

2022 Innovation Panorama



FTTH APAC Panorama
Post Pandemic FTTH Opportunities
5G Mini Panorama APAC
IoT Mini Panorama APAC

**New Horizons.
New Beginning.
FTTH Council APAC.**



SCAN ME FOR FULL REPORT

1. FTTH APAC Panorama

Broadband status in Asia Pacific

Markets at December 2021



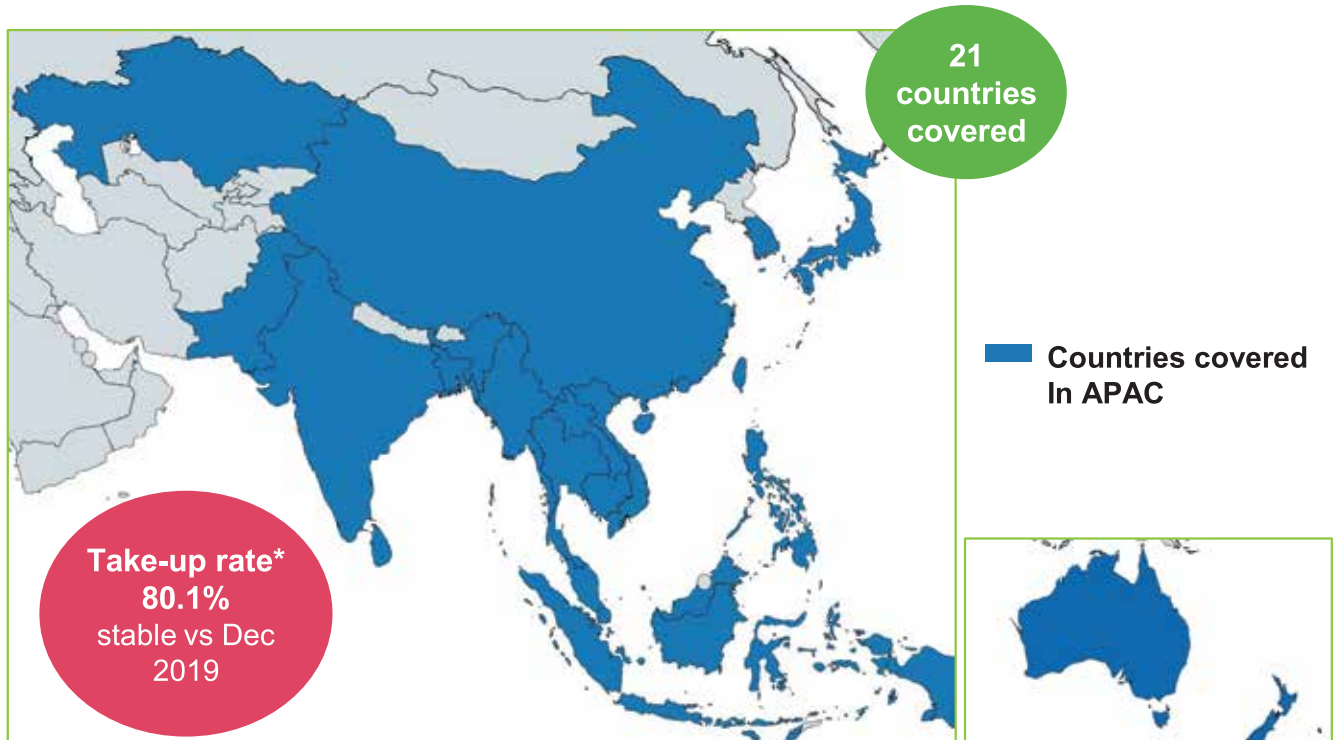
General overview and main trends

FTTH/B figures as at December 2021

As at December 2021 in Asia Pacific (*)

- 591 million FTTH/B subscribers
- 738 million FTTH/B Homes Passed

FTTH Council Asia-Pacific scope at December 2021

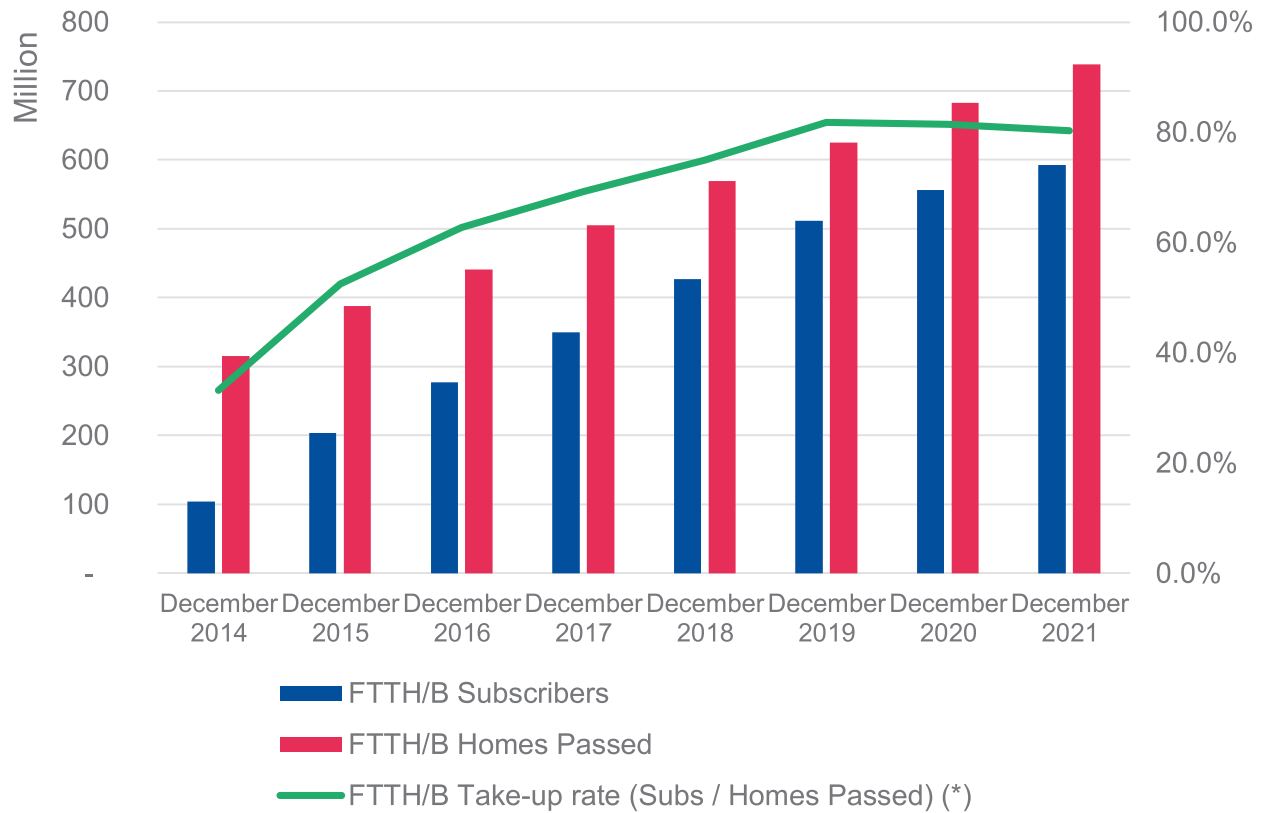


(*) APAC - 21 = Australia, Bangladesh, Cambodia, China, Hong Kong, India, Indonesia, Japan, Kazakhstan, Laos, Malaysia, Myanmar, New Zealand, Pakistan, Philippines, Singapore, South Korea, Sri Lanka, Taiwan, Thailand, Vietnam

