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ECONOMIC IMPACT OF GOOGLE'S APAC NETWORK INFRASTRUCTURE

FOCUS ON SOUTH KOREA

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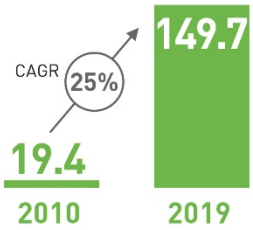
Economic impact of Google's network infrastructure in South Korea

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

South Korea data traffic growth 2010–2019 (EB)



12% Google services' share of APAC internet traffic

GOOGLE INVESTED USD2.2 BILLION IN NETWORKING INFRASTRUCTURE ACROSS APAC, WHICH SUPPORTS THE INTERNET IN SOUTH KOREA

>$2bn Google's APAC network infrastructure investment

4 private facilities and **2** IXPs with Google PoPs

All bandwidth purchased from telcos

11 cities where GGC nodes are deployed

These investments improve the connectivity ecosystem which benefits consumers and businesses

13 EB increase in internet traffic in 2024

1 All currency in USD, in real 2019 terms

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GOOGLE'S INFRASTRUCTURE INVESTMENT HELPS SOUTH KOREA REALISE STRONG ECONOMIC BENEFITS FROM INCREASED INTERNET USAGE

Last 10 years (2010-2019)

33 000 Jobs

$23bn in GDP

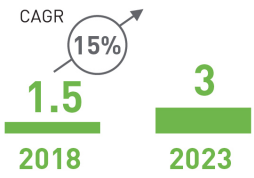
Next 5 years (2020-2024)

33 000 Jobs

$16bn in GDP

SOUTH KOREA CLOUD SPEND IS EXPECTED TO GROW STRONGLY DRIVING ADDITIONAL ECONOMIC BENEFITS

South Korea cloud spend (USD bn)
2018–2023

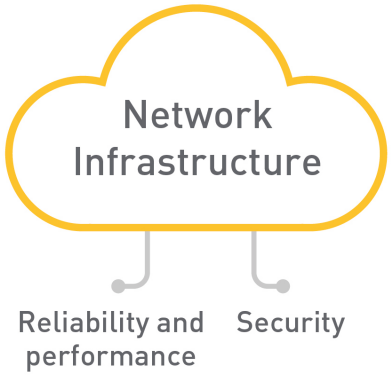


Benefits of cloud adoption

- Supports digital transformation agenda
- Additional economic impact from 2019-2023

50 000 Jobs **$45bn** in GDP

NETWORK INFRASTRUCTURE IS IMPORTANT FOR CLOUD – IT IMPROVES:



Case Study: Netmarble

Netmarble uses advance GCP tools including analytics and machine learning to support game development, manage infrastructure and spread business intelligence throughout its organisation.

"The public cloud aligns with our vision for innovation and is as committed as we are to building better player services with advanced artificial intelligence and reliable, scalable cloud infrastructure"
Duke Kim, SVP, Head – Netmarble AI Revolution Centre, Netmarble

South Korea's telecom landscape is one of the most advanced in APAC and, as of 2019, 96% of its population was connected to the internet. Internet traffic generated across both fixed and mobile networks has been growing strongly at around 25% annually from 2010 to 2019, reaching 150EB in total in 2019.

There are three main telecoms service providers in South Korea:

- **KT Corp**, the incumbent and largest fixed broadband operator
- **SK Telecom**, the largest MNO and second largest fixed broadband operator
- **LG Uplus**, the third largest operator, with its largest shareholder being the LG Corporation.

Both fixed and mobile networks are extensive in coverage, with more than 95% of households[2] having access to fibre broadband and 100% of the population are within range of 4G mobile services.[3] In terms of international connectivity, South Korea is connected to nine international submarine cable systems that offered a total of 430Tbit/s in potential capacity[4] in 2019.

1 Google's investments in edge network infrastructure contributed to improvements in latency and bandwidth, leading to an estimated 4% higher demand in South Korea in 2019

As of 2019, Google does not have submarine cables landing in South Korea but has invested in edge infrastructure. Google deployed PoPs in four private peering facilities (mainly for cloud services) and are cross-connected to IXPs at two locations as shown in Figure 1 below. GGC nodes are also deployed in operator networks in 11 cities across South Korea.

