot be received by handsets, the frequency can be received by routers, which can then provide Wi-Fi connection for 20 Mbps on selected locations
- This frequency can be received from 100 km, making it ideal for remote locations and Indonesia's scattered geography.

Net1 INDONESIA

Net1 currently operates through a combination of low(450 MHz) and high (3.5 GHz) frequency networks

They collaborate with a local partner in Indonesia to provide a 4G network in remote areas (incl highlands and offshore areas)

Net1 Indonesia's network is currently available in 31 provinces, of which 70% is located in remote and rural villages. The company is planning to provide 4G LTE-450MHz network access on 14,000 islands to more than 260 million Indonesians

They offer end to end connectivity for local government units throughout the Philippines, connecting schools through a turn-key solution

Source: Net1 Annual report; BCG Analysis

Build, Operate & Transfer by BAKTI| Selling infrastructure for expanding services into underserviced areas rather than money

BAKTI has been investing in backbone infrastructure project such as the Palapa Ring

- Upon completion, the Palapa Ring project will span 36,000 km in on- and off-shore fiber optic network. BAKTI has invested in this project and MCIT owns the infrastructure
- BAKTI also built BTS, which is then also owned by MCIT[1]

[1] **MCIT** – Ministry of Communication and Technology

BAKTI can make negative NPV areas more attractive by selling infrastructure for payment in-kind

- The backbone infrastructure that is built through BAKTI often operates in underserviced areas, where large telco players have not expanded to yet due to large CapEx, Opex and lower demand.
- By offering to sell their infrastructure, BAKTI and MCIT provide these players with an opportunity to expand into these areas.
- Instead of asking monetary returns for the use of the fiber backbone of the Palapa ring, BAKTI can ask telco players to expand into negative Net Present Value (NPV) project areas and mandate school connectivity (payment in-kind). This gives telco players the opportunity to expand into areas at low CapEx and practically have a monopoly, as they are the first to service it.

Source: BAKTI, MCIT, BCG analysis

Coverage as a service - revenue sharing (I/II) | Though Indonesia is used to sharing infra, formalized revenue-sharing provides opportunity for funding

Current situation exists in which informal players provide internet to other households

In Indonesia, there are already many small informal players operating by setting up their own connectivity access point. This is not in line with legal guidelines as they do not have the proper licenses or formal permission from large operators to commercialize

> An individual can procure a stand-alone package and franchise it to 20 households or so, then they collect fees. This private procurement does not sit well with permits and regulations
>
> Sr. Advisor, ITU

Formalized revenue-sharing in cooperation with official telco companies would allow for a potential solutions

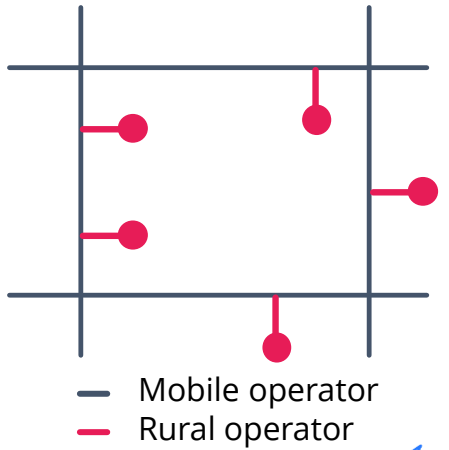
- In the formalized revenue-sharing method, the mobile operator owns backbone infrastructure but is not nimble enough to expand into rural areas or the pay-off is not large enough. They will earn a percentage of the rural operator's revenue.
- The rural operator builds on the backbone to provide last mile connectivity. They market the mobile operator's brand in their local area

For the formalized revenue-sharing model to work, certain prerequisites must be met

- Mobile operator must have backbone infrastructure on the island in question
- Mobile operator must be willing to share their infrastructure with smaller, local/regional players
- One of the following must be true:
  - Rural operator has lower CapEx than mobile operator in the rural/difficult to connect areas
  - Rural operator has lower OpEx than the mobile operator in the rural/difficult to connect areas

Subscribers, number plans, end-users remain in ownership of mobile operator; rural player owns last-mile infra

- Rural operators do not have their own spectrum, numbering plans or end users
- Mobile operators must use the assets of the rural operator in case they want to expand to these areas



Source: Expert interviews, GSMA, BCG analysis

Coverage as a service - revenue sharing (II/II) | There are many local providers that could offer school connectivity at a fair price

	Explanation of role	Financial consequences	Considered players
 Large player	• Large player provides general network, along main infrastructure and cities • Allows local player to add onto their network and provides access • Large player does not have to provide maintenance, which is a bottleneck in the current system	• In return for opening the network, large player gets a share of the revenue obtained by local player from connecting the community	• Main mobile players are Telkom Indonesia, XL Axiata, and Indosat who have 4G coverage in most urban areas • Most of the fiber is owned by Telkom Indonesia, the market leader in Indonesia.
 Local player	• Local player provides local network, connecting schools, households and other important community buildings • Can add onto general network from larger player, thereby reducing costs • Local player is responsible for maintenance and upgrades of network	• Local player obtains revenue from providing connectivity to schools and community • Local player shares part of revenue with large player in return for network use	• There are currently many (informal) local players that have a network in place but cannot compete for school connectivity because government usually offers nation-wide projects to firms
 School	• The schools and community get reliable connectivity through a player that knows local needs and restrictions • Optional: local player trains community members to provide maintenance and training to community (community collaboration model)	• Schools and community pay a fair price for connectivity • When community members provide training and maintenance, internet use will go up and maintenance cost will go down, leading to a more competitive price for connectivity	• This model would be most effective in rural areas with larger villages and relatively close to 4G/fiber nodes

Source: Expert interview with Secretary of Education; BCG analysis

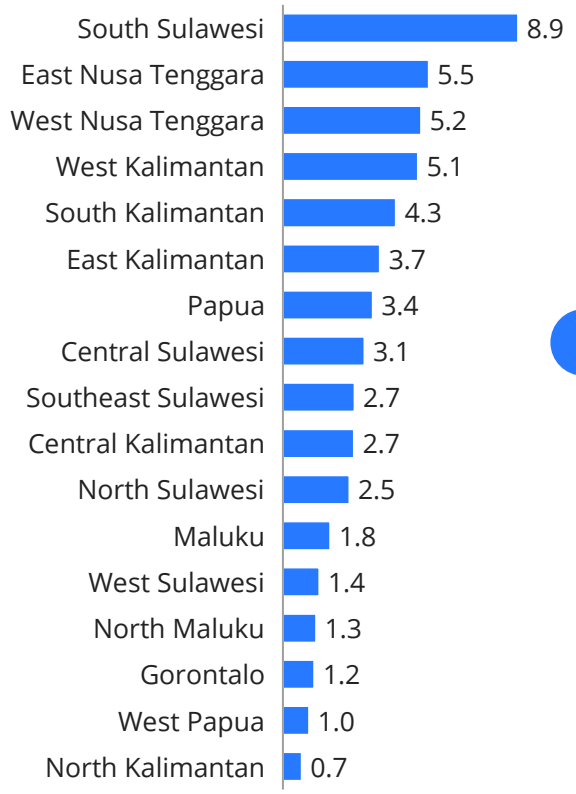
Regional focus: Kalimantan, Sulawesi, Nusa Tenggara & Papua