*Take-up rate = FTTH-B Subs / FTTH-B Homes Passed

FTTH/B market evolution in Asia Pacific (APAC-21)

In terms of Homes Passed and Subscribers (2014 - 2021)



Trends from 2014 to 2021

FTTH/B Subscribers

x **5.7**

Homes Passed evolution

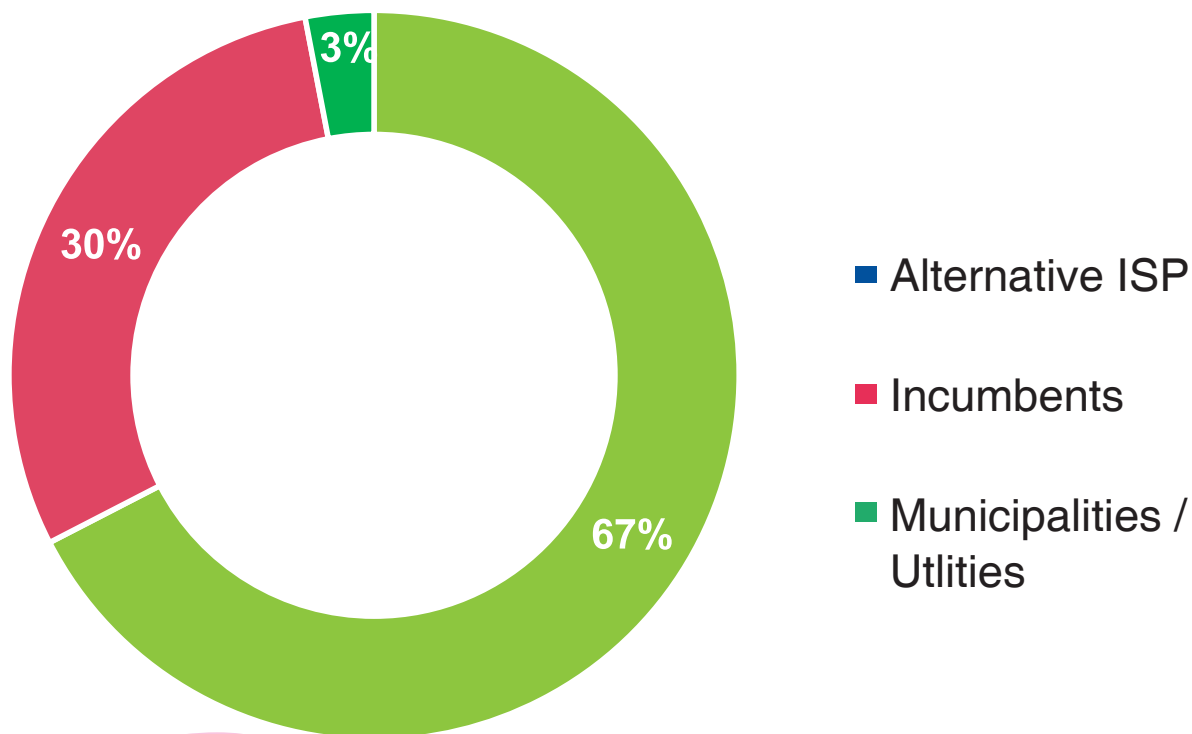
x **2.3**

Source: IDATE for FTTH Council APAC

Private players are taking a leading role in FTTH/B initiatives

- The region has increased the number of FTTx initiatives. During 2021 it was counted more than 130 initiatives in the 21 APAC countries under study.
- **Two thirds** of fibre deployments have been performed by Private players while 30% by public telecom players and 3% by utilities.
- Local Authorities are working with private players also in order to deploy and to reach with fibre more home in isolated areas.

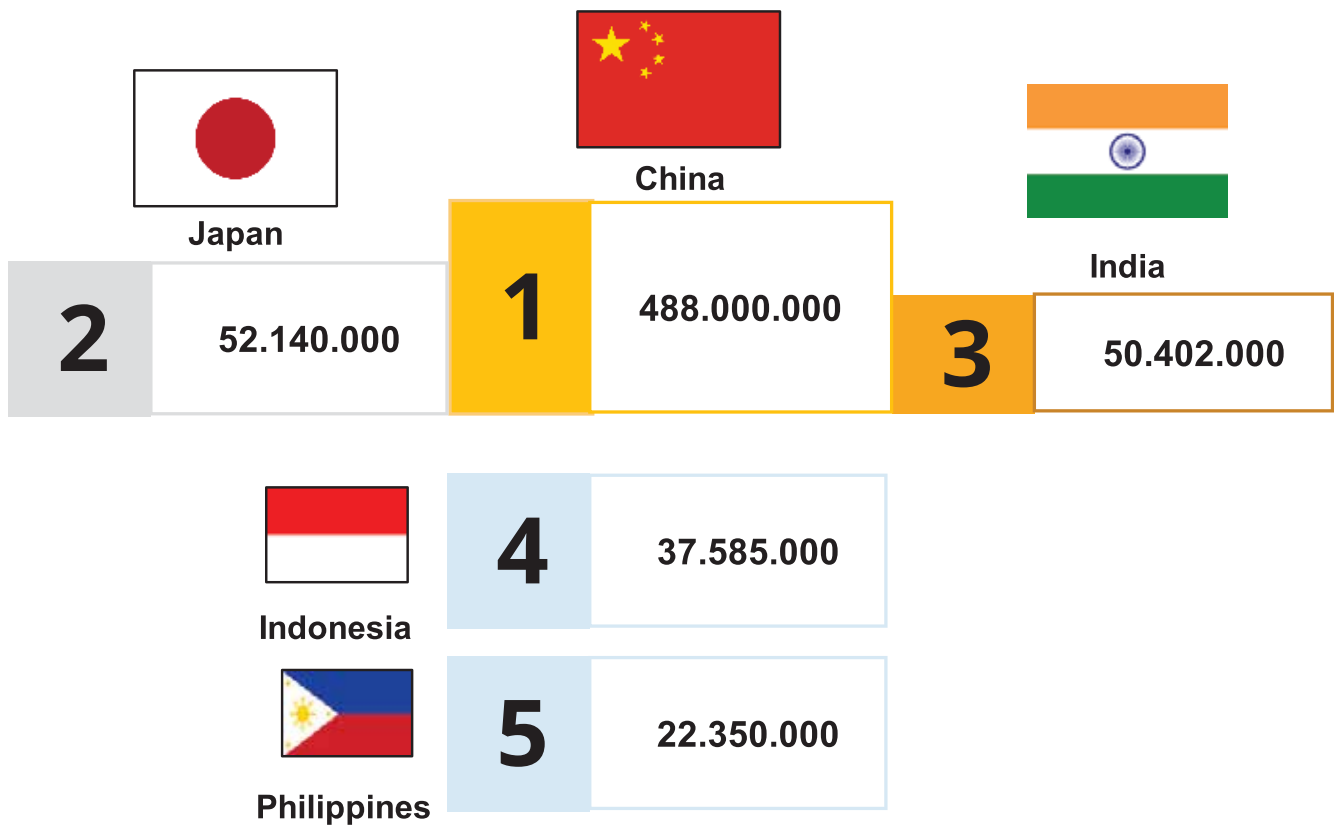
Breakdown of FTTH/B Homes Passed by type of player (%)
Data by December 2021



