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REPORT FOR GOOGLE

2022 UPDATE: ECONOMIC IMPACT OF GOOGLE'S APAC NETWORK INFRASTRUCTURE

FOCUS ON THAILAND

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Google's network infrastructure investments in Thailand

Investments in submarine cables in Thailand

MIST

2022

CABLE LANDING POINTS

Singapore, Malaysia, Myanmar, Thailand, India

IAX

2023

CABLE LANDING POINTS

Singapore, Malaysia, Thailand, India

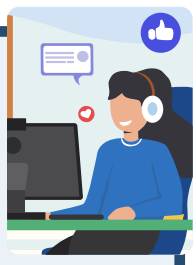
26 cities with GGC nodes

2 peering locations in Thailand

Benefits to digital connectivity

SUPPORT USE-CASES FOR POST-PANDEMIC DIGITAL TRANSFORMATION:

- Cloud services
- e-Commerce
- Video-conferencing



2026 FORECAST

24% USAGE OF INTERNET ENABLED

9% REDUCTION IN END-USER LATENCY

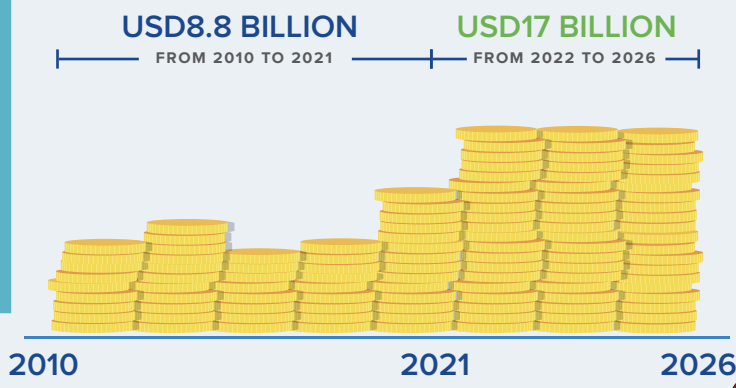
12% REDUCTION IN IP TRANSIT PRICES

17% INCREASE IN INTERNET BANDWIDTH

Economic impact

Forecast to support up to
97 000 additional jobs
in 2026

Supported up to
20 000 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

Thailand can benefit from following best practices from other leading APAC economies

Potential areas of progression

Introduce an open investment policy without foreign ownership restrictions to encourage foreign investments in network infrastructure

Streamlining processes and requirements from various government departments in relation to cable deployment and maintenance

Relax cabotage policy to allow ease of submarine cable repair vessels to enter Thailand's territorial water

This report supplements our regional level report for APAC – an update of our 2020 edition entitled *Economic impact of Google's APAC network infrastructure*.[1] In this 2022 update, Thailand has been added as an economy of focus. This follows Google's announced investments in two submarine cables, the MIST and IAX, which are scheduled to land in Thailand by 2023 respectively.[2]

In recent years, Thailand's telecoms landscape has seen significant development, and fibre broadband connections and internet usage have increased rapidly. Internet traffic generated across both fixed and mobile networks in Thailand has grown strongly at an annual average of 44% from 2017 to 2021, reaching a total of 51EB in 2021.

There are three main telecoms service providers in Thailand:

- **Advanced Info Service (AIS)** – the majority of its shares are owned by InTouch Holdings and Singtel
- **True Corp** – in process of merging with **DTAC** as announced in November 2021
- **National Telecom (NT)** – formed as a merger between CAT Telecom and TOT in January 2020.

Fixed networks have fallen behind mobile networks in terms of coverage – only around 72% of households[3] have access to fibre broadband, while 98% of the population are within range of 4G mobile services.[4] In terms of international connectivity, Thailand is connected to eight international submarine cable systems that offered a total of 171Tbit/s in potential capacity[5] in 2021. Most of the submarine cables are connected to landing stations at the South of the country and only three of the eight submarine cables have been deployed in the last ten years, as seen below in Figure 1 and Figure 2.