Less developed islands with poorer connectivity for general population and lower school connectivity levels

Majority schools have limited or no connectivity in the sparsely populated islands

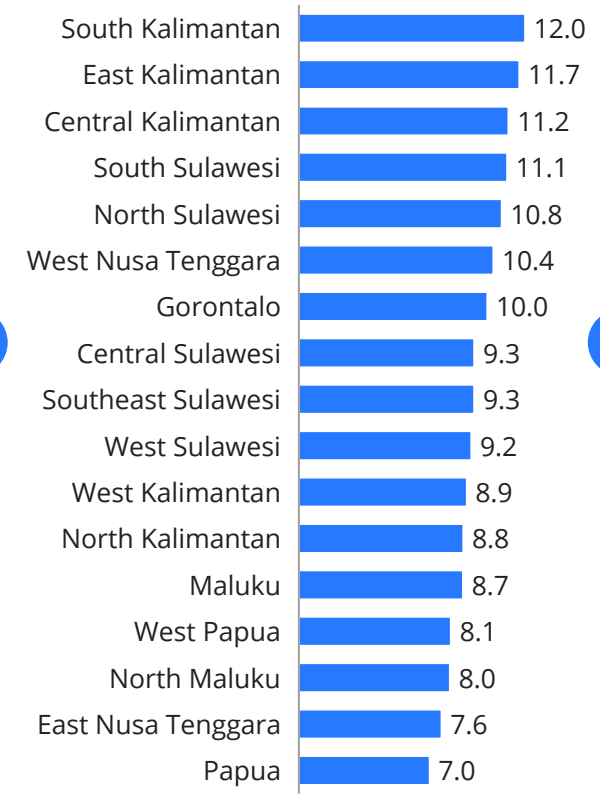
Smaller size of population across the islands ...

Population (m)



... and smaller size of economic contributions ...

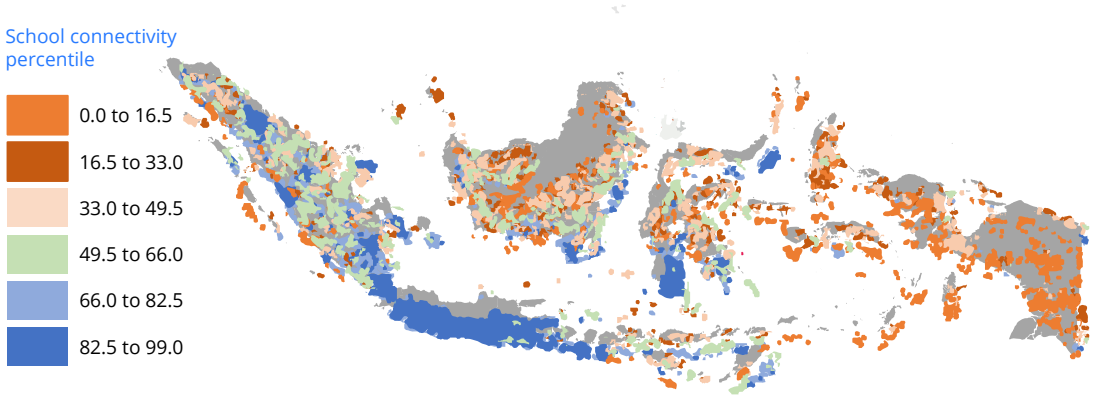
Spending per capita (IDR' thousands)



... while schools are highly unconnected, with lower schools per region due to smaller population

Schools per region map

School connectivity map



Source: Statistics Indonesia, Uniced, BCG Analysis

For the less-developed regions, we believe five funding methods would be needed in order to reach meaningful connectivity in the long-term

Funding method		Reason for suitability
 Demand-side subsidy	Overlaps with region 1	• Suitable because: Government of Indonesia has shown high willingness to work with service providers to connect unconnected regions. In addition, government has shown willingness to invest in education • Reason for concern: Government funding on education already very high vis-à-vis neighboring countries. Therefore, sustainability of solution in long-term likely not high. A combination of money from different, relevant ministries could work, so long as the total amount funded is a small increase
 USO financing		• Suitable because: BAKTI's mission, vision, and existing priorities are well-aligned with Giga's and FCDO's mission to connect schools to the internet globally. BAKTI has proven to be efficient and successful in rolling out connectivity • Reason for concern: Likely not enough funds available to cover schools in all unconnected areas, especially those that are 'hard to connect
 Regulated advertising model		• Suitable because: Using cross-subsidization, income could be generated using ad revenue from Java, Bali & Sumatra mostly. This revenue would then lead to a cost-contribution in hard-to-connect, high-cost areas • Reason for concern: A lot of ethical considerations need to be worked out (e.g., what types of ads would kids be allowed to see, how many a day, and who would approve them?)
 Community contribution		• Suitable because: Exists in two variations: the traditional type and the village model. Can help in covering the costs and leads to higher appreciation for service (large number of projects where connectivity was provided for free did not yield good results). • Reason for concern: Likely relatively little & unstable source of cost-sharing as population in many of these islands has little disposable income
 Govt co-invest alongside SPs		• Suitable because: Government has shown high willingness to connect the unconnected areas • Reason for concern: Difficult as most "low hanging fruit" has been picked already; very few positive NPV projects left, potentially even with the availability of government contribution

Source: BCG analysis

USO financing | A trustworthy USO can be leveraged as a financial mechanism

A USO can be used in three ways, the first being the traditional way and the other two as financial mechanisms

Traditional USO spending

- Current mechanism of spending the fund as income comes in.
- ✓ This function is currently being used by BAKTI