Source: IDATE for FTTH Council APAC

Private players are taking a leading role in FTTH/B initiatives

Breakdown in terms of FTTH/B Homes Passed Top 5 Asian countries

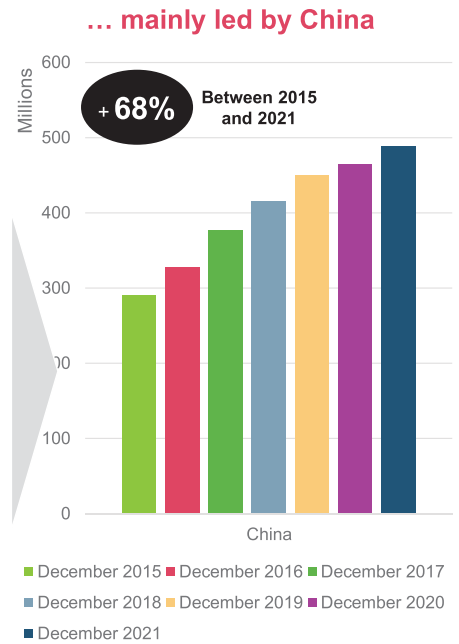
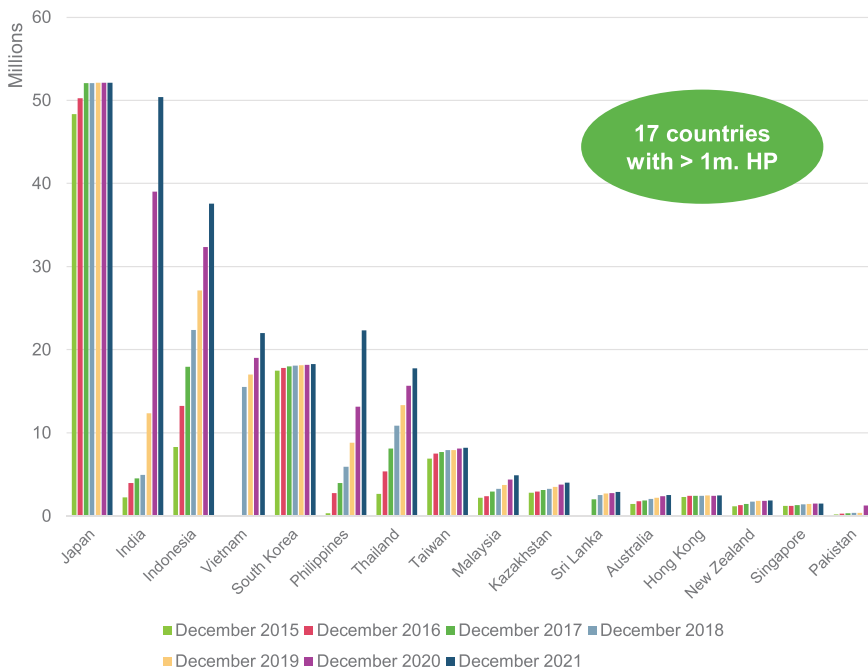


General Ranking: FTTH/B Homes Passed

China accounting for around 67% of total FTTH/B Homes Passed in APAC-21

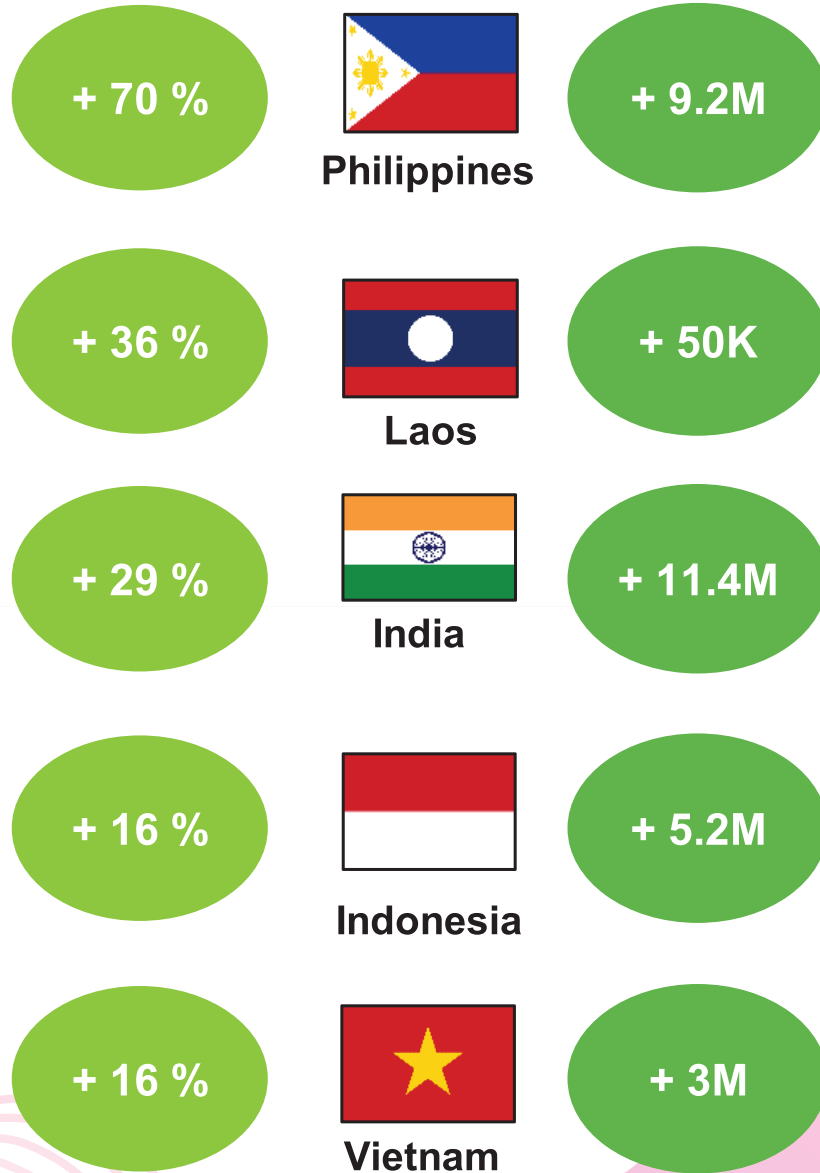
Asia Pacific ranking in terms of FTTH/B Homes Passed over time (in million homes)