Figure 1: List of submarine cable landing stations in Thailand[Source: TeleGeography, 2022]

Landing Station	Cable System	RFS Year
Rayong	Malaysia-Cambodia-Thailand Cable (MCT)	2017
Sri Racha	Asia America Gateway (AAG)	2009
Satun	SeaMeWe 3	1997
	FLAG Europe Asia (FEA)	1997
	SeaMeWe 4	2005
	Asia Africa Europe 1 (AAE-1)	2017
	FLAG Europe Asia (FEA)	1997

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

2 See: https://cloud.google.com/blog/topics/inside-google-cloud/whats-new-google-cloud#:~:text=Week%20of%20Aug%2029%20%2D%20Sept%202%2C%202022

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

4 Analysys Mason Research

5 Refers to the estimated theoretical maximum capacity that a cable could handle using current technology

Landing Station	Cable System	RFS Year
Songkhla	Thailand-Indonesia-Singapore (TIS)	2003
	Asia Pacific Gateway (APG)	2016
	Asia Africa Europe 1 (AAE-1)	2017

Figure 2: Geographic distribution of submarine cable landing stations in Thailand [Source: TeleGeography, 2022]

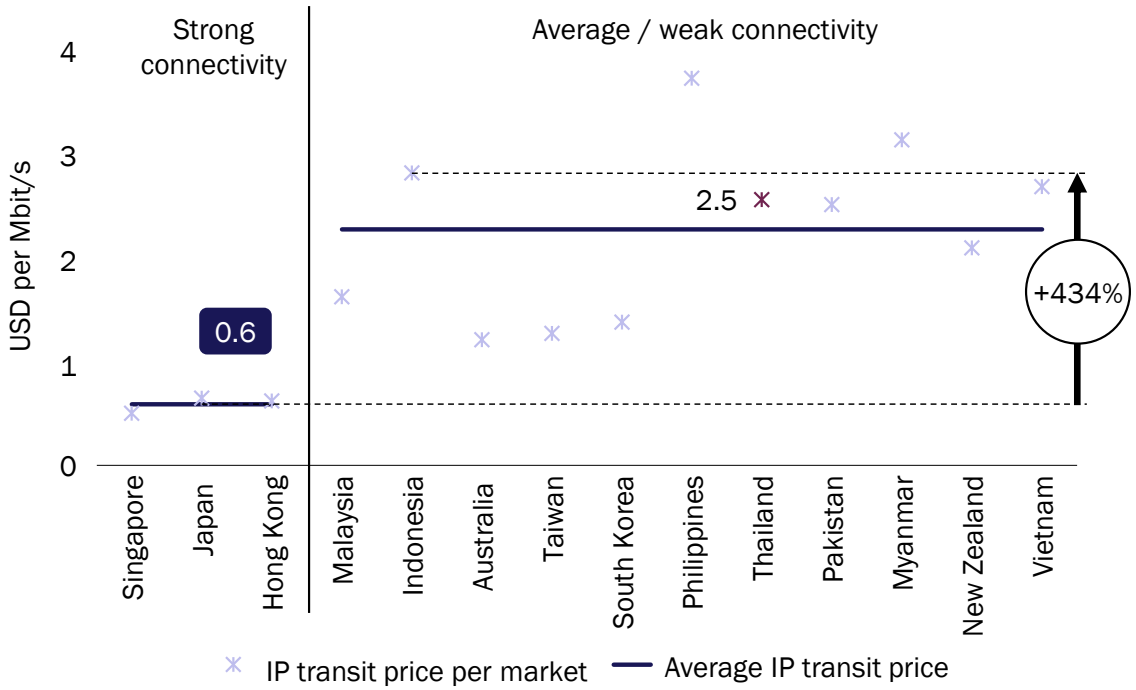
1 Google's network infrastructure investments generated benefits to the connectivity ecosystem, leading to greater usage of the internet in Thailand

Thailand is a connecting point for both the MIST and IAX cable systems, which are due to be ready for service by 2023. The MIST cable system will consist of 12 fibre pairs and will provide more than 216Tbit/s of potential capacity. The new cable will improve the supply of bandwidth and route diversity, which will reduce end-user latency in Thailand. Google has also announced investments in the IAX cable which will provide more than 200Tbit/s of potential capacity connecting India to Thailand, Malaysia, and Singapore.[6] IP transit prices in Thailand are still high compared to well-connected economies in APAC (see Figure 3). We expect that further stimulation of submarine

[6] Submarine Cable Networks - See: https://www.submarinenetworks.com/en/systems/intra-asia/iax/jio-moves-forward-with-iax-and-iex-projects

cables investments, in particular from non-incumbent telecom operators, will reduce the cost of international capacity transit to Thailand.