Using the fund to raise more capital

- The USO can leverage the upcoming revenue streams to move cashflows forward. Over a 5-year period, instead of raising IDR 1 tn a year, it would be able to invest 5 tn in first the year whilst paying off the investment in the subsequent year.
- ✗ To the best of our knowledge, the USO is not being leveraged as a financial mechanism yet

Using the USO as a guarantor

- The USO can act as guarantor for new investments. This would take some of the risk off the telco companies undertaking new projects.
- The service provider occurs the upfront cost and can be compensated retrospectively for unfair net costs.
- Safeguards against corruption and the misappropriation of funds, especially if the USO fixes a maximum compensation percentage in advance.
- ≈ It is probable that BAKTI has used this function for the Palapa ring

Most important prerequisite to reach that is a clear regulatory framework

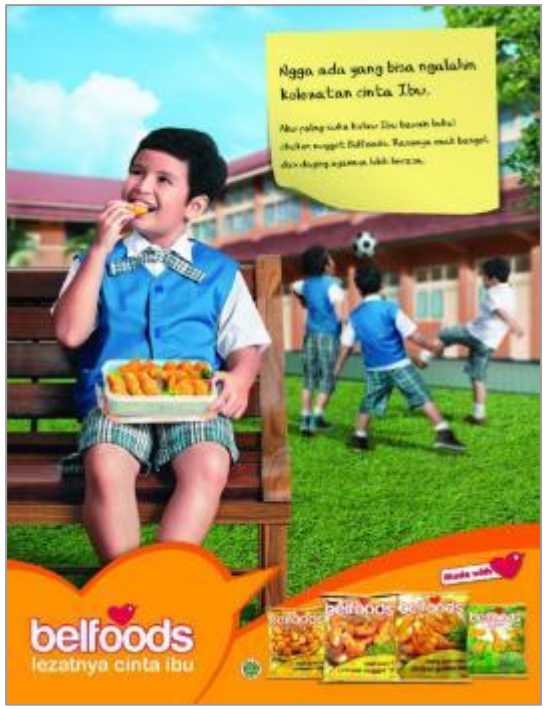
- To be able to leverage a USO as a financial mechanism, it needs to be trustworthy enough for banks and companies. This requires a clear regulatory framework.
- Thankfully, the USO has set up clear rules and criteria for its use and is under overseen by the Ministry of Communication and Technology
- BAKTI serves as an additional independent body to make sure that funds are not misappropriated.
- Larger upfront investments can be made if the Indonesian government decides to use USO as a financial mechanism.

> “There is definitely not enough government funding. BAKTI pulls from the USO, and we need to look at alternative sources of funding.
>
> — BCG expert on Indonesia

Source: Expert interview, GSMA, MCIT, Press news, BCG Analysis

Regulated advertising model | Advertisement seen as potentially viable option for funding method, however rules & guidelines surrounding ethics needed

With curated advertisements that adhere to clear standards of what can and cannot be shown …



- Currently, advertisement in school is widely used, especially on school's event like art festival or other educational activities
- The company and advertisement content should be subject to filtering by the national Ministry of Education

Commercial sponsors are widely used in school events, not only in art festival but also on educational event

… this could be a viable option as one of funding methods for school connectivity

- There is no specific government ruling[1] found on the limitation of using advertisements in school, however many schools have their own policy for it
- A maximum no. of ads per day should be agreed upon to avoid any type of decrease in the quality of education
- Cross-subsidization can fund hard-to-connect areas by using ad revenue generated in Java, Bali & Sumatra
- As there are no insurmountable upfront barriers identified, advertisement could be further investigated as a viable option as one of funding method for school connectivity
- Further research required into stance of students, parents, and teachers' community

1. Not verified by legal expert
Source: Press news, BCG Analysis

Community contribution | A community contribution model is driven by local ownership leading to lower costs

Local ownership of the community would lead to affordable, high-quality connectivity

The goal of community networks is to set up affordable, quality connectivity

In the successful example of Zenzeleni Networks (see right side), community networks work as follows:

The local community sets up and maintains the network, creating job opportunities and providing new opportunities for connectivity for individuals, schools and businesses

The technical set-up consists of a Wi-Fi internet backhaul, a Wi-Fi mesh and hotspot, and is powered by a solar panel with a backup battery. Excessive power can be used to charge phones at a cheap price

OpEx financing comes from the community. People can buy vouchers for access or set up a dedicated line at home. Additionally, there some anchor clients in the form of NGOs and local businesses who can afford to pay a fixed fee. Schools can be connected for free

The Zenzeleni Cooperative pioneered a community network in South Africa. The keys to its success are the professional Not-For-Profit (NPO) structure, job creation in the community and smart financing

Financials	2017	2018	2019	2020
Hotspots	12	35	55	75
Anchor clients	2	5	8	21
Data Usage (TB/Mth)	0.5	6.0	13.5	23.0
Net (USD)	-203	-521	758	7,184
Gross margin	0%	-8%	21%	51%

1. Excluding USD338.000 grant by University of Western Cape for R&D and CapEx
Source: Include a source for every chart that you use. Separate sources with a semicolon; BCG-related sources go at the end

Community contribution #1 – local ownership | Zenzeleni's model is successful due to professional organization steering local communities

Meso

Zenzeleni not-for-profit company

Obtains funding to:

- Seed & establish the micro level ISP business
- Train & develop capacity to ensure sustainability
- Continuous support on legal, regulatory, technical, advisory, backhaul, etc.

Micro level

Local ownership

- Community based ISP
- Co-operative

Micro level

Local ownership

- Community based ISP
- Co-operative

Micro level

Local ownership

- Community based ISP
- Co-operative

Zenzeleni model based on meso & micro level organizations

- Model is based on inception & support of community-based micro-enterprises
- Two entities (meso & micro) work together to stimulate the digital ecosystem, e.g., health, entrepreneurship, etc.
- Government too has a role to create an enabling policy & regulatory environment and subsequently use the ecosystem to deliver its programs to stimulate growth in impoverished areas

Source: Zenzeleni networks, BCG analysis

Community contribution #2 – village ownership | The Indonesian village model variant of the Zenzeleni model would look as follows

Meso

Not-for-profit Company or local Ministry/government

Obtains funding to:

- Seed & establish the micro level ISP business
- Train & develop capacity to ensure sustainability
- Continuous support on legal, regulatory, technical, advisory, backhaul, etc.