Data comparison between Dec. 2015 and Dec. 2021



Top 5 annual growth rates (in %)

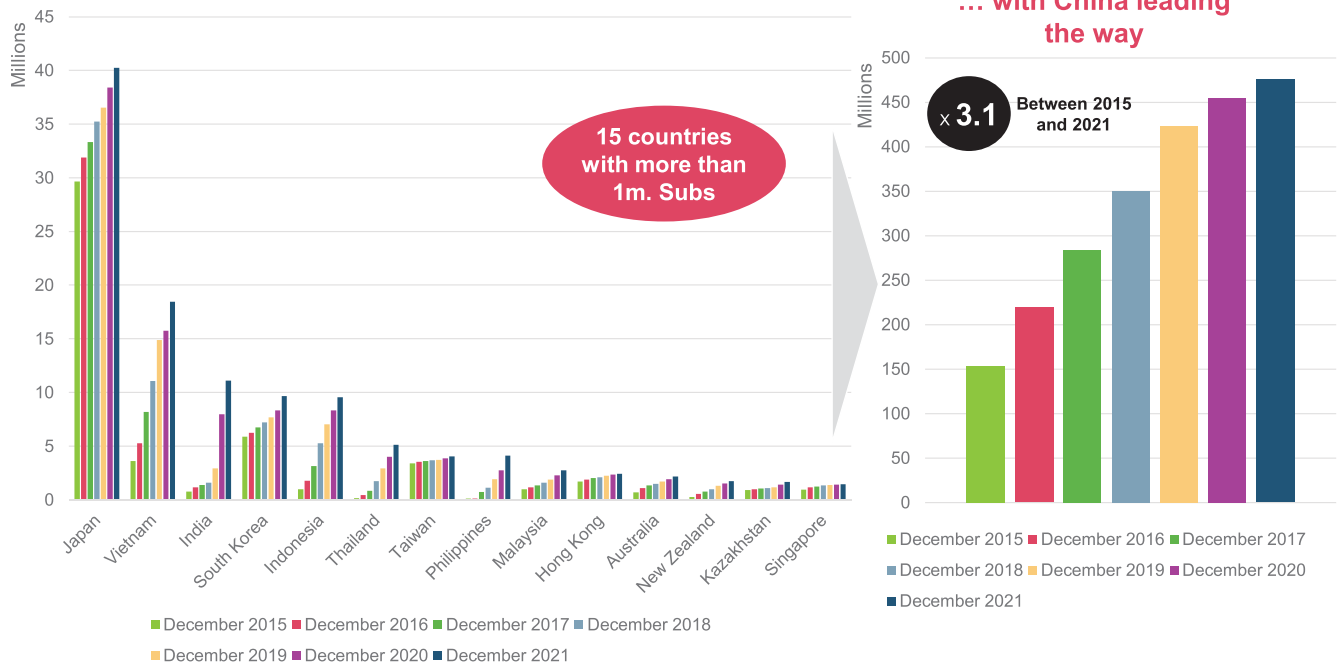
FTTH/B Homes Passed Growth and additional Homes Passed from Dec. 2020 to Dec. 2021)



General Ranking: FTTH/B Subscribers

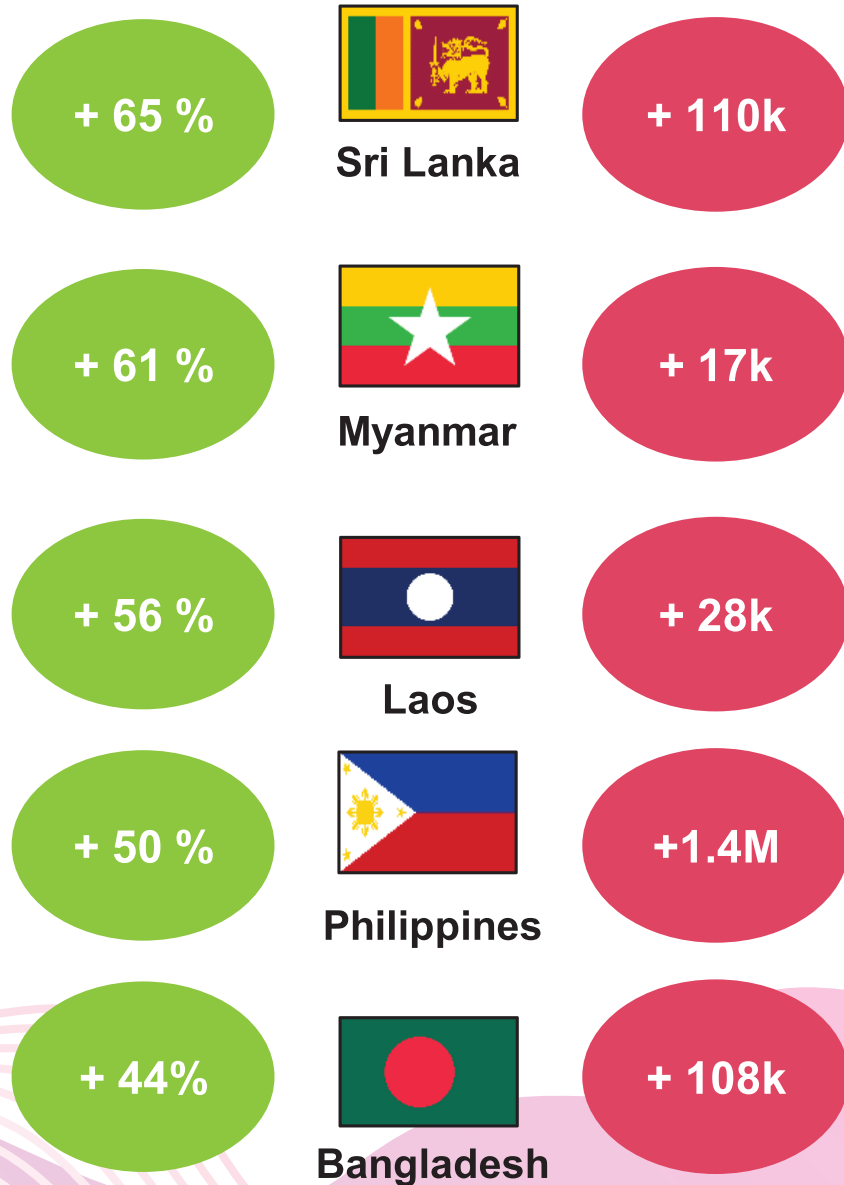
China accounting for around 80% of total FTTH/B Subscribers in APAC-21