Figure 3: IP transit prices[7] across APAC [Source: TeleGeography, Analysys Mason, 2022]



As of 2022, Google does not have a submarine cable investment that has landed in Thailand, however it does have edge infrastructure in the country. Google has deployed points of presence (PoPs) in two private peering facilities. Google also invests in content caches, and Google Global Cache (GGC) nodes are already deployed in 26 cities across Thailand.

Figure 4: List of Google peering facilities in Thailand [Source: Google, PeeringDB, 2022]

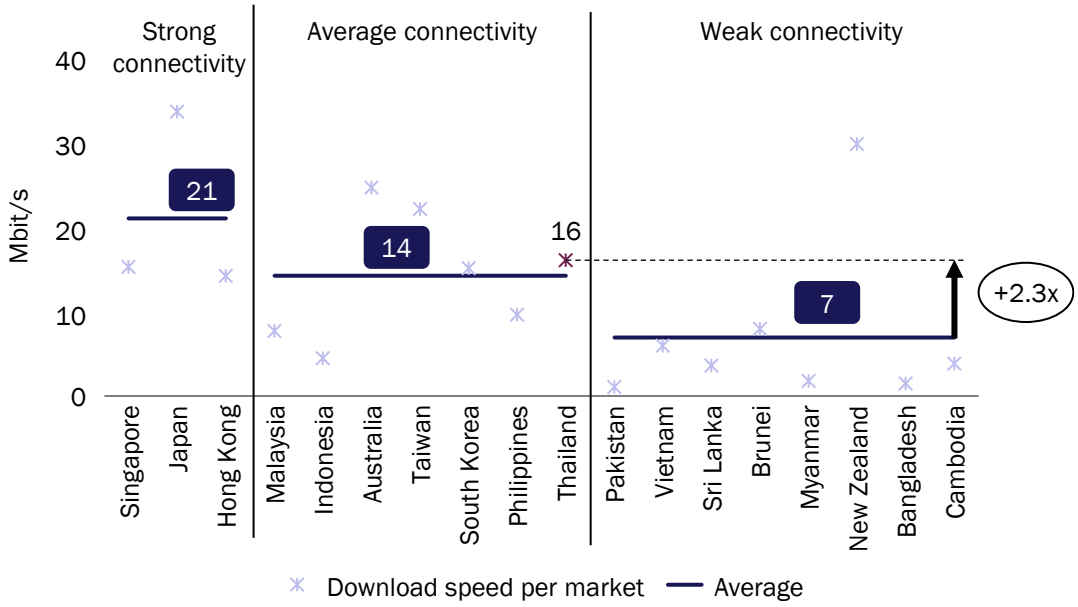
Name of facility / fabric	Type	Location
BKK The Cloud	Private	Bangkok
BKK True NMT	Private	Bangkok

In 2021, Thailand's download speed was slightly higher compared to other APAC economies (see Figure 5). Further stimulation of investments in network infrastructure will increase the supply of international connectivity to the country and lead to the decrease in the unit cost of international bandwidth. This means that ISPs in the country can provision higher capacity to carry more traffic with the same budget, and use a wider variety of routes. The ability to carry more traffic through a greater variety

7 Refers to USD per Mbit/s of IP transit prices in 2020 based on the committed data rate of 10Gbit/s from TeleGeography; calculation is based on average price per Mbit/s in a country or region after accounting for the mix of port sales generated by that country or region. IP transit price data for 10Gbit/s is referenced, as it provides the highest number of available data points (14 APAC economies with submarine cables)

of routes translates to improved end-user speeds in Thailand and enables Thailand to be in a better position to compete with leading APAC economies.

Figure 5: Download speed comparison[8] [Source: M-lab, 2021]