Name of facility / fabric	Type	Location
KINX	Public	Seoul
KRIX (Sejong)	Public	Seoul
KINX Gasan	Private	Seoul
LG Uplus Pyeongchon IDC	Private	Anyang-si
LG Uplus SEOCHO1 IDC	Private	Seoul
Sejong IX Center	Private	Seoul

Figure 1: List of Google peering facilities in South Korea [Source: Google, PeeringDB, 2020]

These edge infrastructure investments bring Google content closer to end users and enable local ISPs' to better manage available bandwidth to carry more traffic. Everything else being equal, this reduces very significantly the cost of carrying traffic that their end-users access from Google's

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

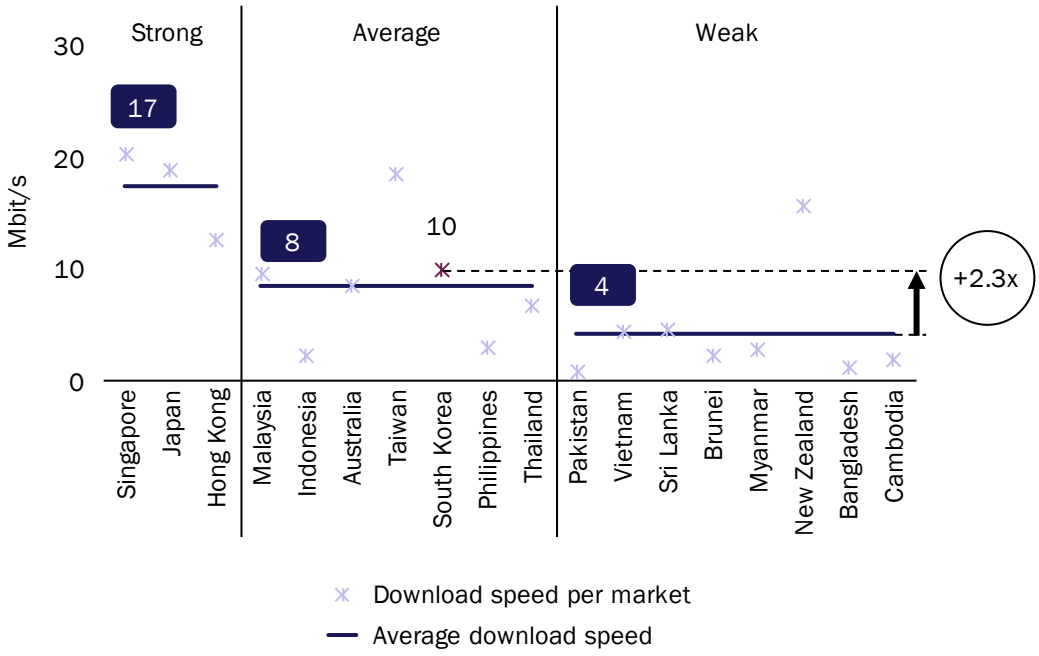
3 Analysys Mason Research

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

network. We understand that the current uncertainty related to the regulatory regime for interconnection is impeding ISPs from fully benefitting from the available options.

Google's investments, together with infrastructure investments by ISPs and other CASPs, have also contributed to download speeds in South Korea[5] being relatively high. In 2019, the average download speeds in the country were more than twice that of less well-connected economies. However, download speeds in Korea appear to lag behind markets such as Singapore, Hong Kong and Japan, as seen in Figure 2, despite having comparable access networks.

Figure 2: Download speed comparison [Source: M-lab, 2019]

