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# ECONOMIC IMPACT OF GOOGLE'S APAC NETWORK INFRASTRUCTURE

## FOCUS ON TAIWAN

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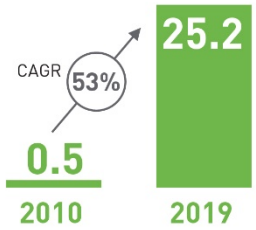
# Economic impact of Google's network infrastructure in Taiwan

## DATA TRAFFIC IN TAIWAN IS GROWING STRONGLY, DRIVEN IN PART BY THE POPULARITY OF GOOGLE'S SERVICES

Taiwan data traffic growth 2010–2019 (EB)




**12%** Google services' share of APAC internet traffic

## GOOGLE INVESTED OVER USD2 BILLION IN NETWORK INFRASTRUCTURE ACROSS APAC, WHICH SUPPORTS THE INTERNET IN TAIWAN

**>$2bn**

Google's APAC network infrastructure investment

### Taiwan investments

- **2** submarine cables (Faster, PLCN)
- **3** private facilities and **2** IXPs with Google PoPs
- **~35%** of bandwidth purchased from telcos
- **6** cities where GGC nodes are deployed

## GOOGLE'S INFRASTRUCTURE INVESTMENT HELPS TAIWAN REALISE STRONG ECONOMIC BENEFITS FROM INCREASED INTERNET USAGE

| Last 10 years (2010-2019) | Next 5 years (2020-2024) |
|---|---|
| **72 000** Jobs | **82 000** Jobs |
| **$19bn** in GDP | **$29bn** in GDP |

1 All currency in USD, in real 2019 terms



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## THESE INVESTMENTS IMPROVE THE CONNECTIVITY ECOSYSTEM WHICH BENEFITS CONSUMERS AND BUSINESSES

**2024**

**24** Exabytes internet traffic

**234Tbit/s** in additional capacity

**15ms** reduction in end-user latency

**4.4x** faster download speeds vs. rest of APAC

**47%** lower IP transit prices vs. rest of APAC

**3** new use cases supported

- Video Conference
- Commerce and Transactions
- Cloud Services

## REGULATORY AND INVESTMENT REGIMES NEED TO SUPPORT FURTHER INVESTMENT IN NETWORK INFRA DEPLOYMENT TO GENERATE ADDITIONAL ECONOMIC BENEFITS

### Deployment and landing of submarine cables

- Transparent and clearly laid out procedure to obtain licences / permits ☐
- Single agency provides a central point of contact to facilitate the process for licence and permit applications ☑
- Open cable landing station provides non-discriminatory and cost-oriented access to landing parties ☐
- Open investment policy allowing majority submarine cable ownership by foreign investors ☑

### Protection and maintenance of submarine cables

- Fast-tracked permit application process for inspection and repair works ☑
- Exemption of submarine cable works from cabotage laws ☑
- Implementation and effective enforcement of cable protection laws ☑

**Supported by**

Strong respect for the law and effective regulatory enforcement

- Government regulations are effectively enforced without improper influence
- Administrative proceedings are conducted without unreasonable delay
- Due process is respected in administrative proceedings

☑ 5 out of 7 best practices observed in Taiwan



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Taiwan's telecoms landscape is very developed and, as of 2019, 93% of its population was connected to the internet. Internet traffic generated across both fixed and mobile networks has been growing strongly at around 53% annually from 2010 to 2019, reaching a total of 25EB in 2019.

There are three main telecoms service providers in Taiwan:

- **Chunghwa Telecom**, the incumbent and largest telecoms operator in Taiwan
- **Taiwan Mobile Company**, the second largest operator in Taiwan
- **FarEasTone**, its largest shareholder is Yuan Ding Investment and it is the third largest MNO in Taiwan.

Both fixed and mobile networks are extensive in coverage, with approximately 94% of households[2] having access to fibre broadband and nearly 100% of the population within range of 3G and 4G mobile services.[3]

Taiwan is connected to ten international submarine cables that offered a total of 487Tbit/s in potential capacity[4] as of 2019. These cables mainly serve intra-APAC routes and are less diverse in connecting to destinations outside Asia as compared to other APAC economies.

