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REPORT FOR GOOGLE

ECONOMIC IMPACT OF GOOGLE'S APAC NETWORK INFRASTRUCTURE

2022 UPDATE - FOCUS ON INDONESIA

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Contents

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Google's network infrastructure investments in Indonesia

Investments in submarine cables

Unity
2010
CABLE LANDING POINTS
Japan, USA

Indigo
2019
CABLE LANDING POINTS
Singapore, Australia, Indonesia

MIST
2022
CABLE LANDING POINTS
Singapore, Malaysia, Myanmar, Thailand, India

IAX
2023
CABLE LANDING POINTS
Singapore, Malaysia, Thailand, India

SJC
2013
CABLE LANDING POINTS
Singapore, Hong Kong, Japan, China, the Philippines, Brunei, Thailand

PLCN
2020
CABLE LANDING POINTS
Taiwan, USA, the Philippines

Topaz
2022
CABLE LANDING POINTS
Japan, Canada

Apricot
2024
CABLE LANDING POINTS
Singapore, Japan, Indonesia, the Philippines, Taiwan, Guam

FASTER
2016
CABLE LANDING POINTS
Japan, Taiwan, USA

JGA-S
2020
CABLE LANDING POINTS
Australia, Guam

Echo
2023
CABLE LANDING POINTS
Singapore, Indonesia, USA, Guam

Raman
2024
CABLE LANDING POINTS
Jordan, Saudi Arabia, Djibouti, Oman and India

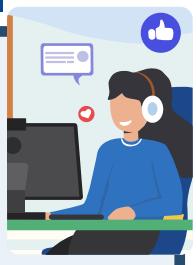
39 cities with GGC nodes

7 peering locations in 3 cities

Benefits to digital connectivity

SUPPORT USE-CASES FOR POST-PANDEMIC DIGITAL TRANSFORMATION:

- Cloud services
- e-Commerce
- Video-conferencing



2026 FORECAST

35% USAGE OF INTERNET ENABLED

14ms REDUCTION IN END-USER LATENCY

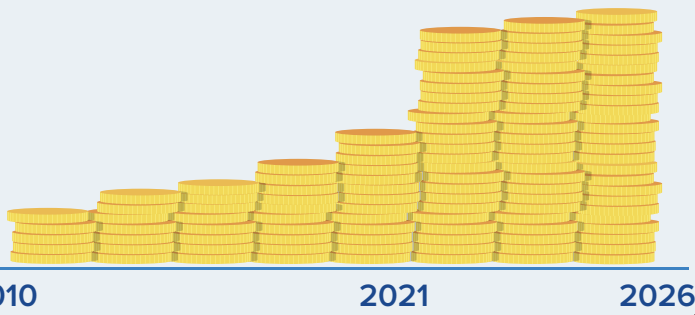
37% REDUCTION IN IP TRANSIT PRICES

34% INCREASE IN INTERNET BANDWIDTH

Economic impact

Forecast to support up to
1.6 million additional jobs
in 2026

Supported up to
299 000 additional jobs
in 2021



Regulatory and investment regime

Need to enable ease of :

Deployment and landing
of submarine cables

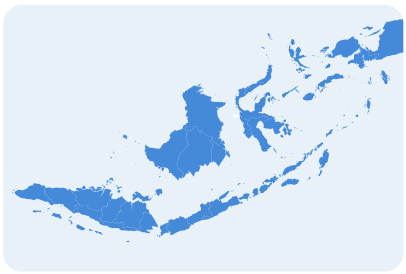
Protection and maintenance
of submarine cables

Indonesia can benefit from following best practices from ***other leading APAC economies***

Potential areas of progression

Modify Kepmen KP 14/2021 and Ministerial Regulation 5 to be aligned with recommendations from the ICPC and best practices from international markets

Consider removing preferential treatment towards Indonesian vessels for submarine cable laying and maintenance activities



Create a more diverse list of cable corridors that enables cable route resilience and are well patrolled and protected

This report is an update of the *Economic impact of Google's APAC network infrastructure – focus on Indonesia* report, released in 2020.[1] We have further refined our methodology first used in 2020.[2] Since 2020, digital connectivity and the economic landscape of Indonesia have seen significant development, largely due to the impact of the Covid-19 pandemic. This report will refresh our quantitative impact estimates in line with these developments and our improved methodology.