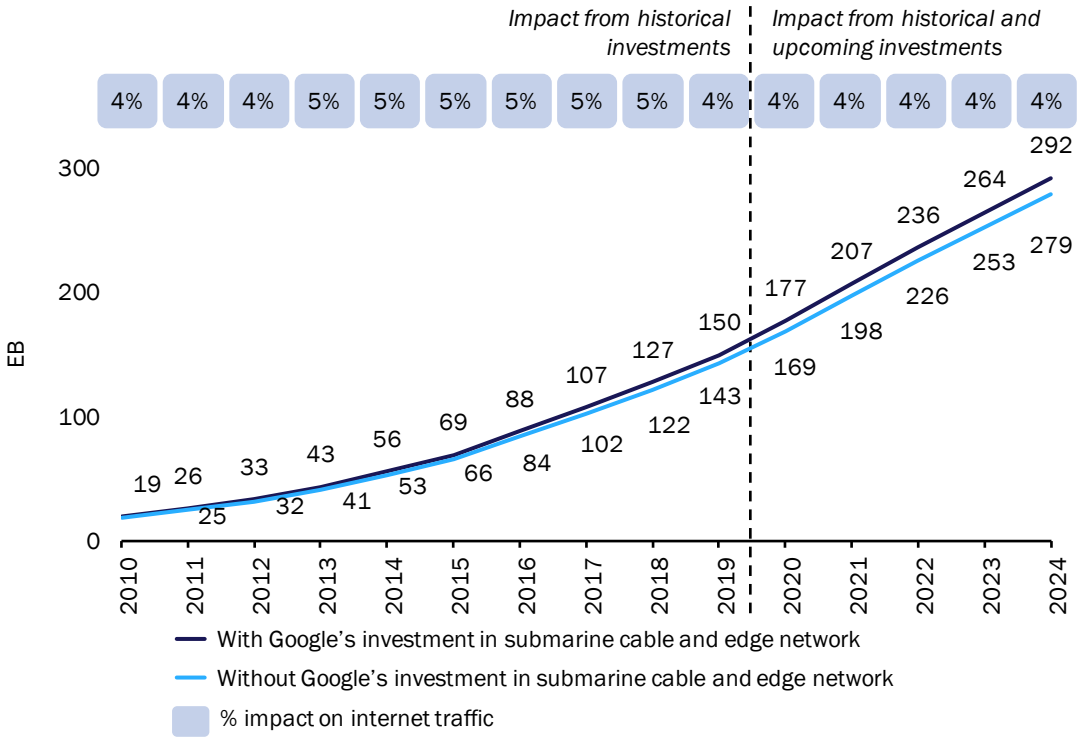


Improvements in latency and internet speed increase ISPs' ability to deliver innovative services such as cloud services, video conferencing and gaming. Low latency is also critical for transactional services, including e-commerce.

The end result of these improvements is greater demand for the internet in South Korea: based on Analysys Mason's modelling, we estimate that internet traffic in South Korea between 2019 and 2024 would have been 4% lower in 2019 had Google not made investments in network infrastructure, as seen below in Figure 3. Further stimulation of network infrastructure investments in South Korea will enable greater traffic growth in the future.

5 Google traffic is a significant contributor to network traffic in APAC – approximately 12% of total uplink and downlink network traffic, according to Sandvine

Figure 3: Impact of Google's investments in edge network infrastructure on internet traffic served by Google's services in South Korea [Source: Analysys Mason, 2020]



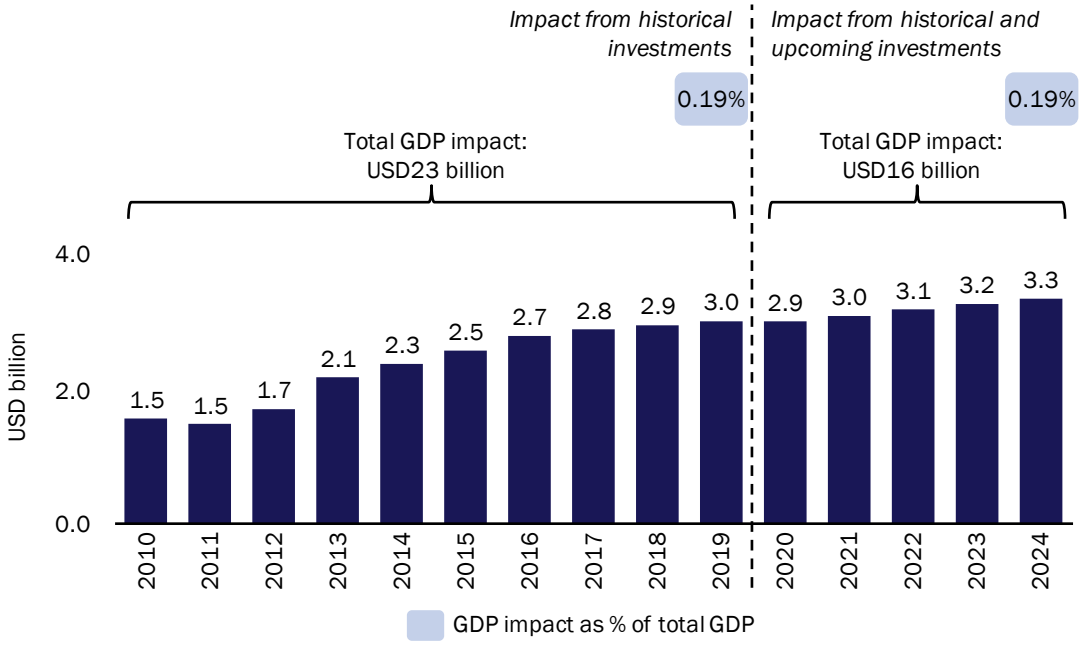
2 Google's network infrastructure investment benefits the internet ecosystem in South Korea, supporting 33 000 jobs and led to USD3 billion in additional GDP in 2019