Asia Pacific ranking in terms of FTTH/B Subscribers over time
(in million homes) Data comparison between Dec. 2015 and Dec. 2021



General Ranking: FTTH/B Subscribers

Top 5 annual growth rates (in %)
Data from Dec. 2020 to Dec. 2021 (in terms of
FTTH/B Subscribers)



APAC region progressively shifting towards fiber adoption: 36.8 million new FTTH/B subscribers and 55.4 million FTTH/B homes passed added by Dec. 2021 YoY

Trends in 3 main APAC markets



China

China is still moving towards a fiber migration of its fixed networks. The progression is covering more than curve.



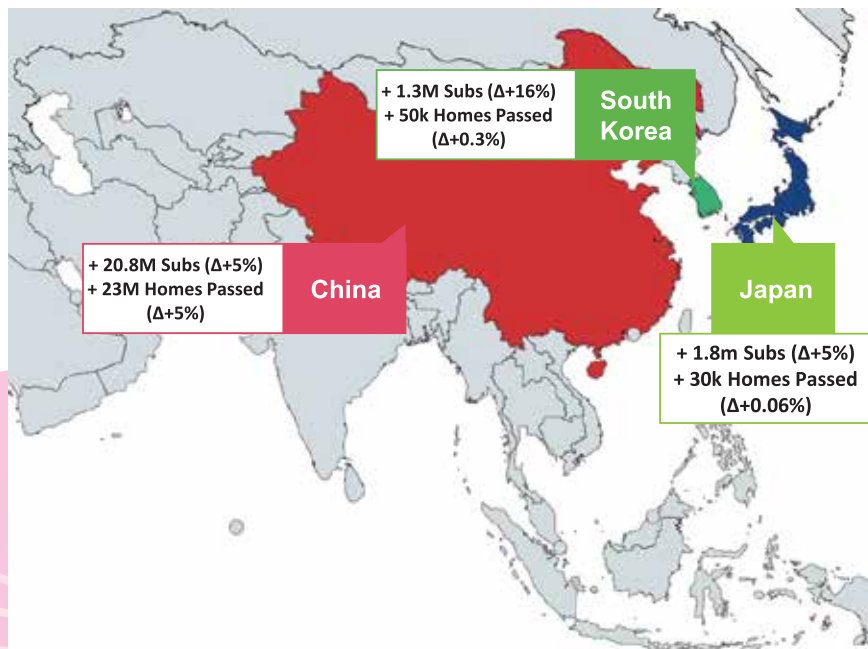
Japan

Japan has a consolidated fiber market and is still trying to increase its take-up rate with better value propositions for final users.

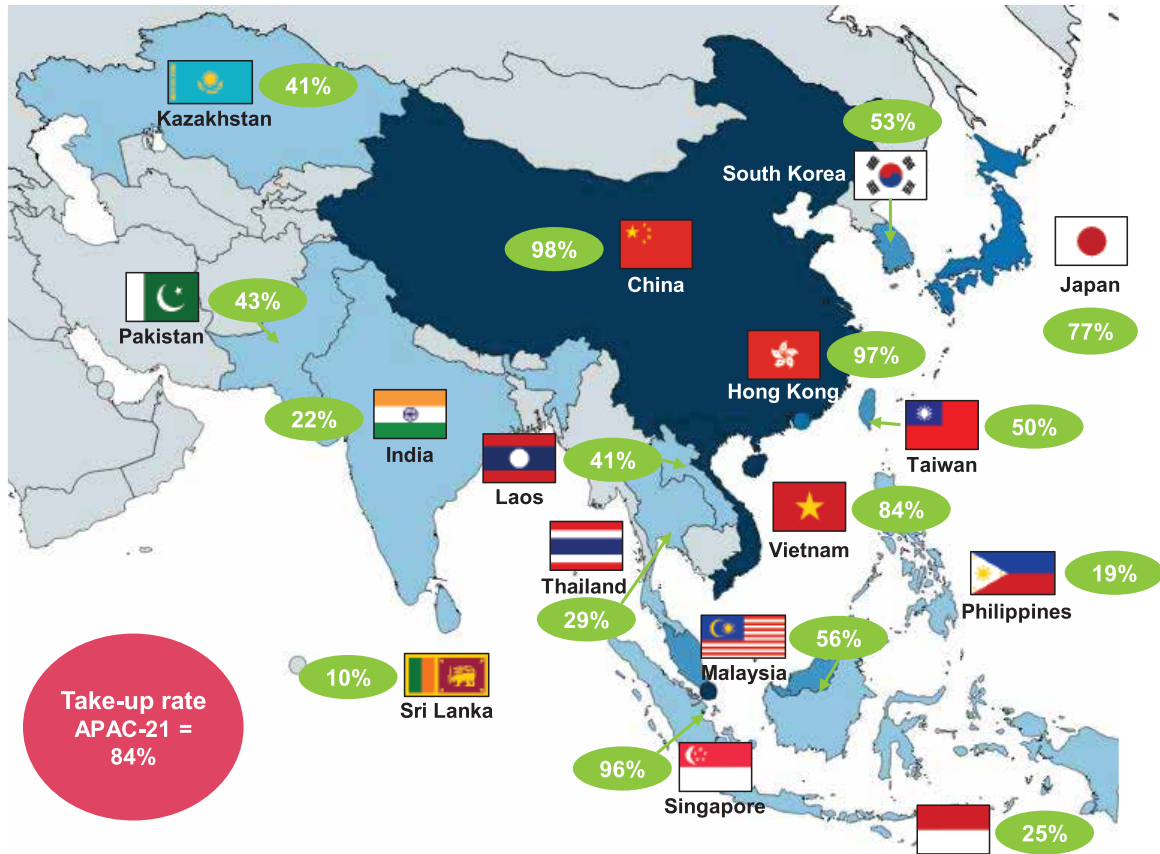


South Korea

South Korean Government is encouraging to migrate 1G solutions to 10G access (10GPON) and to promote fiber adoption to its final users