Indonesia is one of the fastest growing economies in ASEAN,[3] with the internet economy driving the most growth.[4] Internet traffic generated across both fixed and mobile networks has been growing strongly at around 81% annually from 2010 to 2021, reaching 130EB in total in 2021.

There are three main telecoms service providers in Indonesia:

- **Telkom Indonesia** – the incumbent and largest fixed and mobile operator in Indonesia
- **XL Axiata** – backed by Axiata Group
- **Indosat Ooredoo Hutchison** – majority-owned by Ooredoo Hutchison Asia, a joint venture between Ooredoo and Hutchison Asia Telecom Group[5]

Fixed broadband networks fall behind mobile networks in terms of coverage – almost half of premises[6] have access to fibre broadband, while 98% of the population are within range of 4G mobile services.[7] There has been increased activity in deployment of fixed broadband infrastructure led by players such as Moratelindo as well as new entrants such as Lightstorm.[8]

In October 2022, Indonesia will host the G20 summit, where two key focal points will be the transition to sustainable energy and digital transformation. Indonesia has prioritised low-carbon and green development in its National Medium-Term Development Plan (RPJMN 2020–2024). In telecoms specifically, recent developments in line with Indonesia's digital transformation goals include the

1 Analysys Mason – Economic impact of Google's APAC network infrastructure, see: analysysmason.com/consulting-redirect/reports/impact-of-google-network-apac-2020/

2 We have updated the list of cables with additional "open-cable" effects to include not just Google cables but that of other CASPs. We have also assessed the impact differently for each Google cable depending on a combination of factors including the number of international submarine cables landing in the country, the number of Google cables landing in the country, the consortium members participating in the cable, and Google's level of contribution to the consortium.

3 Association of Southeast Asian Nations

4 Google – e-Conomy SEA 2021, see: services.google.com/fh/files/misc/indonesia_e_conomy_sea_2021_report.pdf

5 Reuters - Indonesia approves merger of units of Qatar's Ooredoo, CK Hutchison, see: https://www.reuters.com/markets/europe/indonesia-approves-merger-units-qatars-ooredoo-ck-hutchison-2022-01-04/

6 FTTx coverage and capex worldwide: forecasts and analysis 2020–2026, Analysys Mason Research

7 Analysys Mason Research

8 Mint - Lightstorm to invest $1 bn in fibre, cable landing stations, see: https://www.livemint.com/companies/news/lightstorm-to-invest-1-bn-in-fibre-cable-landing-stations-11653249243604.html

liberalisation of investment restrictions across a range of areas such as infrastructure, e-commerce, and network and service activities.[9]

Indonesia is also well positioned to attract new investments for submarine cables given its strategic geographical location in South-East Asia. In recent years, multiple large submarine cable projects (such as Echo and Apricot) have been initiated that will connect directly to Indonesia.

By the end of 2021, Indonesia was connected to 20 international submarine cable systems that together offered a total of 372Tbit/s in potential capacity.[10] While Indonesia has a relatively large number of submarine cables, they are heavily reliant on the route to Singapore through the Java Sea, so increasing route diversity should be a market priority.

1 Google's network infrastructure investments generated benefits to the connectivity ecosystem, leading to greater usage of the internet in Indonesia

Google's network investments in Indonesia boost traffic in two main ways: improving the performance and reliability of Google services and content as well as the overall internet infrastructure of the economy. New submarine cables bring new supply and improve international cable route diversity while directly supporting Google's edge infrastructure. Internet service providers (ISPs) and end users benefit from lower latency, faster speeds and low international connectivity costs, and consequently there is an uptake of new internet use cases and applications.