Village level

Village ownership

- Village-based ISP
- Co-operative
- Partially funded by village budget

Village level

Village ownership

- Village-based ISP
- Co-operative
- Partially funded by village budget

Village level

Village ownership

- Village-based ISP
- Co-operative
- Partially funded by village budget

The village model has a few advantages

This version is more robust than the Zenzeleni model as it keeps it strengths

- The overarching NPO, local Ministry or government provides continuous guidance and training. It also helps with initial funding
- At the town level, villagers are taught and paid to keep the network running, leading to better engagement and long-term sustainability

And overcomes the weaknesses of the Zenzeleni model

- New laws allow villages to invest budget in connectivity, thus CapEx requirements are more easily met because the villages can contribute to funding as well
- This also allows for better scalability across villages

Similar pilots have been proven successful in Indonesia

- The Common Room has done come pilot studies that empowers communities to maintain their own networks. ISP Awinet provides infrastructure and training, and connectivity is sold through vouchers

Source: Zenzeleni networks, BCG analysis

Government invests alongside ISPs | The Indonesian government can help ISPs to expand into new areas by co-investing

The Indonesian government has made steps to help ISPs expand into new areas

- A big hurdle for service providers towards providing connectivity in underdeveloped regions is the negative NPV of new projects
- Operators need an incentive to expand into these regions
- Through several Indonesian initiatives such as the joint service operation launched in June 2021, the Telecommunication and Information Accessibility Agency can help relieve some of the costs and risk that comes with operating in these areas

> Providing connectivity across all islands is a nightmare. The government is already doing this, but for some it just doesn't make business sense, even with government help. That's why BAKTI was started. I think NPV-positive is impossible, especially if we talk about the most remote population. This isn't even an NPV case, but a humanitarian need.
>
> —BCG expert on Indonesia

Deep-dive on example of funding model – Joint Service Operation launched in June 2021

- The JSO allows selected partners the right to use the 4G Base Transceiver Station Infrastructure and its supporting infrastructure built by BAKTI to provide 4G Mobile Services and receive revenue
- BAKTI is responsible for providing the BTS infrastructure, including loaning land from the local governments

Government invests alongside ISPs is especially relevant to connect schools in most rural areas

- Plans such as the JSO are great opportunities for school connectivity, because a school connectivity mandate can be included in the right to use BAKTI infrastructure
- Plans for new infrastructure developed by telco players that rely on government subsidies should also include provisions to connect schools

Source: BAKTI, Expert interviews, BCG Analysis

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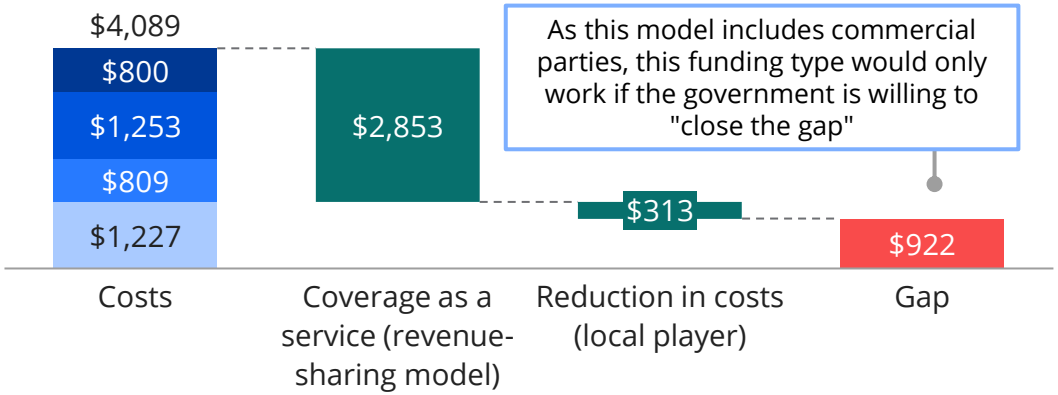
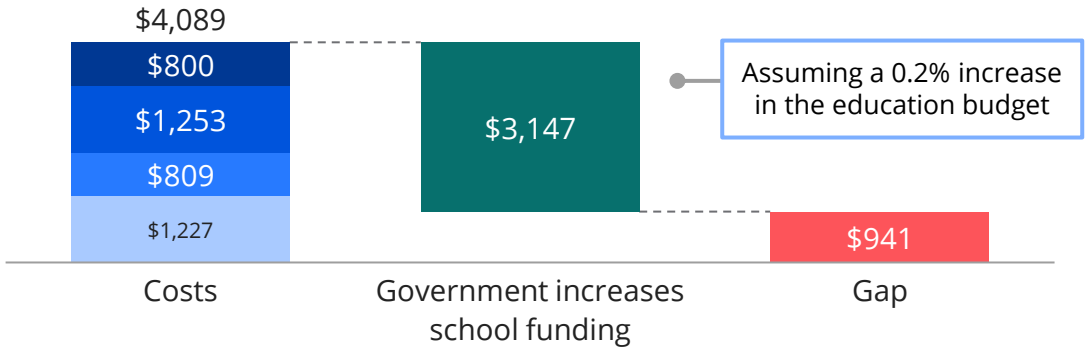
P&L of an avg. school[1] in Java, Bali & Sumatra | No model sufficient by itself to cover costs, though clear differences in potential arise

Model 1: Coverage as a service (revenue sharing)



Model 2: Government increases school funding



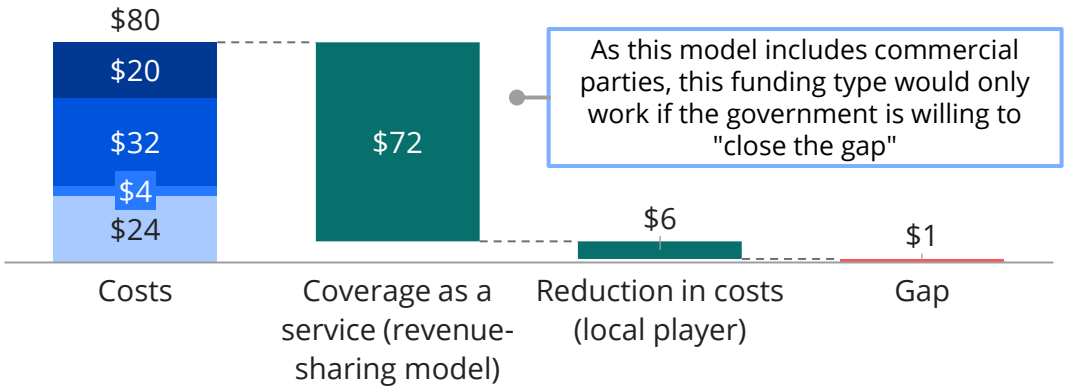
Model 3: One-off government subsidy

Annualized connectivity capex costs | Annual connectivity opex costs | Annualized electricity opex & capex costs | Indirect costs[2]