## 1 Google's network infrastructure investments contributed to higher internet usage in Taiwan, equivalent to 46% of total internet traffic in 2019

Google's investments in network infrastructure not only improve service performance and reliability of its content and services, they also improve the overall performance and cost-effectiveness of internet infrastructure in Taiwan. Investments in submarine cables bring new supply, improve the diversity of links and also support the expansion of Google's edge infrastructure in Taiwan. The connectivity improvements include lower latency, faster end-user speeds, lower cost of international connectivity and stimulation of new use cases. These effects translate into more internet traffic generated by both consumers and businesses in Taiwan.

Google is an investor on the Faster cable, which was launched in 2016 and connects Japan, Taiwan and the USA. In addition, it has also invested in the PLCN cable which as of 2020 is being used to connect Taiwan and the USA. In total, the two submarine cables would bring up to an estimated 234Tbit/s[5] of potential capacity to Taiwan. Google also purchases additional capacity on other international links provided by telecoms carriers, and this purchased bandwidth accounted for 35% of Google's network capacity in Taiwan in 2019. The combination of owned and purchased capacity is important in allowing the network to scale up in anticipation of future growth.

2 FTTx coverage and capex worldwide: forecasts and analysis 2019–2025, Analysys Mason Research

3 Analysys Mason Research

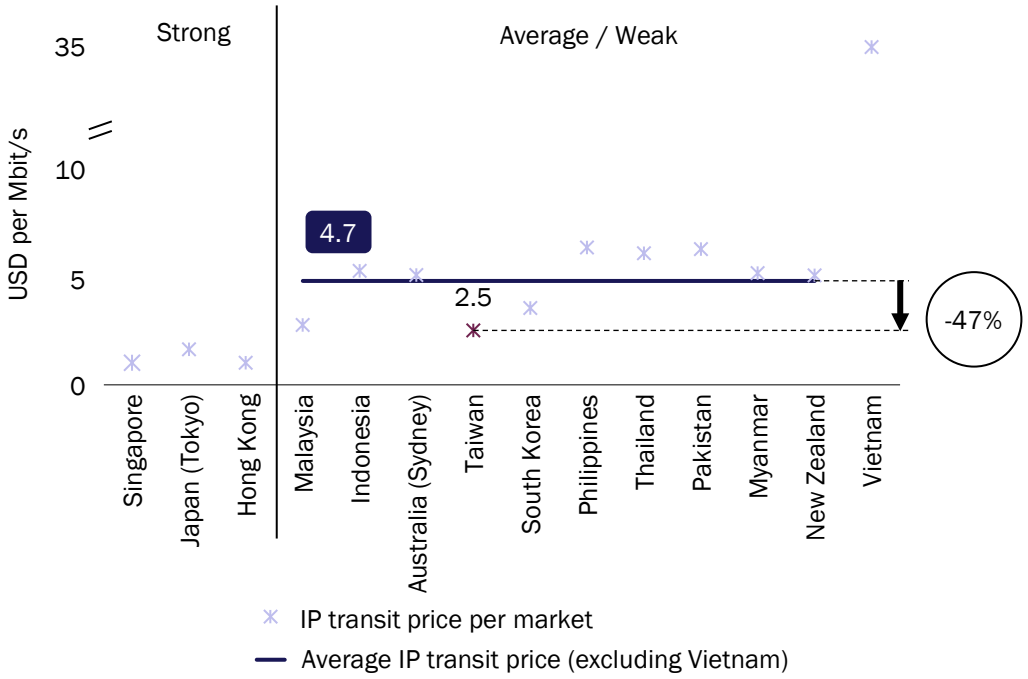
4 Refers to the estimated theoretical maximum capacity that a cable could handle with current technology

5 This data is from the TeleGeography Global Bandwidth Research Service, and refers to the theoretical maximum capacity that a cable could handle using current technology

Besides bringing additional bandwidth into Taiwan, Google's investments in submarine cables also improve route diversity. Our modelling suggests that Google's network investments are correlated with lower end-user latency; in Taiwan, this could be linked to a 15ms reduction in end-use latency by 2019.