Google has invested in the Indigo-West cable system, which went live in 2019, and has announced investment in a further two cable systems, Echo and Apricot:

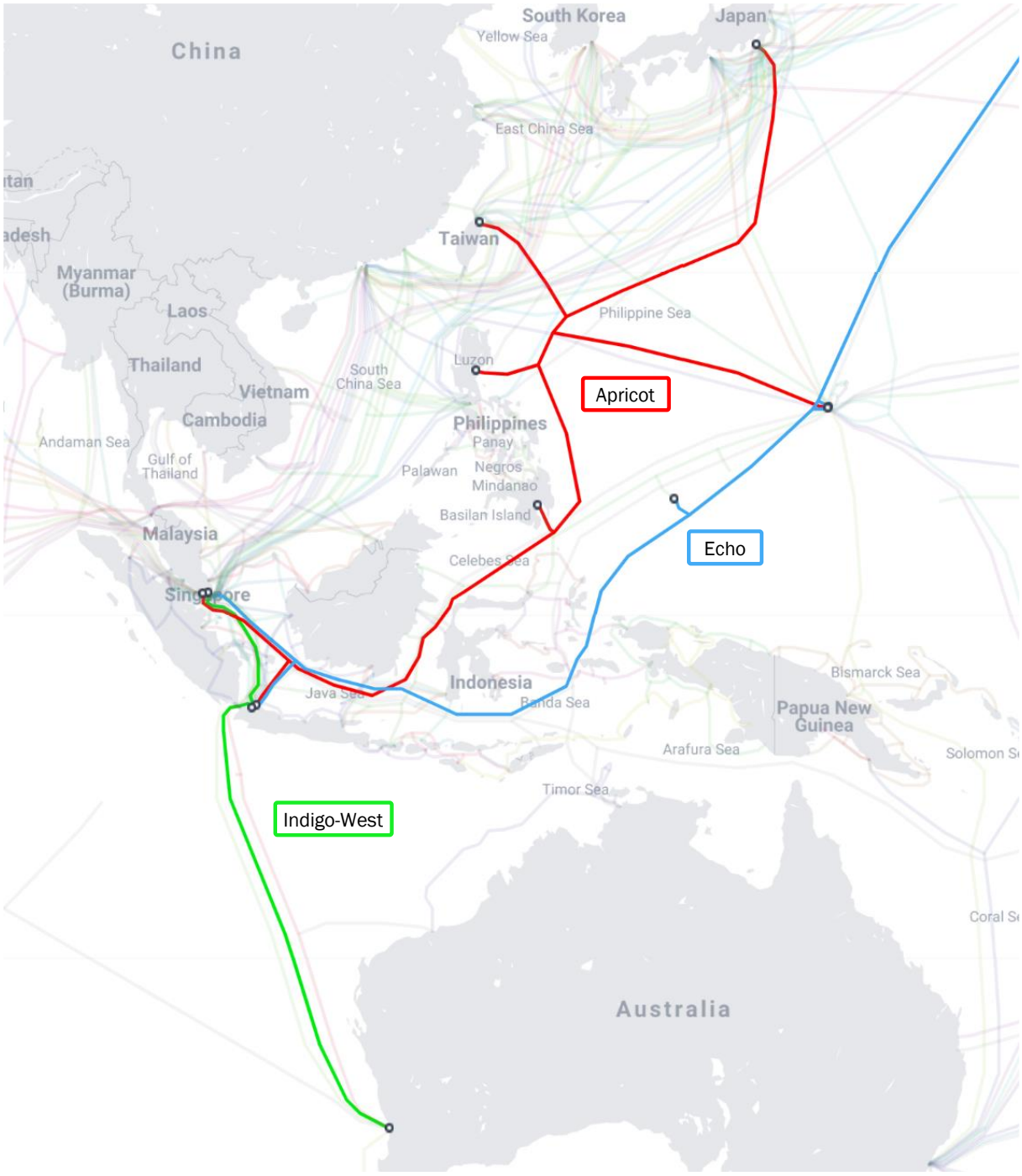
- **Indigo-West (2019)** – 36Tbit/s capacity, open cable system connecting Indonesia, Singapore and Australia
- **Echo (2023)** – Trans-Pacific cable system due to connect Indonesia, Singapore and the USA; the first direct connection between Indonesia and the USA
- **Apricot (2024)** – Pan-Asian cable system due to connect Indonesia, Singapore, the Philippines, Japan, Taiwan and Guam.