1. Using as example a school that does not have electricity access; 2. Assumed, based on external academic sources on telecommunications sector, at 30% of total costs
Note: Excludes profit margin for commercial parties. Source: BCG analysis

P&L of total area in Java, Bali & Sumatra | No model sufficient by itself to cover all schools of central states, though clear differences in potential arise

Model 1: Coverage as a service (revenue sharing)



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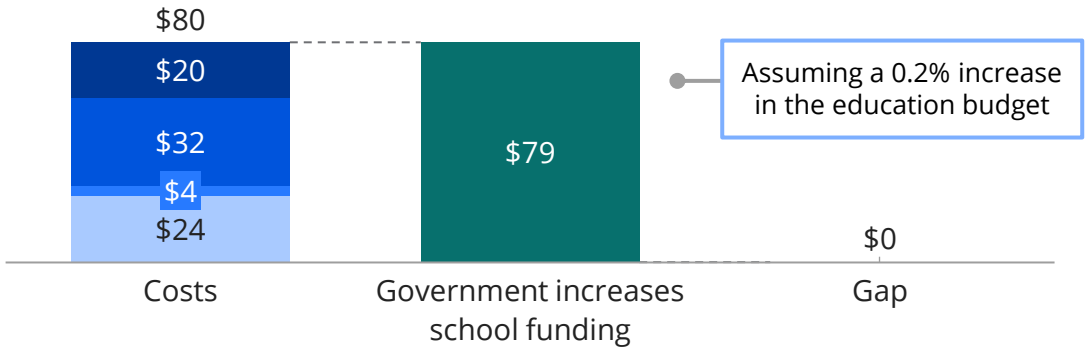

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Annualized connectivity capex costs | Annual connectivity opex costs | Annualized electricity opex & capex costs | Indirect costs

1. Assumed, based on external academic sources on telecommunications sector, at 30% of total costs

Note: Excludes profit margin for commercial parties. Source: BCG analysis

Detailed assumptions | These are the "what you need to believe" for these P&Ls to hold true and what targets must be met for theory to meet practice

Model 1: Coverage as a service (revenue sharing)

- The basic underlying premise of this funding model is that gov't input is needed to 'close the gap' – Assuming efficient markets, these areas would have already been covered by commercial parties if financially attractive.
- Around ~1400 people on average live around each school (based on total population area and no. of schools in region). Of those, around ~41 are willing to use school connectivity in year 1, ramping up to ~140 people in year 10 (based on the growth behavior seen in other countries with similar penetration rate, but with an assumed growth cap at 10% of population around each school). They are willing to contribute 0.5% of their Gross National Income (GNI) per capita.
- This model also allows for a cost-reduction, assuming that local players are more efficient on a small-scale operation or in the particular region. As such, a cut of 5% on capex and 10% on opex has been assumed vs. the usual cost assumptions

Model 2: Government increases school funding

- The government is willing to increase the average spend per student from 3.58% of GDP to 3.59%, which is equal to a 0.2% increase in government budget spent on education
- This additional budget will be divided by the unconnected schools equally, to be used exclusively to connectivity
- In addition, the implicit assumption is that the government will continue with the financial support, regardless of potential shifts in political priorities

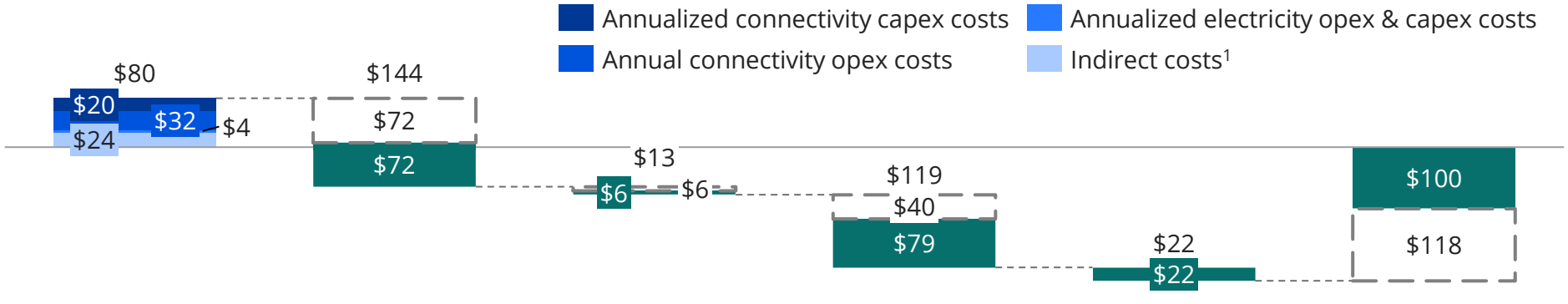
Model 3: One-off government subsidy

- A one-off subsidy from the government is provided to cover initial capex expenditures and accompanying indirect costs[1], which could be financed by various methods, such as spectrum auctions (assuming the reduction in the spectrum price paid by commercial parties is equal to the price of initial capex and the indirect costs attributed to the addition of the new last-mile connectivity)

1. This implies a one-off government subsidy that will cover 4 years of 4G, WISP, and satellite connection (assumed depreciation period), and 20 years for fiber
Note: For each of these models there's the assumption that the cost-side analysis is correct. The cost side analysis is based on the open-source ACTUAL model by Giga (ITU/UNICEF).
Source: BCG analysis

P&L o total area in Java, Bali & Sumatra | Funding models can lead to school connectivity if assumptions turn out positive

P&L annualized ($ million)