Google's investments have also contributed to the decline in the cost of international bandwidth: IP transit prices in Taiwan are 47% lower than average prices in the region, as shown in Figure 1 below.

*Figure 1: IP transit prices[6] across APAC [Source: TeleGeography, Analysys Mason, 2019]*




6 Refers to USD per Mbit/s of IP transit prices in 2019 based on the committed data rate of 10Gbit/s from TeleGeography; calculation is based on averaging the weighted median prices by cities and quarters (up to Q3 2019) to derive 2019 prices; 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)

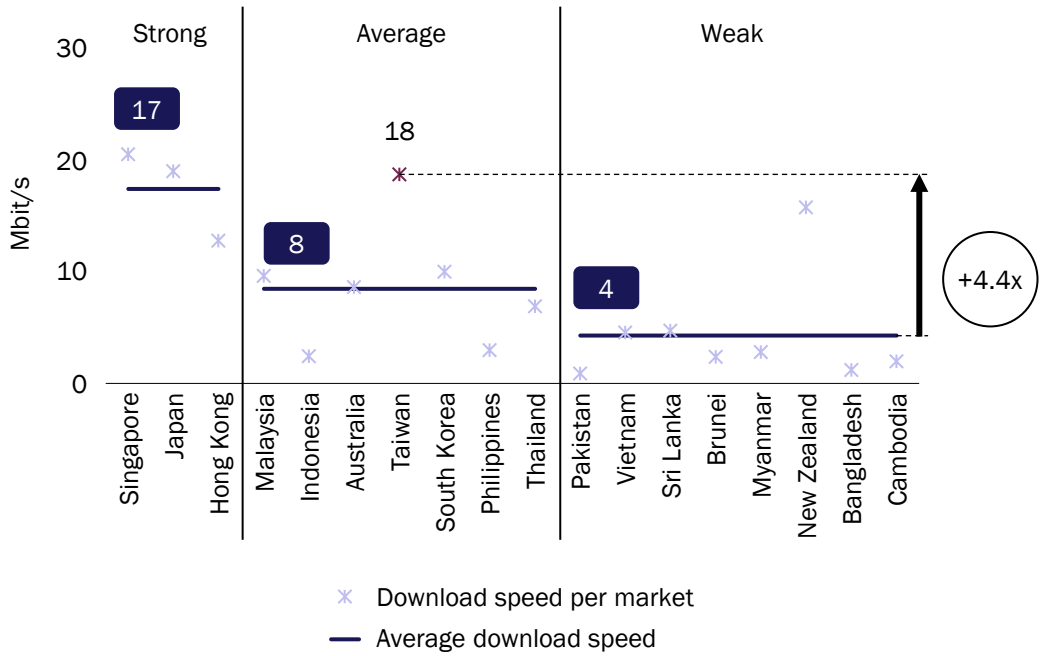
Apart from investments in international capacity, Google has also invested in edge infrastructure and deployed PoPs in three private peering facilities and cross-connected to IXPs at two locations as provided in Figure 2 below. GGC nodes are also deployed in operator networks in Northern cities of Taiwan.

| Name of facility / fabric | Type | Location |
|---|---|---|
| TPIX-TW | Public | Taipei |
| TWIX | Public | Taipei |
| CHT Taipei Aikuo IDC | Private | Taipei |
| CHT Taipei Banqiao IDC | Private | New Taipei City |
| Chief LY Building Taipei | Private | Taipei |

*Figure 2: List of Google peering facilities in Taiwan [Source: Google, PeeringDB, 2020]*

These investments in edge infrastructure and PoPs bring popular Google content closer to end users in Taiwan, which has supported faster download speeds[7]; in 2019, the average download speeds in Taiwan were up to 4.4× that of less well-connected economies, as shown below in Figure 3. The relatively high download speed in Taiwan is also due in part to strong domestic policies which supported the deployment of high-speed broadband infrastructure.