A map of Google's submarine cable investments that connect to Indonesia is provided in Figure 1. These cables will significantly increase international capacity and internet performance for Indonesia, therefore enabling sustained traffic growth since 2019 and into the future.

9 Baker McKenzie – Indonesia: Building Up Regulations to Support Digital Economy, see: insightplus.bakermckenzie.com/bm/technology-media-telecommunications_1/indonesia-building-up-regulations-to-support-digital-economy

10 Refers to the estimated theoretical maximum capacity that a cable could handle with current technology

Figure 1: Map of Google's submarine cables that connect to Indonesia[11] [Source: Analysys Mason, 2022]



Apart from investments in international capacity, Google has also continued its investments in edge infrastructure. Google has deployed points of presence (PoPs) in three private peering facilities and cross-connected to internet exchange points (IXPs) at four locations as summarised in Figure 2 below.

11 Edited from The Submarine Cable Map from TeleGeography. For the avoidance of doubt, the locations of the landing points are approximated, and cables do not generally connect to each other.

Google also invests in content caches, and Google Global Cache (GGC) nodes are already deployed in 39 cities across Indonesia.

Figure 2: List of Google peering facilities in Indonesia [Source: Google, PeeringDB, 2022]

Name of facility / fabric	Type	Location
IIX-Jakarta	Public	Jakarta
DCI Indonesia	Public	Jakarta
JKT-IX	Public	Jakarta
OpenIXP	Public	Jakarta
Cyber Data Center International	Private	Jakarta Selatan
DCI Indonesia	Private	Kabupaten Bekasi
NTT Com Jakarta	Private	Jakarta

These investments in submarine cables, PoPs and GGC nodes in Indonesia have continued to bring improvements to the connectivity ecosystem.

End-user latency	End-user latency will reduce by an additional 14 milliseconds by 2026 with Google's investments
IP transit price	IP transit prices are forecast to be 37% lower by 2026 due to the increased supply from Indigo-West, Echo and Apricot.
Internet bandwidth	By 2026, we forecast that the impact of Google's investments will have enabled 34% of international internet bandwidth
Internet traffic	By 2026, we forecast that the impact of Google's investments will have enabled 35% of internet traffic in Indonesia[12]

2 These investments generate social benefits by supporting new use cases and economic benefits in the form of GDP growth and jobs

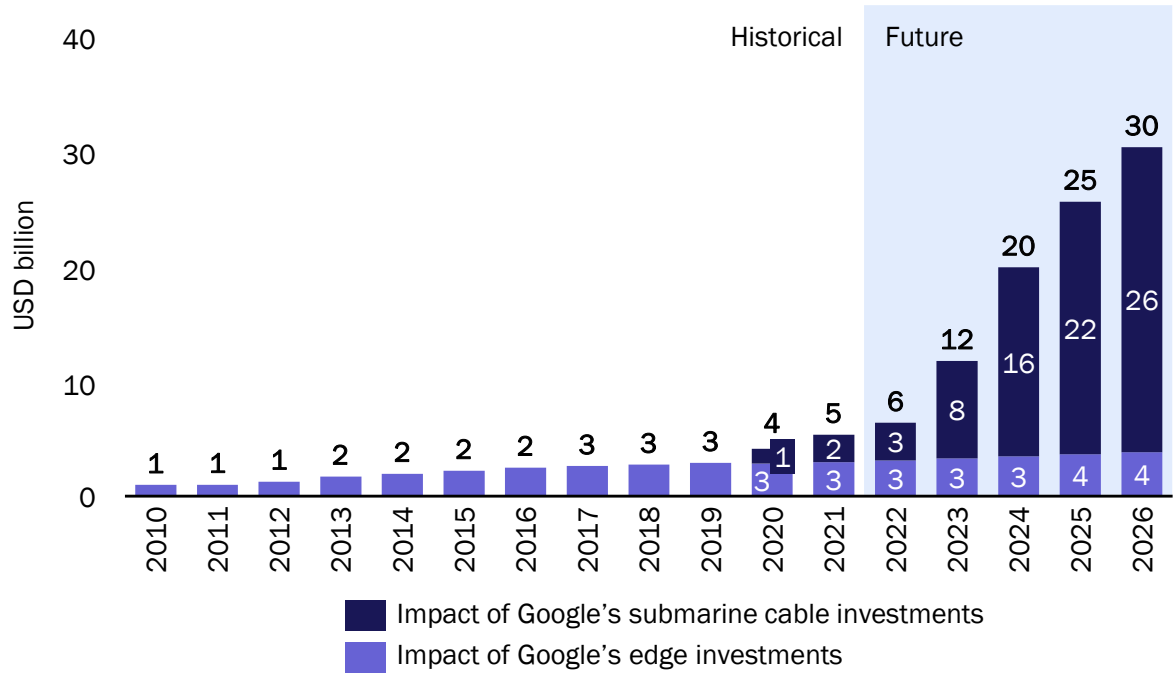
One of the impacts of the Covid-19 pandemic was a notable increase in remote working and online activity, significantly expanding the economic reliance that Indonesia has on internet connectivity. We estimate that the additional internet usage enabled by Google's network infrastructure investments has driven an additional cumulative USD29 billion in GDP (in real terms[13]) in Indonesia from 2010 to 2021. As a result of Google's historical and future investments in Indonesia, we forecast an additional