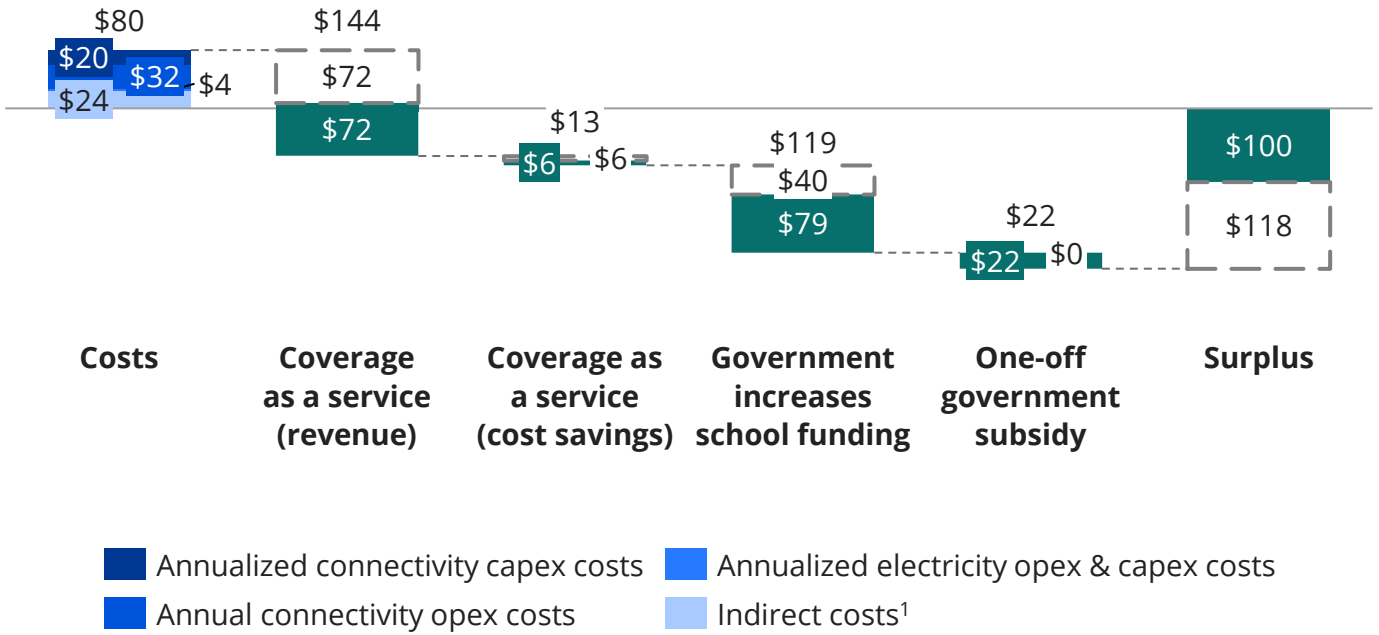


	Costs	Coverage as a service (revenue)	Coverage as a service (cost savings)	Government increases school funding	One-off government subsidy	Surplus
Description of model		Local operator adds on to MNO infrastructure and community pays for use in school	Local operator adds on to MNO infrastructure and does so at a cheaper rate vs. MNO	Government increases education budge (used to fund OPEX and/or CAPEX)	Government provides one-off subsidy funded by spectrum auctions	
Range assumptions		GNIpc spend on connectivity (%): 0.5% to 1.0%2	Discount on CAPEX (%): 5% to 10% Discount on OPEX (%): 10% to 20%	Increase in education budget (%): 0.2% to 0.3%		

1. Assumed, based on external academic sources on telecommunications sector, at 30% of total costs; 2. Indonesia's current value is 1.3% (ITU);
Note: Excludes profit margin for commercial parties. Average profit margin of 17%; Source: ITU, BCG analysis

P&L of total area in Java, Bali & Sumatra | Combining funding models leads to school connectivity in theory, however many hurdles need to be overcome

Analysis shows that if the assumptions used turn out positive, a theoretical 'surplus' in funding could be achieved ...



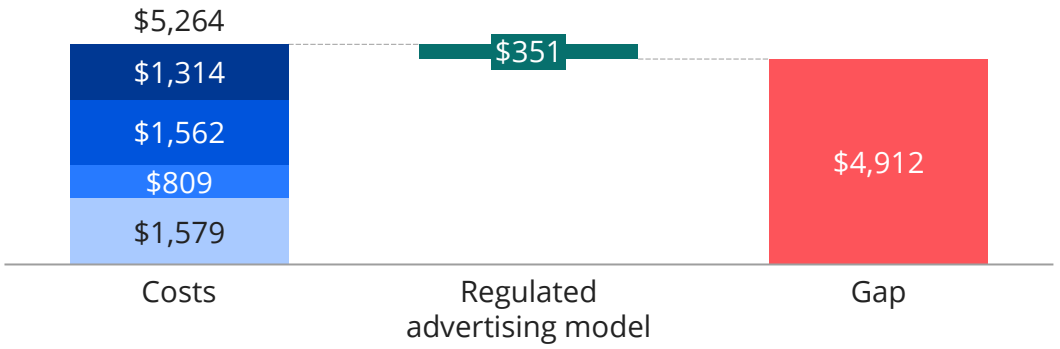
... however, several practical hurdles need to be overcome

- While a theoretical surplus could be realized, lots of practical hurdles need to be overcome (see chapter 'short-term next steps')
- In addition, the current model does not account for potential profit margins that commercial parties demand. These numbers have not been included to allow for flexibility in operating model choice (e.g., infrastructure may be provided on non-profit basis due to CSR efforts)
- Even though the full potential of these models may not be realized in practice, this exercise still provides us with useful insights. It shows:
  - Which models have the largest potential pay-off in covering capex & opex
  - What prerequisites "need to hold" for the funding models to work
  - The potential upside of overcoming the hurdles that require solving

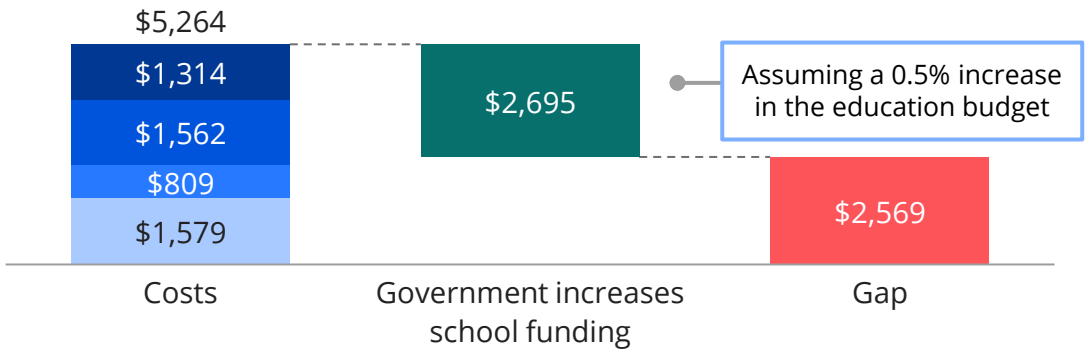
1. Assumed, based on external academic sources on telecommunications sector, at 30% of total costs; Note: Excludes profit margin for commercial parties. Source: BCG analysis