*Figure 3: Download speed comparison [Source: M-lab, 2019]*




7 Google traffic is a significant contributor to network traffic in APAC – approximately 12% of total uplink and downlink network traffic

Improvements in latency and internet speed increase ISPs' ability to deliver innovative services such as cloud services, video conferencing and gaming. Low latency is also critical for transactional services, including e-commerce.

**Case study: 17 Media deployed GCP solutions to support its fast-growing live streaming services business**

17 Media is a live-streaming app and social networking platform founded in 2015 and headquartered in Taiwan. Its operations span seven Asian countries, supporting more than 40 million users. Over the past three years, rapid growth in its live streaming services business resulted in a need for 17 Media to reassess the capabilities of its infrastructure.

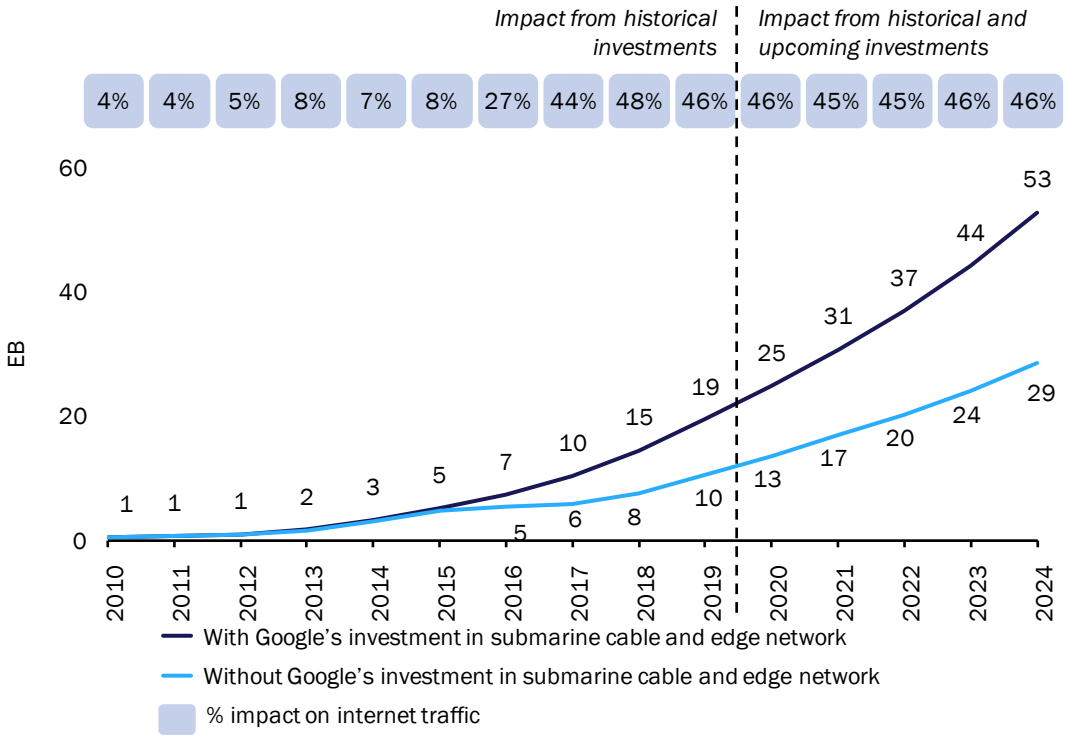
With an infrastructure migration to GCP, 17 Media deployed several cloud-based solutions and was able to leverage the scale of Google's network infrastructure to meet its requirements on network reliability and service scalability. In particular, 'Cloud CDN' allowed 17 Media to contain its content serving costs and maintain fast delivery times through caching load-balanced content across Google's edge PoPs.

> "[We] migrated [our] infrastructure to GCP for its reliable subsea cable network and load balancing."
>
> **17 Media**

The end result of these improvements is greater demand for the internet in Taiwan: based on Analysys Mason's modelling, we estimate that internet traffic in Taiwan would have been 46% lower from 2019 to 2024 in the scenario where Google had not invested in network infrastructure, as seen below in Figure 4.[8]

8 This takes into account the effect of the entire submarine cable system(s) that Google participates in. As explained in Annex A of the full report, the fact that Google was an investor in these systems appears to have a statistically significant effect on their impact on the geographies they sere, including Taiwan.