12 We forecast that Google's network infrastructure investments will drive an additional 53% increase in internet traffic beyond forecasts without these investments by 2026. This results in 35% of total traffic being attributed to Google's network infrastructure investments in Indonesia.

13 GDP figures are in constant USD using 2020 as the base year and using a fixed exchange rate to USD in 2020; GDP statistics in USD are sourced from the World Bank and Euromonitor

cumulative USD94 billion in GDP enabled by Google's investments between 2022 and 2026 (see Figure 3 below).

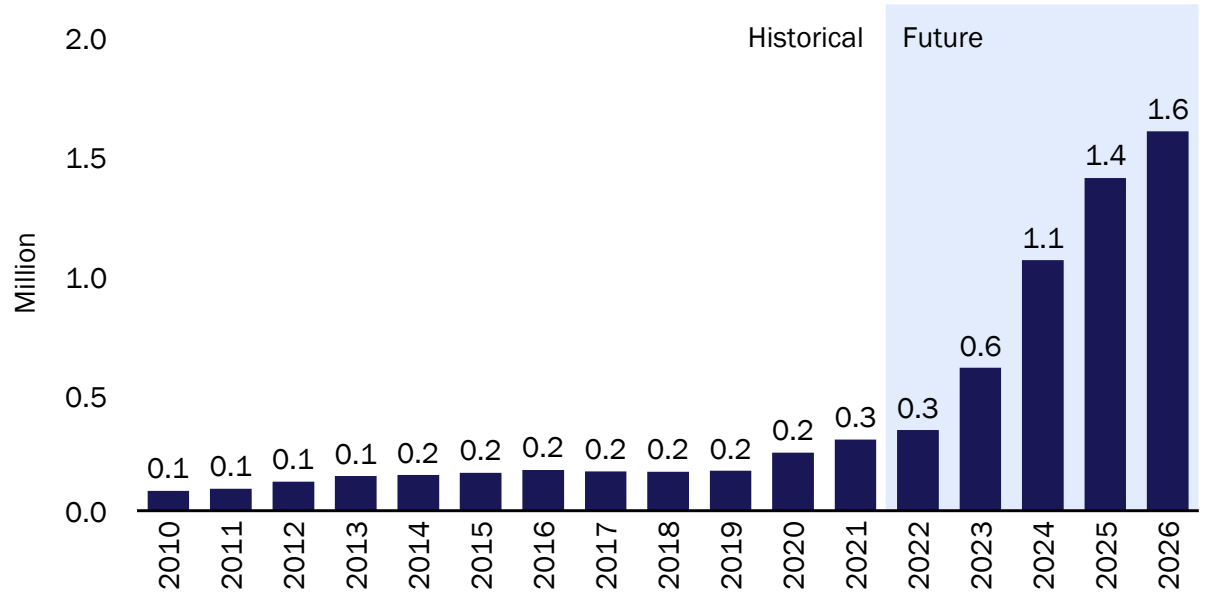
Figure 3: Increase in real GDP attributable to Google's network infrastructure investments in Indonesia[14] [Source: Analysys Mason, 2022]