P&L of an avg. school[1] in Kalimantan, Sulawesi, Nusa Tenggara & Papua | N… model sufficient by itself to cover costs, though clear differences in potential arise

Model 1: Regulated advertising model



Model 2: Government increases school funding



Model 3: One-off government subsidy

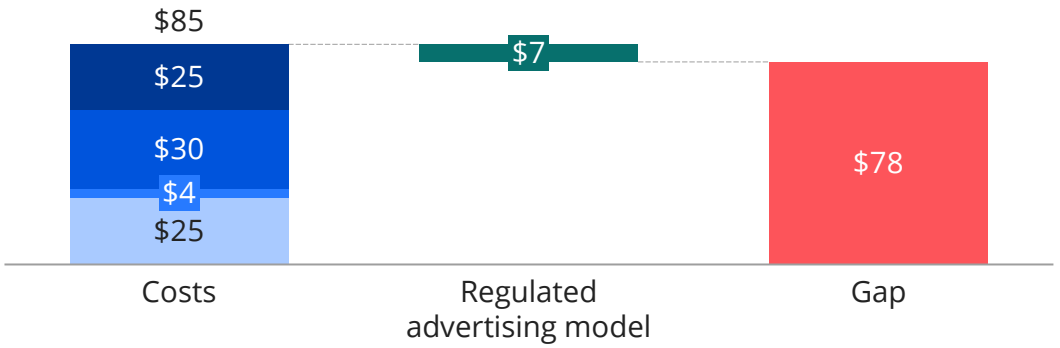
Model 4: Community contribution

Annualized connectivity capex costs | Annual connectivity opex costs | Annualized electricity opex & capex costs | Indirect costs[2]

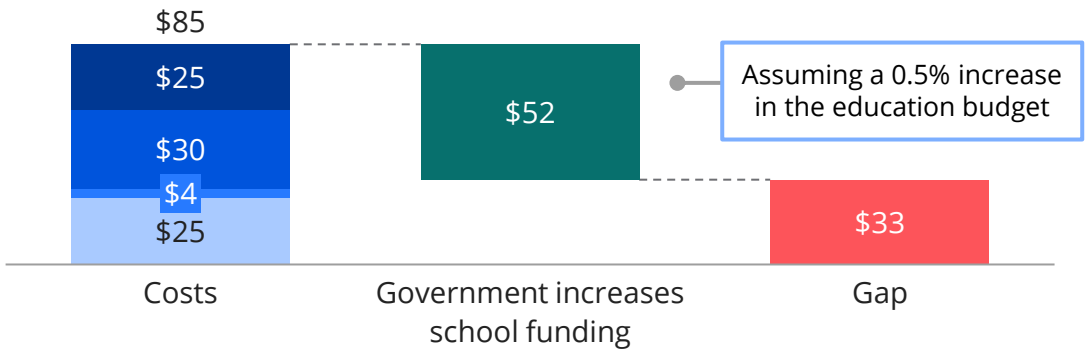
1. Using as example a school that does not have electricity access; 2. Assumed, based on external academic sources on telecommunications sector, at 30% of total costs
Note: Excludes profit margin for commercial parties. Source: BCG analysis

P&L of total area in Kalimantan, Sulawesi, Nusa Tenggara & Papua | No model sufficient by itself to cover all schools, though clear differences in potential arise

Model 1: Regulated advertising model (millions)



Model 2: Government increases school funding (millions)



Model 3: One-off government subsidy (millions)

Model 4: Community contribution (millions)

Annualized connectivity capex costs | Annual connectivity opex costs | Annualized electricity opex & capex costs | Indirect costs[2]

1. Assumed, based on external academic sources on telecommunications sector, at 30% of total costs

Note: Excludes profit margin for commercial parties. Source: BCG analysis

Detailed assumptions | These are the "what you need to believe" for these P&Ls to hold true and what targets must be met for theory to meet practice

Model 1: Regulated advertising model

- ~9.4 M students eligible to view advertisements (all students except for students at private schools)
- 100% of them will view one advertisement everyday (180 school days)
- CPM is $4.0 (source: Magna - average of online display and online video for Indonesia)

Model 2: Government increases school funding

- The government is willing to increase the average spend per student from 3.58% of GDP to 3.60%, which is equal to a 0.5% increase in government budget spent on education
- This additional budget will be divided by the unconnected schools equally, to be used exclusively to connectivity
- In addition, the implicit assumption is that the government will continue with the financial support, regardless of potential shifts in political priorities

Model 3: One-off government subsidy

- A one-off subsidy from the government is provided to cover initial capex expenditures and accompanying indirect costs[1], which could be financed by various methods, such as USO financing (assuming the USF has enough funds and is willing to attribute enough financing to cover one-off capex and attributed indirect costs)

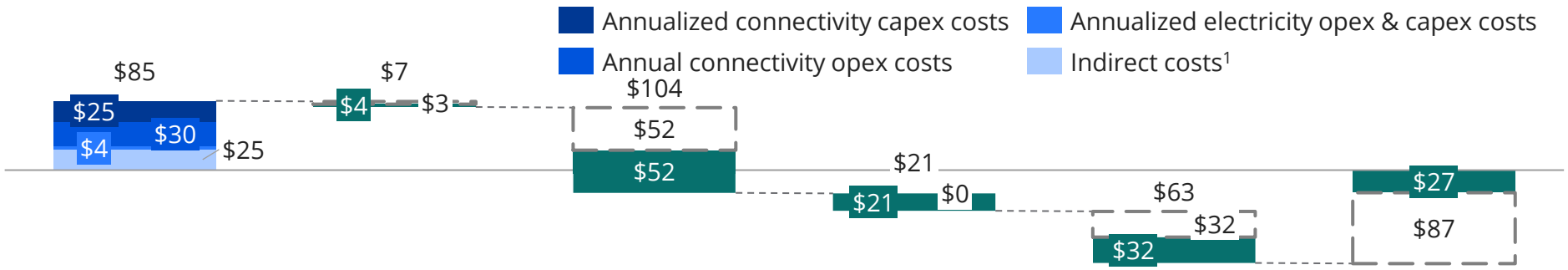
Model 4: Community contribution

- Around ~880 people on average live around each school (based on total population area and no. of schools in region)
- Of those, around ~22 are willing to use school connectivity in year 1, ramping up to ~88 people in year 10. This is based on the growth behavior seen in other countries with similar penetration rate, but with an assumed growth cap at 10% of population around each school.
- These 22 (Y1) to 88 (Y10) people are willing to contribute 1% of their Gross National Income (GNI) per capita
- GNIpc is assumed to increase 2% per year, in line with the historic 5-year average compounded annual growth rate