*Figure 4: Impact of Google's investments in edge network infrastructure on internet traffic served by Google's services in Taiwan [Source: Analysys Mason, 2020]*




## 2 Google's network infrastructure investment benefits the internet ecosystem in Taiwan, supporting 72 000 jobs and generating additional USD3 billion in GDP in 2019

The increase in 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 contributed USD19 billion in GDP impact (in real terms[9]) in Taiwan from 2010 to 2019; in 2019, we estimate that GDP would have been 0.81% lower in the scenario where Google had not made investments in network infrastructure.

Google's continued network investments from 2020 onwards are expected to spur higher internet traffic usage, bringing total benefits of USD29 billion in GDP impact from 2020 to 2024, of which USD6 billion would be in 2024 alone (see Figure 5). This GDP impact represents the mid-range of Analysys Mason's modelling estimates and could range between USD8 billion to USD71 billion from 2020 to 2024 (see Figure 6 below).

9 GDP figures are in constant USD using 2019 as the base year and using a fixed exchange rate to USD in 2019; GDP statistics in USD are sourced from the World Bank and Euromonitor

*Figure 5: Increase in real GDP attributable to Google's network infrastructure investments in Taiwan [Source: Analysys Mason, 2020]*

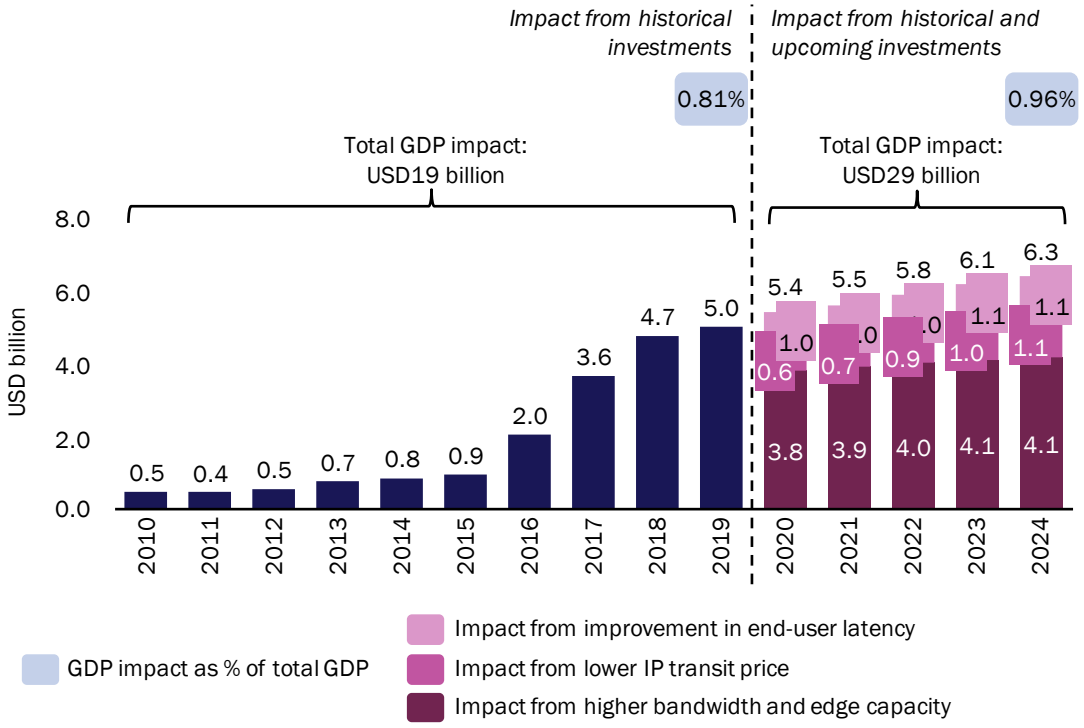


*Figure 6: Increase in real GDP from 2020 to 2024 attributable to Google's network infrastructure investments in Taiwan by modelling scenarios and connectivity components [Source: Analysys Mason, 2020]*

| Drivers of data traffic impacting GDP | Conservative[10] | Base case[11] | Aggressive[12] |
|---|---|---|---|
| Bandwidth and edge impact + IP transit price + Latency impact | 13 | 29 | 71 |
| Bandwidth and edge impact t + IP transit price impact | 11 | 24 | 58 |
| Bandwidth and edge impact only | 8 | 20 | 50 |