The economic benefits arising from Google's network infrastructure investments lead to direct job creation in sectors such as telecoms and construction. Indirect job creation is prominent in industries that can benefit most from improved internet connectivity and digitalisation, namely IT, financial and professional services, and manufacturing. We estimate that up to 299 000 jobs were supported through Google's investments in 2021, growing to 1.6 million by 2026 (see Figure 4).

14 Figures are rounded leading to subtotals shown not summing to annual totals

Figure 4: Jobs supported by Google's network infrastructure investments in Indonesia [Source: Analysys Mason, 2022]



3 Investments in network infrastructure continue to drive security, reliability and performance improvements in cloud services while cloud adoption is booming

As discussed in our original report, Google's network infrastructure investments are beneficial to ISPs and end users in various ways, by providing route diversity, reducing latency, and increasing availability and network resilience. Cloud services, including Google Cloud, can in turn offer improved service quality, security and reliability for its customers. Google's infrastructure also delivers cloud traffic directly, which means that traffic from Google Cloud customers is shielded from internet exposure, making it less likely to be susceptible to attacks.

At the end of 2021, Google Cloud was operating 11 cloud regions in APAC, one of which is in Jakarta, Indonesia. The GCP region in Jakarta was launched in 2020 and contains three availability zones.[15] Indonesia's economy is becoming increasingly entrepreneurial and digital, as evidenced by Indonesia's successful digital unicorn companies, nine of which have been added during the Covid-19 pandemic.[16] Google Cloud and submarine cable investments therefore contribute to the foundation of Indonesia's digital economy while increasing accessibility to technology-based commerce in Indonesia.

There are significant energy savings that result from Google Cloud adoption[17] – supporting Google's network investments and encouraging enterprise cloud adoption would thus lend credence to

15 Google – The new Google Cloud region in Jakarta is now open, see: cloud.google.com/blog/products/infrastructure/new-google-cloud-region-in-jakarta-now-open

16 CNA - 'Pushing the boundaries of innovation': How 9 Indonesia start-ups become unicorns during the pandemic, see: https://www.channelnewsasia.com/asia/indonesia-new-unicorns-during-pandemic-jd-id-xendit-akulaku-2724756

17 Further details on the energy savings brought about by the adoption of Google Cloud are provided in the regional APAC 2022 report

Indonesia's environmental sustainability efforts. Digitalisation and the migration to cloud services could also be showcased at the G20 summit in 2022, demonstrating Indonesia's commitment to achieving its net zero emissions (NZE) target.

4 Indonesia could consider adopting regulatory best practices to stimulate more investment in network infrastructure

Indonesia has made progress in liberalising its telecoms environment by allowing foreign ownership of telecoms assets, including submarine cables landing in Indonesia. Over the past few years, new regulations have been added to accelerate the transition to a new digital economy and to stimulate further network infrastructure investment in Indonesia. Some of the key regulations include:

- Decree of Minister of Marine Affairs and Fisheries Number 14 of 2021 (Kepmen KP 14/2021) to organise the submarine cable systems in Indonesia's territorial waters
- Kominfo Ministerial Regulation 5 (MR5) to mandate all digital services and platforms, including foreign ownership restriction of submarine cable systems
- Relaxation of cabotage laws for submarine cable repair vessels, based on the announcement made at the 2016 International Cable Protection Committee (ICPC) Plenary.[18]

The adoption of cable corridors in Kepmen KP 14/2021 may optimise the use of marine space and stimulate further investments but implementation needs to align with international best practices

One of the key objectives of the Kepmen KP 14/2021 decree is to organise the submarine cable systems in Indonesia's territorial waters and support further investment in submarine cable systems in Indonesia. Kepmen KP 14/2021 mandates the use of cable corridors that require submarine cable operators to route their infrastructure in defined geographical areas. The regulations include a map attachment and a list of coordinates of the submarine cables that incorporate four designated cable landing stations (i.e. Batam, Kupang, Manado and Jayapura). This is expected to optimise the use of marine space, provide clear directions for submarine cable deployment and stimulate further network infrastructure investment in Indonesia.