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 USD23 billion in GDP impact (in real terms[6]) in South Korea from 2010 to 2019; in 2019, we estimate that GDP would have been 0.19% lower (USD3 billion) in a scenario where Google had not made investments in network infrastructure.

Google's continued investments in edge infrastructure, including that supporting the growth of GCP, from 2020 onwards are expected to enable ISPs to handle higher internet traffic. The historical and continued investments are expected to contribute an additional USD16 billion in GDP impact from 2020 to 2024, of which USD3 billion would be in 2024 alone (see Figure 4 below).

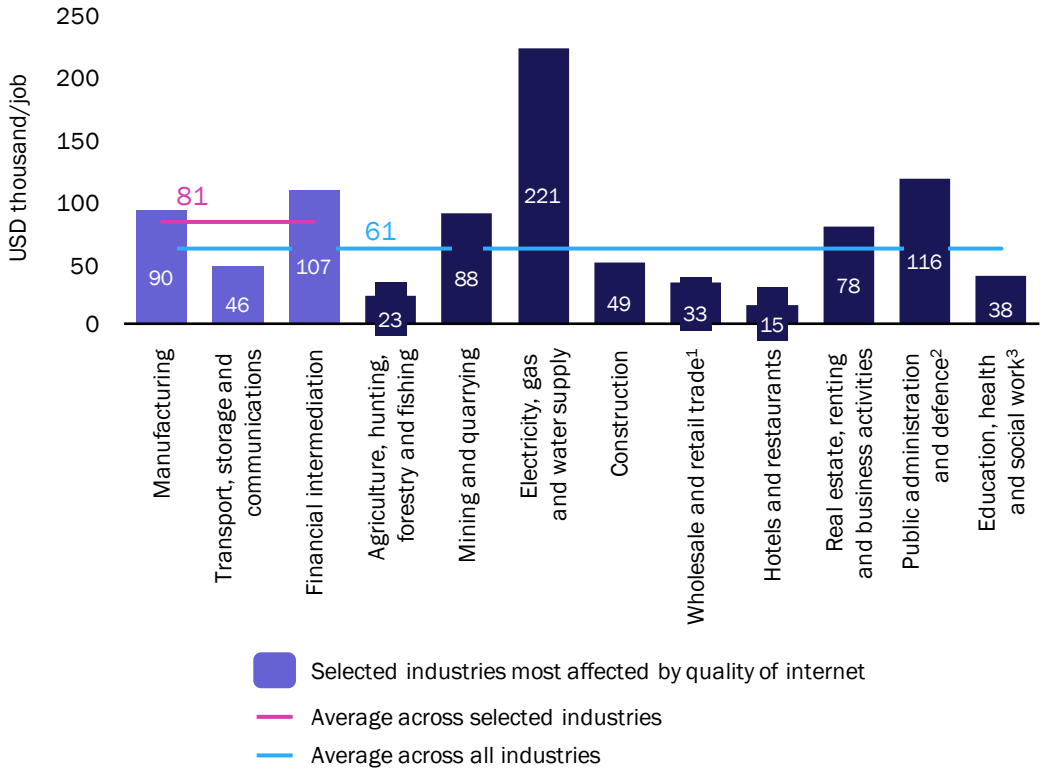
6 GDP figures are in constant USD using 2019 as the base year and using a fixed exchange rate to USD in 2019; GDP statistics in USD are sourced from the World Bank and Euromonitor

Figure 4: Increase in real GDP attributable to Google's network infrastructure investments in South Korea [Source: Analysys Mason, 2020]



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 South Korea, we estimate that, in 2019, the average GVA per job was USD81 000 in industries most affected by the quality of the internet (see Figure 5 below).