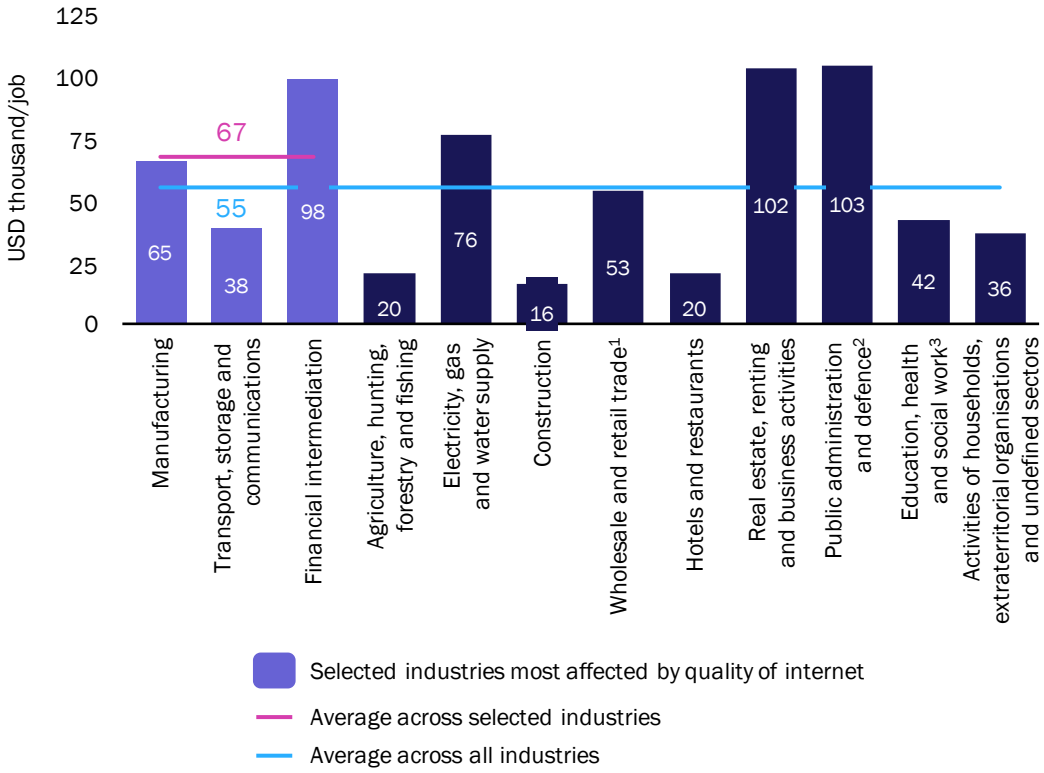
The economic benefits arising from Google's network infrastructure investments translate into jobs: direct jobs in the construction and telecoms sector, and indirect jobs driven by the improvement of broadband connectivity across the broader economy, particularly in industries such as IT, financial services and manufacturing. Based on an assessment of gross value added (GVA) across industries in Taiwan, we estimate that, in 2019, the average GVA per job was USD67 000 in industries most affected by the quality of the internet (see Figure 7 below).