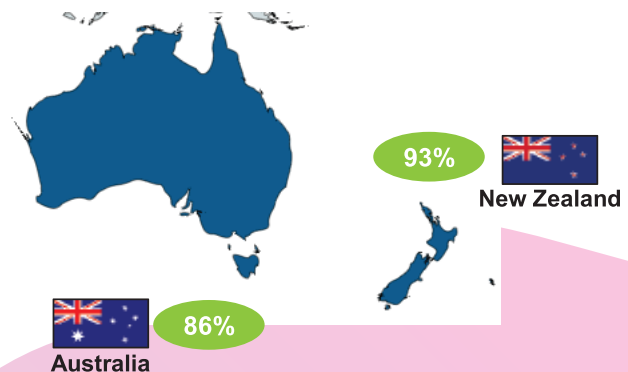
General Ranking: FTTH/B Take-up



*Take-up rate = FTTH-B Subs / FTTH-B Homes Passed

FTTH/B take-up* as at December 2021

- FTTH/B take-up > 80%
- FTTH/B take-up 60 – 80 %
- FTTH/B take-up 40 – 60 %
- FTTH/B take-up < 40 %
- Data not available

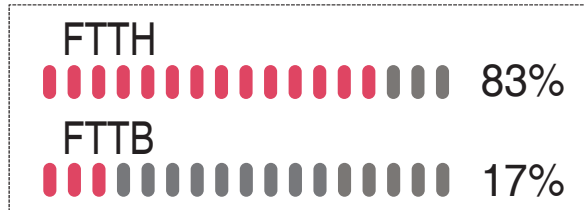


Source: IDATE for FTTH Council APAC

FTTH GPON maintained as the norm in APAC countries

FTTH vs FTTB

APAC has concentrated its consolidating its efforts to deploy full fiber solution the end user. More countries are migrating legacy networks towards full FTTH solutions.



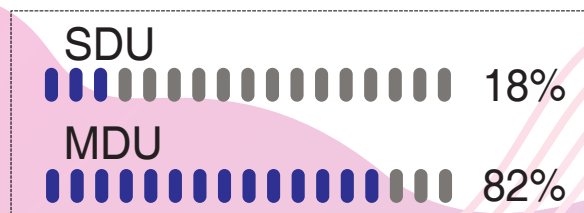
PON vs Ethernet P2P

APAC-21 countries are concentrated in the deployment of PON technologies. Now its observed the announcement of new XGPON projects to reach 10G services.



SDU vs MDU

Countries in APAC tend to have a highly concentrated population, thus explaining the predominance of MDU architecture in the region



APAC : FTTH/B Ranking

Indicators affecting the FTTH adoption

Positive criteria



After Covid-19, data demand grew more than ever, and data consumption is higher than the pre-pandemic levels. This put the industry under pressure, but operators realized that fiber is robust and scalable in time.



Governments in APAC-21 have national broadband plans to promote fiber deployments and reduce administrative barriers.



More players shifting from copper-based and cable-based networks towards full fiber infrastructure.



Fiber network sharing allowing telcos to put more efforts on underserved and isolated areas (Ex. Australia, New Zealand, Japan and China)



New business models towards fiber deployments adopted by utilities and local municipalities, to diversify and to stimulate local economies

Indicators affecting the FTTH adoption

Negative impacts



Still no clear mass-market applications for telcos to monetize fiber-related investments in a fast pace



FTTH investments delayed in several areas due to direct alternative technologies such as Cable (Docsis 3.1/4.0) and G.Fast



Gigabit Capable FWA is becoming more common in isolated areas, thus will delay FTTH deployments in some regions. 5G technology used in high spectrum bands can directly challenge FTTH in the fixed residential market

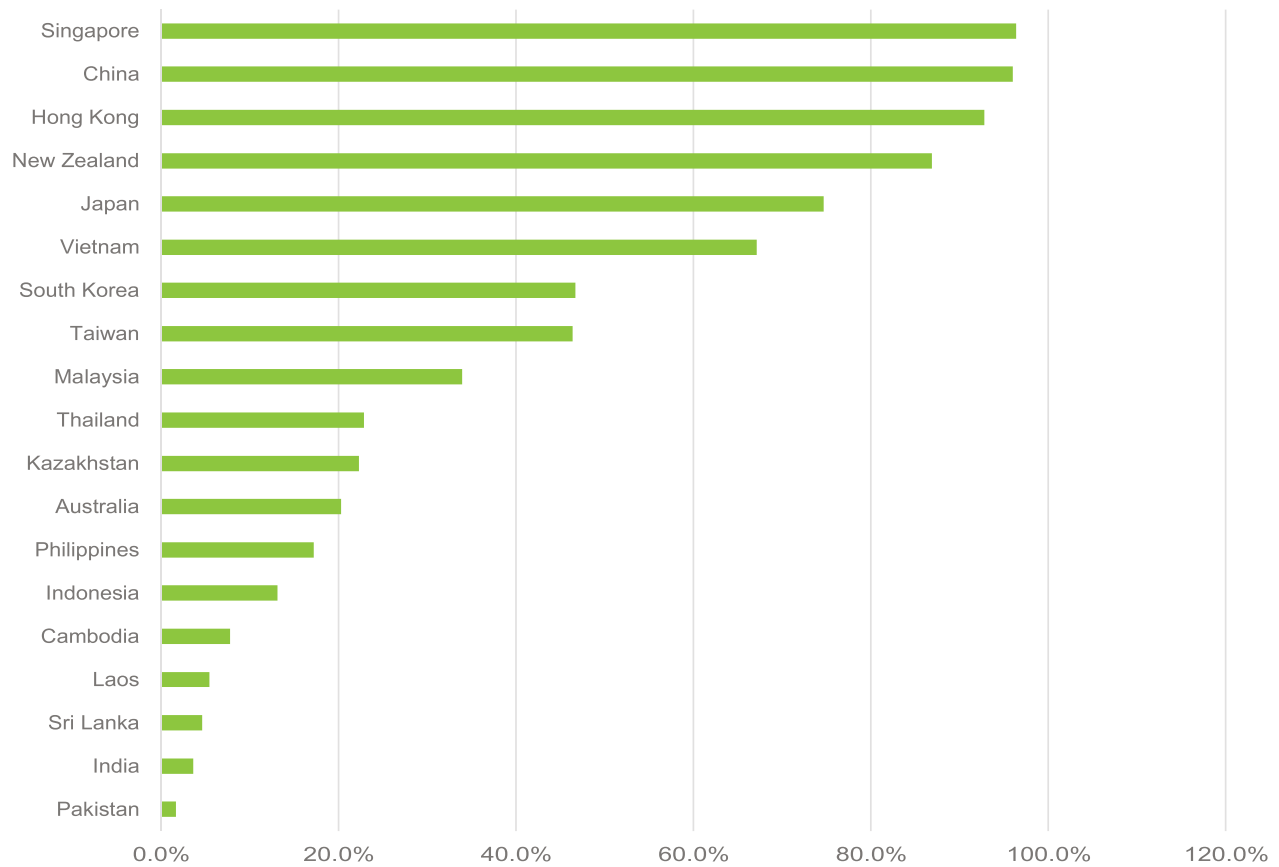


More interventions could be needed from public authorities to consolidate fiber deployments in APAC. Public funding initiatives may not be strong enough to effectively encourage FTTH growth in lagging countries.