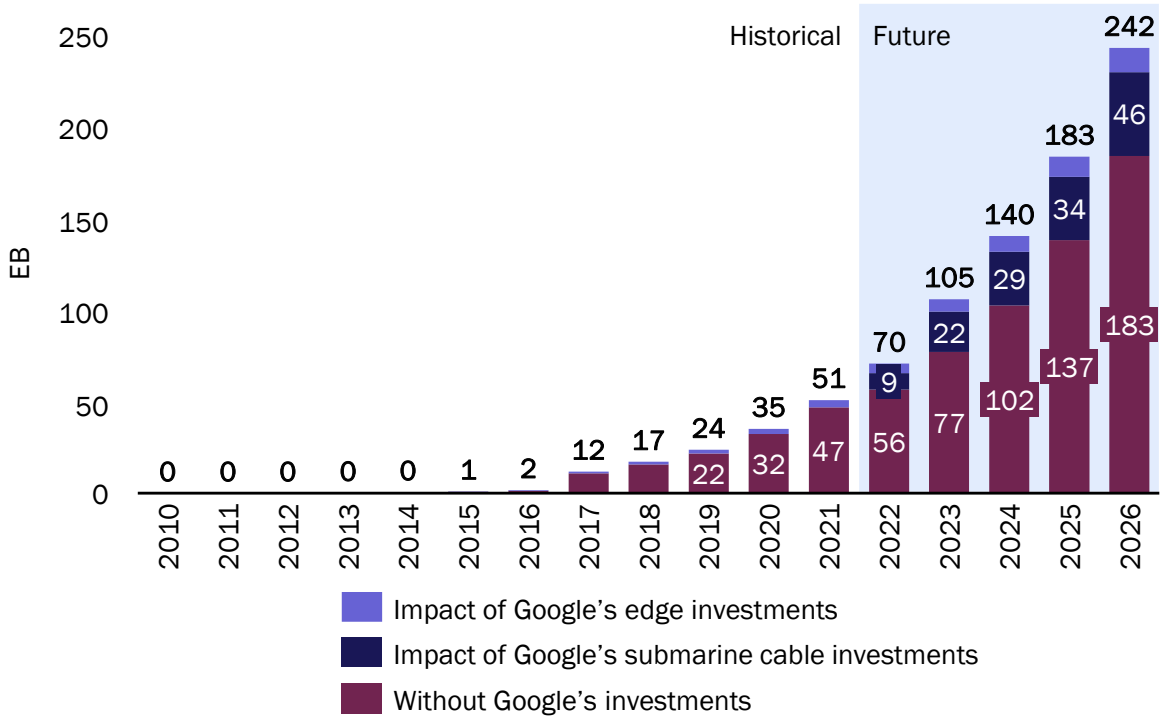
Improvements in latency and internet speed increase the ability of internet service providers (ISPs) to deliver innovative cloud services, video conferencing and gaming. Low latency is also critical for transactional services, including e-commerce.

The end result of these improvements is greater demand for the internet in Thailand: based on our modelling, we estimate that Google's infrastructure investments enabled 4EB or 8% of traffic in 2021, rising to 59EB or 24% of traffic by 2026[9], following the deployments of MIST and IAX (see Figure 6).

8 The data extracted from M-lab ranges from Jan-Nov 2021. M-lab aggregates and groups data to establish log scale "buckets". The sets of data are then randomised and calculated from random samples daily. M-lab would then count the samples that fall into each bucket and get the frequencies for the histogram. The eventual download speeds from M-lab are measured as log average throughputs (Mbit/s)

9 We forecast that Google's network infrastructure investments will drive an additional 32% increase in internet traffic beyond forecasts without these investments by 2026. This results in 24% of total traffic being attributed to Google's network infrastructure investments in Thailand.

Figure 6: Impact of Google's network infrastructure investments on internet data traffic in Thailand [Source: ITU, Analysys Mason Research, Analysys Mason, 2022]