1. This implies a one-off government subsidy that will cover 4 years of 4G, WISP, and satellite connection (assumed depreciation period), and 20 years for fiber
Note: For each of these models there's the assumption that the cost-side analysis is correct. The cost side analysis is based on the open-source ACTUAL model by Giga (ITU/UNICEF).
Source: BCG analysis

P&L of total area in Kalimantan, Sulawesi, Nusa Tenggara & Papua | Funding models can lead to school connectivity if assumptions turn out positive

P&L annualized ($ million)



	Costs	Regulated advertising model	Government increases school funding	One-off government subsidy	Community Contribution	Surplus
Description of model		Students across the country view advertisements, with revenue distributed to unconnected to schools	Government increases education budge (used to fund OPEX and/or CAPEX)	Government provides one-off subsidy funded by spectrum auctions	Community operates network and pays for connectivity through scratch cards or other methods	
Range assumptions		No. of ads. viewed per student annually: 100 to 180	Increase in education budget (%): 0.5% to 1.0%		GNIpc spend on connectivity (%): 0.5% to 1.0%[2]	

1. Assumed, based on external academic sources on telecommunications sector, at 30% of total costs; 2. Indonesia's current value is 1.3% (ITU);
Note: Excludes profit margin for commercial parties. Average profit margin of 17%; Source: ITU, BCG analysis

P&L of total area in Kalimantan, Sulawesi, Nusa Tenggara & Papua | Combining funding models leads to school connectivity in theory, however many hurdles need to be overcome

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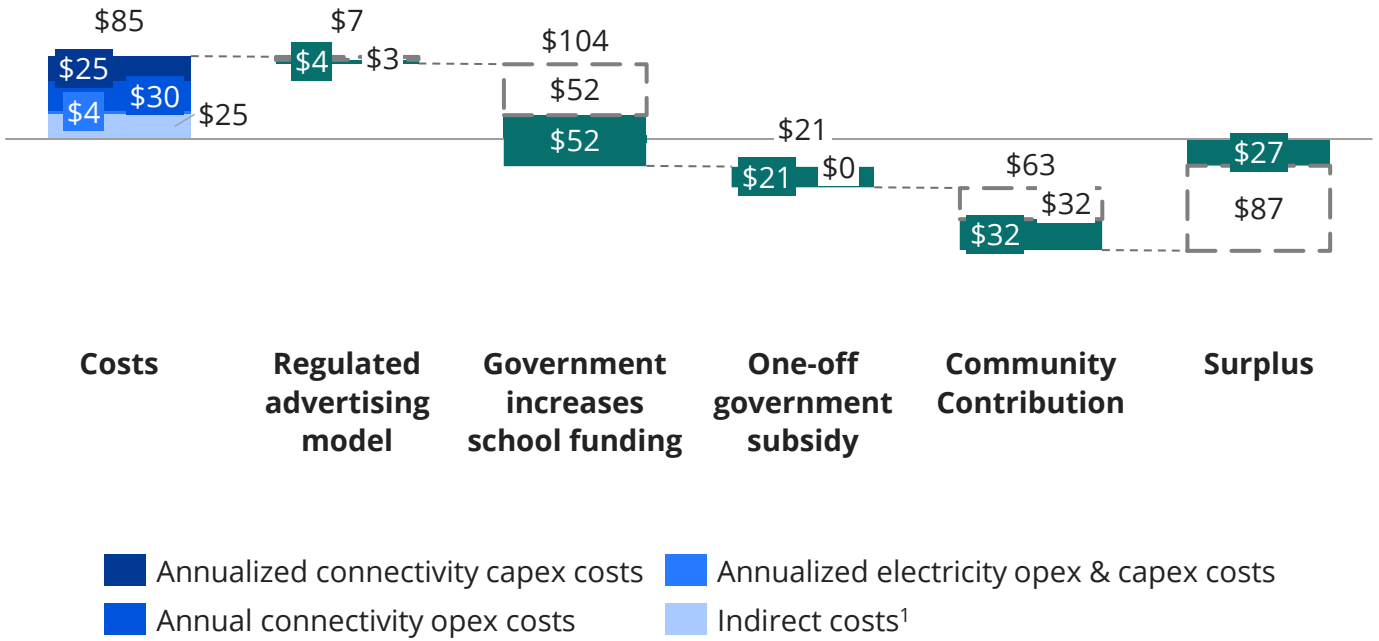

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- While a theoretical surplus could be realized, lots of practical hurdles need to be overcome (see chapter 'short-term next steps')
- In addition, the current model does not account for potential profit margins that commercial parties demand. These numbers have not been included to allow for flexibility in operating model choice (e.g., infrastructure may be provided on non-profit basis due to CSR efforts)
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1. Assumed, based on external academic sources on telecommunications sector, at 30% of total costs; Note: Excludes profit margin for commercial parties. Source: BCG analysis

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Recommendations for short-term next steps

Set up working teams to support the operations of BAKTI, the government and the USO to discuss sustainable funding models

Roll out four pilots

- Use the demand-side subsidy to connect 10 schools in Jakarta
  - A small subsidy is likely to suffice in Jakarta to connect the remaining schools to the internet, therefore roll out pilots to test effectiveness
  - Additionally, these schools cannot count on BAKTI funds, thus it is important to try this model
- Use the revenue-sharing model in Sumatra to connect 10 schools in low connectivity areas
  - In Sumatra, there is a great variance in school connectivity. Test two versions of this pilot
  - Connect 5 schools in a better-connectivity area (>50% of schools) in partnership with the main mobile operator in the area. Identify small entrepreneurs to maintain local network
  - Similarly, connect 5 schools in a low-connectivity area (<50% of schools). It is important to refine the model in this kind of area, so it can be extended to less-developed islands as well
- Use the revenue-sharing model on one of the less-developed islands to connect 10 schools
  - Connect 10 schools in one of the less-developed islands where there is a suitable mobile/rural operator partnership. Use refinements learned in Sumatra before extending.
- Set up 10 community contribution models on the less-developed islands that have strong communities (and lower risk of vandalism) in collaboration with research centers - following the village/Zenzeleni model
  - Roll out a pilot for 5 schools in Papua and 5 in Kalimantan. The difference in GDPpc in these areas allows for refining the model for different environments before extending implementation

Research whether the regulatory framework offers enough possibilities for telco providers and ISPs to implement the sustainable funding models

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