However, the regulations have not fully considered potential technical and operational issues associated with the deployment and operation of submarine cables, and may instead deter future investments:

- cable corridors may be narrow and may therefore provide insufficient spatial separation from other submarine cables to support efficient installation and maintenance processes
- cable corridors encourage geographical clustering of submarine cables, which increases the risk of multiple cables being damaged, and of network outages from a single natural disaster or man-made event
- the four designated cable landing points are outside the optimal routing for international cables, and add cost and complexity to projects, whilst introducing concentrated points of failure.

18 Business Wire, see: businesswire.com/news/home/20160425006234/en/%E2%80%9CVoice-Global-Subsea-Cable-Critical-Infrastructure%E2%80%9D-Resonates

- the new regulation processes and requirements are unclear and this may create uncertainty.

To alleviate the concerns of potential investors, the Indonesian government should consider aligning with guidelines published by institutions such as the Asia–Pacific Economic Cooperation[19] and the ICPC.[20]

Widening and increasing the number of cable corridors reduces geographical clustering of submarine cables. Geographical clustering may otherwise create choke points, which are areas where multiple cables become increasingly susceptible to damage. For example, the Strait of Malacca, a narrow sea corridor between Indonesia, Malaysia and Singapore, contains a high concentration of submarine cables and is one of the busiest shipping routes worldwide. In combination, these factors drastically increase the chances of significant connectivity disruptions caused by shipping anchorage and natural disasters. We therefore recommend that in Indonesia and the surrounding region, a more diverse set of cable routes is created that does not cross with other activities or current cables in Indonesia and the surrounding region. Where narrow corridors already exist, we recommend widening the corridors and implementing patrolling measures to actively protect cables from marine activities.

Kominfo Ministerial Regulation 5 imposes constraints for technology companies which will deter foreign investment in the country

Under the MR5/2021 regulation, the Indonesian government imposed new requirements for at least 5% of the investments in submarine cables that pass through Indonesian waters to be owned by a local telecoms operator and such local telecoms operator will need to have at least 5 years of relevant experience. Such constraints are not practised by regulators in best-in-class markets such as Singapore and Australia. Indonesia may suffer from reduced foreign investment given the restrictions imposed by the MR5 regulations limit participation to a small number of local players.

Although Indonesia's cabotage, licensing and permitting laws have progressed in the right direction, there are still actions to be taken that can promote further foreign infrastructure investment

At the 2016 ICPC Plenary, it was announced that Indonesia had seen dramatically reduced permitting times for cable repairs, cabotage exceptions for non-Indonesian vessels for up to one year, and that cabotage no longer applied to international cable repair in Indonesia's exclusive economic zone (EEZ). However, Indonesian vessels currently benefit from significantly shorter permitting times compared to foreign vessels. By removing preferential treatment towards Indonesian vessels, disruptions caused by submarine cable damages can be reduced. The supply of ships available to conduct cable repairs can extend beyond those that are Indonesian, which would be particularly impactful during times of shortage.

19 APEC – Economic Impact of Submarine Cable Disruptions, see: apec.org/publications/2013/02/economic-impact-of-submarine-cable-disruptions

20 ICPC – ICPC Government Best Practices for Cable Protection Resilience, see: iscpc.org/publications/icpc-best-practices/

Indonesia is an economy with the opportunity to further improve its regulatory regimes, following in the footsteps of other best practice markets in the region, such as Australia, Singapore and Japan. In doing so, Indonesia could attract more foreign investment in order to achieve its target of positioning itself as a key digital hub in APAC.