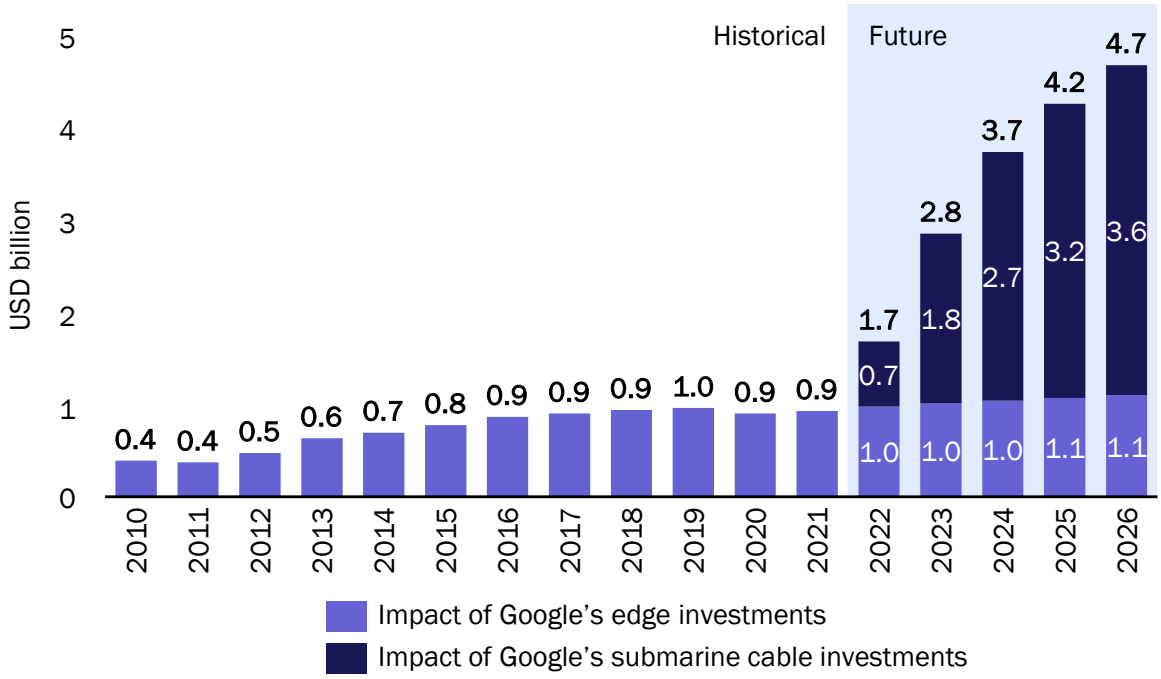


2 These investments generate social benefits by supporting new use cases and economic benefits in the form of GDP growth and jobs

Increased internet use has a positive impact on economic activity across various sectors, leading to benefits for consumers and businesses. We estimate that the increase in internet usage in Thailand contributed an additional cumulative USD8.8 billion in GDP (in real terms[10]) from 2010 to 2021. Google's continued network investments from 2021 onwards, including two submarine cable deployments, are expected to spur higher internet traffic usage. Google's historical and continued investments are expected to contribute an additional cumulative USD17.1 billion in GDP from 2022 to 2026, of which USD4.7 billion would be in 2026 alone (see Figure 7 below).

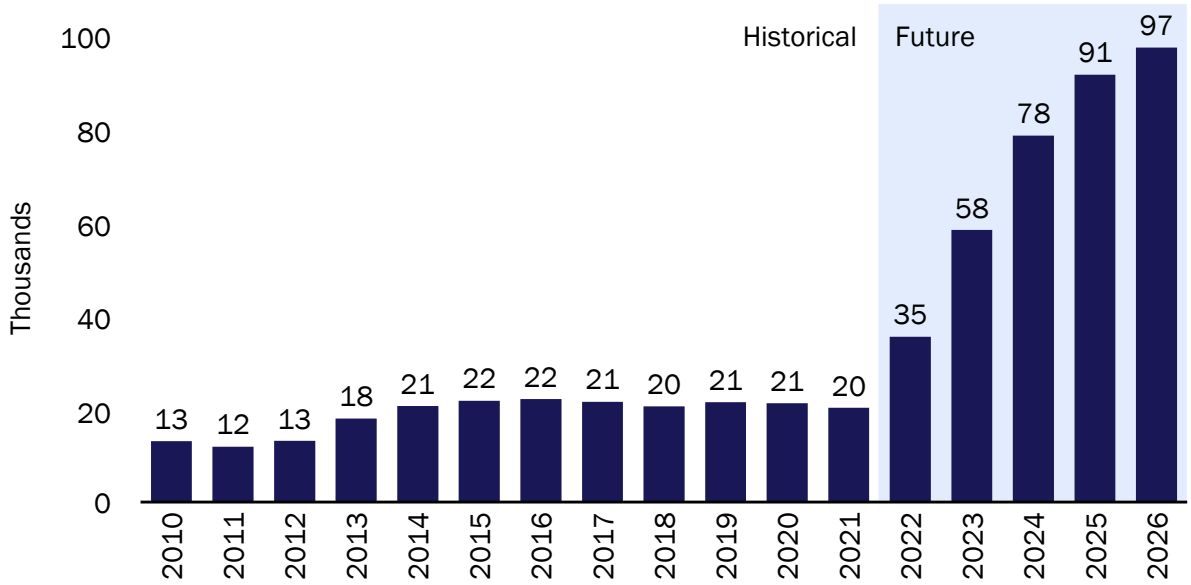
10 GDP figures are in constant USD using 2020 as the base year and using a fixed exchange rate to USD in 2020; GDP statistics in USD are sourced from the World Bank and Euromonitor

Figure 7: Increase in real GDP attributable to Google's network infrastructure investments in Thailand [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. Based on our assessment of the gross value added (GVA) of the abovementioned industries, we estimate that Google's network infrastructure investments and its impact on GDP translated to around 20 000 jobs in 2021, which will grow to 97 000 jobs by 2026 (see Figure 8 below).