Figure 5: 2019 GVA per job by industry in South Korea [Source: Analysys Mason, national statistics authority via Euromonitor, 2020]



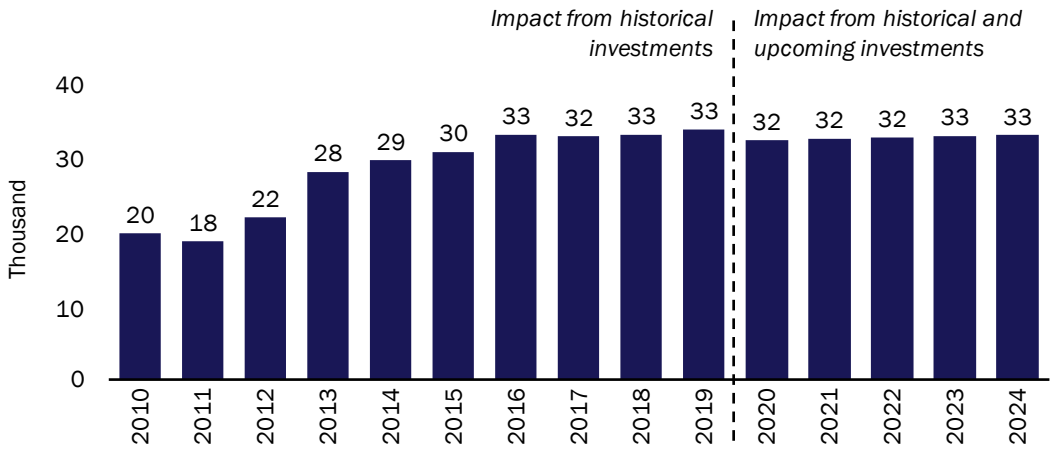
[1] Includes repair of motor vehicles, motorcycles, personal and household goods

[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 its impact on GDP translated into around 33 000 jobs by 2019, which will remain relatively stable at 33 000 jobs by 2024 (see Figure 6 below).

Figure 6: Impact of Google's network investments on job creation in South Korea [Source: Analysys Mason, 2020]



3 Investments in network infrastructure contribute to the reliability and security of the cloud, driving further positive economic impacts as cloud spending expands 15% annually

According to BCG's "Ascent to the Cloud" report, South Korea has strong growth potential. The country's public cloud spend is growing at 15% annually, from USD1.5 billion in 2018 to an expected USD3 billion in 2023. The increase in cloud expenditure is expected to have a cumulative GDP impact of USD45 billion between 2019 and 2023 and support 50 000 jobs in 2023.[7]

Google ranks as one of the top public cloud service providers in the world. At the end of 2019, GCP had been deployed in seven cloud regions in APAC, and in 2020 it launched its cloud region in Seoul with three availability zones.[8]

Google's network infrastructure investments provide route diversity, connecting cloud regions in South Korea to other regions through different paths and enable low service latency, high levels of availability and increased resilience to cable cuts.

Case study: GCP helps Netmarble by providing reliable and scalable infrastructure

Netmarble is a South Korea-based mobile game developer and has become one of the largest mobile gaming companies in the world. GCP began collaborating with Netmarble in 2017 by first helping it with its migration to the cloud. Since then GCP has helped Netmarble to leverage other cloud tools and services to solve business commonly faced by companies in the gaming industry.

7 The studies underlying the cloud market forecasts were conducted before the onset of the COVID-19 pandemic and thus did not include the effects on the economy arising from COVID-19. We have left these forecasts unchanged, although the forecasts used for the main economic impact assessment in this report reflect updated forecasts as of June 2020. The size of the cloud services market may actually increase faster than anticipated as a result of COVID-19

8 Google Cloud Blog, see: https://cloud.google.com/blog/topics/infrastructure/new-gcp-region-in-seoul

Netmarble now uses advanced GCP tools including analytics and machine learning to support game development, manage infrastructure and spread business intelligence throughout its organisation. This has allowed the company to grow without worries due to GCP's reliable and scalable cloud infrastructure.

> "The public cloud aligns with our vision for innovation and is as committed as we are to building better player services with advanced artificial intelligence and reliable, scalable cloud infrastructure."
>
> **Duke Kim, SVP,** Head - Netmarble AI Revolution Center

Besides improving the performance of cloud services, Google's network investments also serve as the underlying infrastructure layer delivering cloud traffic. One particular network advantage is that the GCP customer traffic carried on Google's own network is shielded from internet exposure, making it less likely that it will be attacked, intercepted or manipulated by malicious actors. Given these factors, it will be important for South Korea to provide a conducive regulatory and investment environment to stimulate further investments in the future.