Price has a strong incidence on fiber adoption. Price remains the main criterion for adoption, compared to quality, robustness or latency.

Asia Pacific Ranking as at December 2021



Penetration rates in Asia Pacific as at December 2021
(FTTH/B Subscriptions / Households)

- **Includes countries of +200k Households in which FTTH/B subscribers represent at least 1% of total households**
- **Singapore, China, Hong Kong and New Zealand are the 4 leaders in this ranking, mainly due to a proactive state intervention towards fiber expansion.**
- **The migration from legacy networks towards full fiber networks is starting to be evidenced in countries like Vietnam, Indonesia and Philippines.**

Key Conclusions :

Asia Pacific Ranking as at December 2021

FTTH/B coverage reaching a new level

- By Dec. 2021, the 21 APAC countries under study have reached more than 738 million homes with FTTH/B networks reaching in average 64% of their homes.
- Countries like India, Philippines and Laos have experienced strong growth increasing their Homes Passed by more than 20%
- APAC-21 countries are reaching 591 million FTTH subscriptions at December 2021 with a take-up rate of around 80.1%.
- The effort is now made on fiber adoption among Fixed Broadband subscribers in countries where coverage is almost complete nationwide (Japan, Philippines, South Korea, Taiwan).
- Countries like Philippines, Laos, Myanmar and Sri Lanka experienced also strong growth increasing their subscribers by more than 50%.

Key lessons to be learned

- The whole telecom ecosystem has intensified its efforts towards full-fiber connectivity and the pandemic tends to accelerate both deployments and adoption.
- Underserved regions are also affected by the COVID pandemic and their need for reliable networks is now a clear target for the ecosystem
- 5G implications: 5G will be a key factor for the promotion of fiber deployments and is encouraging strong investments from public and private players
- Technological migration and evolution of business models: Evolution from previous years have showed that cable-based and copper-based ISPs have started to diversify their core technologies towards full-fiber.

2. FTTH Opportunities After Covid-19



Executive Summary

1



FTTH MARKETS IN THE WAKE OF COVID-19 CRISIS

- The sector was impacted in terms of its planned deployments for 2020.
- The FTTH market has nonetheless found in this crisis a window of opportunity to target new areas and to request government aid to expand their operation in different countries.
- Relative to other technologies, FTTH is well positioned since the levels of traffic quality of service, latency and continuity now demanded by end users.

2



THE CRISIS PAVED THE WAY FOR NEW FORMS OF WORK

- Teleworking is a new reality that is enhancing novel ways of doing things. It has opened up innovations in the use of technology to boost the economy in times of recession.
- FTTH providers are a key player in the value chain of all industries. Data traffic has most certainly been boosted due to greater teleworking and academic activities since the beginning of the lockdowns. This has led to new and higher average levels of traffic more than 25% above those before COVID-19 in February 2020.

3



PLAYERS RESPONSES TO THE GLOBAL CRISIS

- FTTH infrastructure was tested and overall showed a good average performance worldwide.
- However, after series of cyber attacks stakeholders have identified the need to reinforce security
- Mobility and new bandwidths requirements are demanded by end users.
- The telecom operation is currently being redefined aiming to provide better solutions more efficiently
- New forms digital exclusion have been observed, depending on the availability and quality of connection nationwide. Policy makers should now intervene to promote deployments and migration towards fiber in areas where other legacy technology (copper, cable) was already deployed.

General overview of the FTTH ecosystem

General overview of FTTH ecosystem before the COVID-19 crisis emerged

FTTH markets in a nutshell

Take-up rate*
worldwide
67.3%

585 million FTTH/B subscribers

80% of FTTH/B subscribers in APAC

Top 5 Countries	FTTH/B Subscribers at Dec 2019
China	372.28m
Japan	39.07m
Russia	22.09m
USA	18.48m
South Korea	15.52m

Source: IDATE DigiWorld, World FTTx markets, July 2020

*Take-up rate = FTTH/B subscribers over FTTH/B homes passed

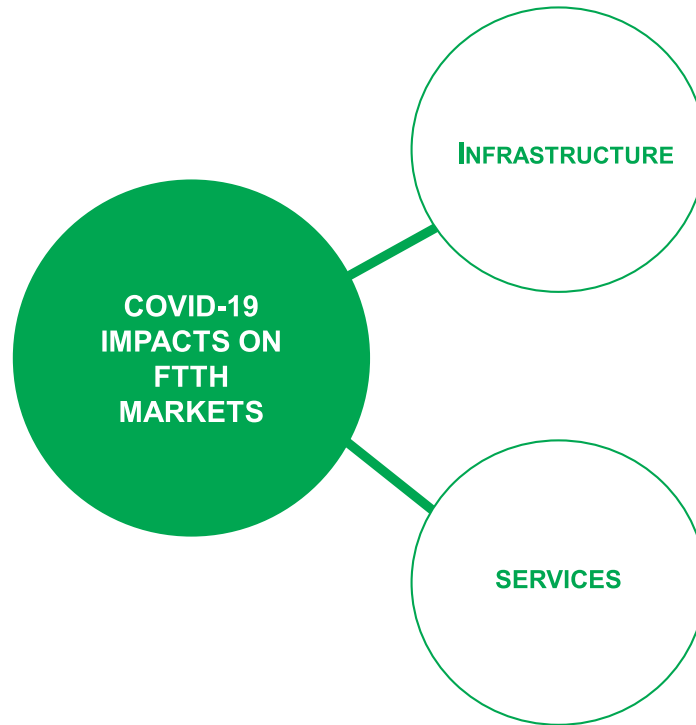
Geographical breakdown of FTTH/B subscribers, Dec 2019 (millions)



Source: IDATE DigiWorld, World FTTx markets, July 2020

Impacts on FTTH infrastructure and services during the COVID-19 crisis

The current crisis will involve both challenges and opportunities for the whole telecom ecosystem. As with the entire economy, the health crisis turned FTTH markets upside down.