10 The conservative modelling scenario refers to the use of coefficients (within the 95% confidence interval) in the supply and demand side equations to provide the lowest GDP impact. Specifically, the highest coefficient values are used in the supply side equation for latency and both latency and IP transit price variables in the demand side equation for mobile data usage; the lowest coefficient values are used in the supply side equation for internet bandwidth and internet bandwidth variable in the demand side equation for mobile data usage

11 The base case modelling scenario refers to the use of mid-point coefficients (within the 95% confidence interval) in the supply side equations (coefficients for submarine cable count and Google submarine cable percentage variables) and demand side equation (coefficients for internet bandwidth); Latency and IP transit price variables in the demand side equation are kept at the highest coefficient values which provides the lowest GDP impact

12 The aggressive modelling scenario refers to the use of coefficients (within the 95% confidence interval) in the supply and demand side equations to provide the highest GDP impact while keeping latency and IP transit variables unadjusted (see above base case modelling scenario). Specifically, the lowest coefficient values are used in the supply side equation for latency; the highest coefficients are used for the supply side equation for internet bandwidth and the internet bandwidth variable in the demand side equation for mobile data usage

*Figure 7: 2019 GVA per job by industry in Taiwan [Source: Analysys Mason, national statistics authority via Euromonitor, 2020]*



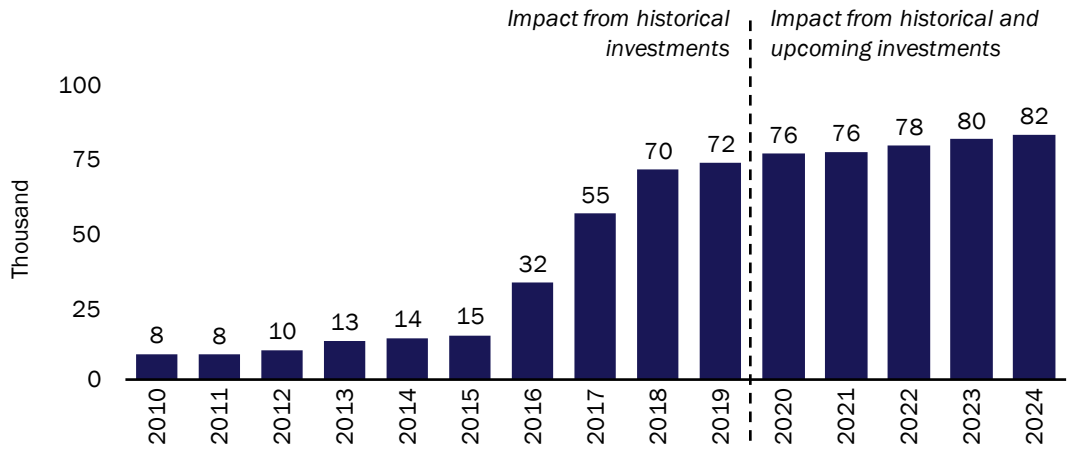

[1] Includes repair of motor vehicles, motorcycles, personal and household goods

[2] Includes compulsory social security

[3] Includes other community, social and personal service activities

Based on this assessment, we estimate that Google's network investments and their impact on GDP translated into around 72 000 jobs by 2019, which will grow to 82 000 jobs by 2024 (see Figure 8 below).

*Figure 8: Impact of Google's network investments on job creation in Taiwan [Source: Analysys Mason, 2020]*




## 3 Taiwan's regulatory regime is conducive to the deployment and landing of submarine cables

Taiwan is regarded as having a supportive regulatory and investment regime for both the deployment and maintenance of submarine cables. It has a relatively mature and established application process for landing submarine cables. It is also seen as a jurisdiction with relatively strong regulatory enforcement which boosts investors' confidence, particularly in the context of capital-intensive investments such as the deployment of submarine cables.

While there are established procedures to obtain permits and licences for landing and repair of submarine cables, the regulatory authorities could lay out the procedures and criteria clearly on a publicly available forum such as those practiced by Singapore and Hong Kong regulatory authorities. This would reduce the uncertainty that new submarine cable owners might face when landing submarine cables for the first time in Taiwan. Taiwan could also consider following Singapore in adopting a regulated open cable landing station regime which would give submarine cable owners access to existing cable landing stations at cost-oriented prices and on non-discriminatory terms.

Interviews with submarine cable owners revealed difficulties in negotiating with the fishery industry in Taiwan when deploying submarine cables. In order to address this issue, Taiwan could consider regulatory involvement in facilitating discussions between the fishery industry and submarine cable owners in order to arrive at a fair compensation value for the fishery industry.