Figure 8: Jobs supported by Google's network infrastructure investments in Thailand [Source: Analysys Mason, 2022]



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

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 to their users. 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. Google has announced the intent to launch a cloud region in Thailand which further represents the commitment to supporting digital transformation in Thailand and across the APAC region.[11]

4 Thailand should consider adoption of regulatory best practices to stimulate further investment in network infrastructure

Thailand has a notable strategic position in APAC as it faces both the Pacific and Indian Oceans. This gives it the potentially significant role of a digital connectivity hub that links Africa, the Middle East, Asia and the Americas. In order to achieve this potential, international telecoms players would need to invest in Thailand by means of a licensing regime that is more conducive to foreign investment.

Thailand has developed an economic model, named Thailand 4.0, to drive socioeconomic development and economic growth through ICT development.[12] Digital Park Thailand is one of the major

11 See: https://cloud.google.com/blog/products/infrastructure/announcing-new-google-cloud-regions-in-asia-pacific

12 Royal Thai Embassy – Thailand 4.0, see: thaiembdc.org/thailand-4-0-2/

development projects under Thailand 4.0. It is located on Thailand's eastern seaboard and supports economic growth by providing access to a submarine cable system, landing station and data centre.[13]

The agendas under Thailand 4.0 include the development of technology clusters and future industries. To achieve these goals, the Thai government has amended the Investment Promotion Act B.E. 2520 to provide more benefits, such as corporate tax exemption of up to 13 years for businesses incorporating advanced technology and innovation.[14] The Eastern Economic Corridor (EEC) initiative is a key part of Thailand 4.0 with the objective of transforming the business landscape in three main provinces of Rayong, Chonburi, and Chachoengsao. The ECC Act provides a variety of incentives for investors, including exemption from restrictions on foreign ownership and favourable tax conditions.[15] These initiatives underscores the positive stance the Thailand government has adopted towards foreign direct investment.

However, there are still regulatory hurdles relating to foreign investments in Thailand's network infrastructure. Thailand currently does not allow foreign majority ownership of submarine cables in its territorial seas.[16] To stimulate foreign investment in its network infrastructure, the Thai government could amend its foreign ownership rules to allow partial or full foreign ownership of assets in public–private partnership investment projects. Thailand also does not allow non locally licensed operators to own and operate submarine line terminal equipment which is typically the last piece of equipment that the submarine cable consortia own. The government could consider relaxing current restrictions to enable more parties to participate in this sector. These changes would facilitate the deployment of submarine cables in Thailand's seas. These practices are also consistent with other best practice markets such as Australia where there are no equity limits on foreign investments in network infrastructure.

Thailand could also streamline processes and requirements from various government departments in relation to cable deployment and maintenance. Currently, submarine cable owners have to deal with multiple parties namely the NBTC, the Marine Department, Department of Highways, Department of Rural Roads and the Royal Thai Navy on matters relating to submarine cable and cable landing stations.

Existing cabotage policy can also be relaxed to allow foreign-registered vessels to perform submarine cable maintenance in Thailand's territorial waters. While the application process for foreign-registered vessels to enter Thailand's waters is established, the process involves approval from both Marine Department under the Ministry of Transport as well as the Royal Thai Navy. To speed up the permitting process for vessels, in turn reducing overall repair times of cable faults,

13 The Board of Investment of Thailand – Thailand's Rankings, see: boi.go.th/index.php?page=thailand_rankings

14 Royal Thai Embassy – Agenda 2: Development of Technology Cluster and Future Industries, see: thaiembdc.org/agenda-2-development-of-technology-cluster-and-future-industries/

15 Eastern Economic Corridor Office, see: https://www.eeco.or.th/en/incentives-schemes

16 Bankgkok Post – Underwater cables not approved: No foreign ownership allowed, see: bangkokpost.com/learning/advanced/1033162/underwater-cables-not-approved-no-foreign-ownership-allowed

Thailand could consider implement an 'approval in principle' approach for permits, as seen in Taiwan.