- Social distancing caused delays on FTTH deployments in both urban and rural areas
- Risks of overloaded Internet traffic due to lockdown measures and people working from home

CHALLENGES AND THREATS FOR TELCOS

- Pressure on fixed networks caused lower throughputs for end users
- Risks of congestion affecting operator QoS
- Data privacy concerns when collecting data to track the spread of the virus

With a great many people working from home, the boom in network usage can justify new investments towards broadband technologies including FTTH and 5G – with no distinction between urban and rural areas

OPPORTUNITIES TO BE ADDRESSED

- A variety of new measures to improve end-user experience while at the same time attracting potential new customers with higher data caps or discounts
- Anonymised data collection and proactive collaboration with governments to efficiently track the spread of COVID-19

The main implications of the COVID-19 crisis for telcos

- By the end of 2019, 73% of FTTx subscriptions worldwide were based on FTTH/B technologies. IDATE estimates that this will reach 860 million by 2024, at an average annual growth rate of 8% from 2019 onwards.
- Due to the COVID-19 crisis and the lockdowns in force worldwide, FTTH deployments and investments were significantly affected in 2020. But while working at home became the norm, the need for reliable and robust speeds is more important than ever, and more especially in remote areas where high-speed broadband connectivity is not currently deployed.
- The COVID-19 crisis reshuffled the cards of fiber expansion in the years ahead. With networks being essential to connect the world in times of health crisis, FTTH networks will surely be a key priority on the agendas of some governments and most players in the post-COVID-19 environment.

KEY QUESTIONS FOR TELCOS

PERATIONAL

- With the need for reliable and robust connectivity becoming ever clearer, will operators be more focused on underserved areas when deploying broadband infrastructure ?
- Will there be delays in the provision of fiber networks ?
- What are the main consequences of the crisis for national broadband plans? What are authorities doing to support telecom sectors?

FINANCIAL

- What will be the major effects of COVID-19 on long-term investment decisions?
- How to readjust cost structure to eventually cope with short- and mid-term revenue losses?
- With telcos taking exceptional measures to support the unusual flow of data and to improve end-user experience, how does that affect their financial situation?
- How to guarantee customer satisfaction while operator networks are put under pressure, with people needing networking services more than ever?

Asia-Pacific

What were the key responses to COVID-19?



Top Asian countries in terms of FTTH subscribers as at December 2019 (in millions)



372m



39.1m



13.7m



8.8m

Source: IDATE DigiWorld, *FTTH Opportunities after COVID-19*, September 2020

- In China, the 'Big Three' telcos have been investing massively in fiber and 5G to support an unexpected surge in network usage, and to assist the healthcare industry in epidemic control.
- In Indonesia, the XL Axiata fiberisation programme (known locally as 'fiberisasi') has been implemented in all provincial capitals and large cities, especially in areas experiencing high levels of data growth/demand due to COVID-19 crisis and lockdown situations
- In the Philippines, PLDT ensure the same level of capex compared to 2019 to address growing data demand (+25% in the lockdown period in the country) and to accelerate the ongoing migration of DSL towards full fiber technologies.

The key consequences for telco businesses behind the COVID-19 crisis

OPERATIONAL CHALLENGES

- 1 Social distancing introduced worldwide had a huge impact on the workforce, creating delays in fiber deployments in selected areas
- 2 With people working massively from home, fixed networks came under heavy pressure due to sudden traffic increases
- 3 Lockdown measures and social distancing encouraged people to move out of densely populated areas, preferring isolated areas but which often lack broadband connectivity
- 4 Ensure a high quality of service (QoS) for end users to reduce churn

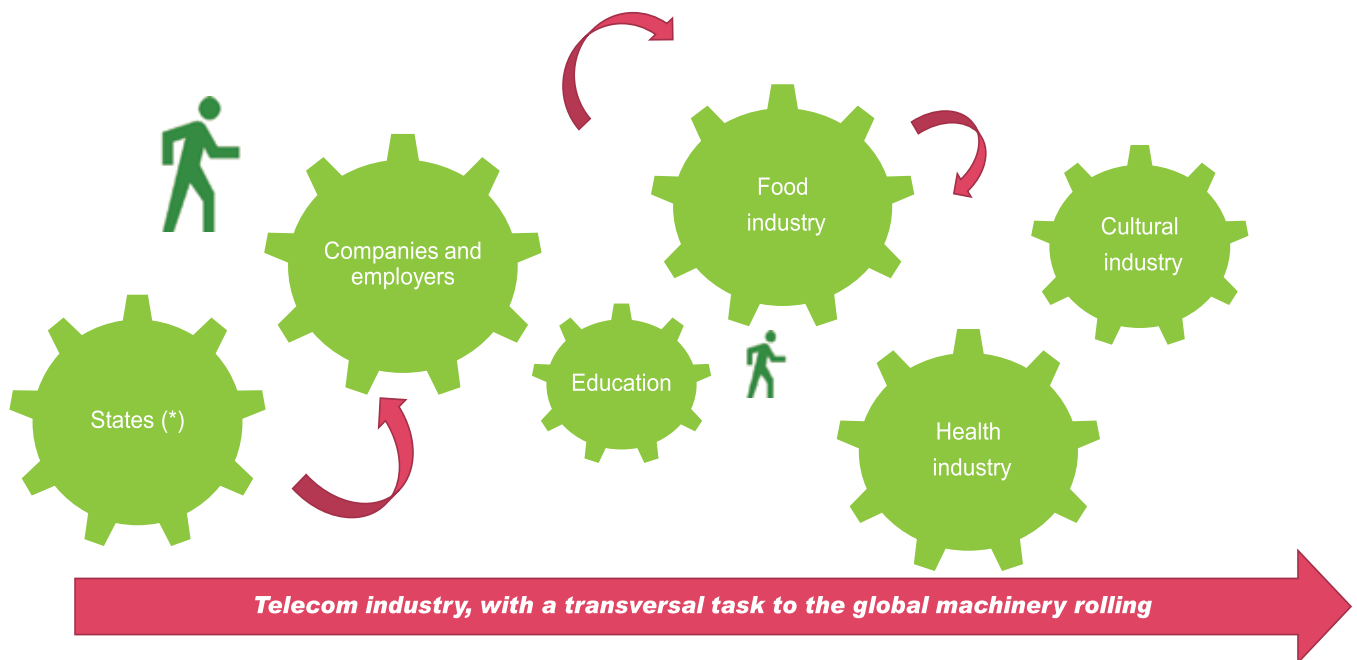
FINANCIAL RISKS

- 1 **Operational disruptions** have **financial implications** in both medium and long-term periods
- 2 COVID-19 delayed **fiber and 5G builds**, which affects **financial stability and telco cost structures**
- 3 In the **post-COVID-19 era**, there could be a huge **call for broadband connectivity**, even more in rural areas, thus **putting operator capex projections under pressure**
- 4 The pandemic could **put pressure on telco debt-reduction programmes and jeopardise their future investment plans towards fiber/5G expansion**

A new way of working

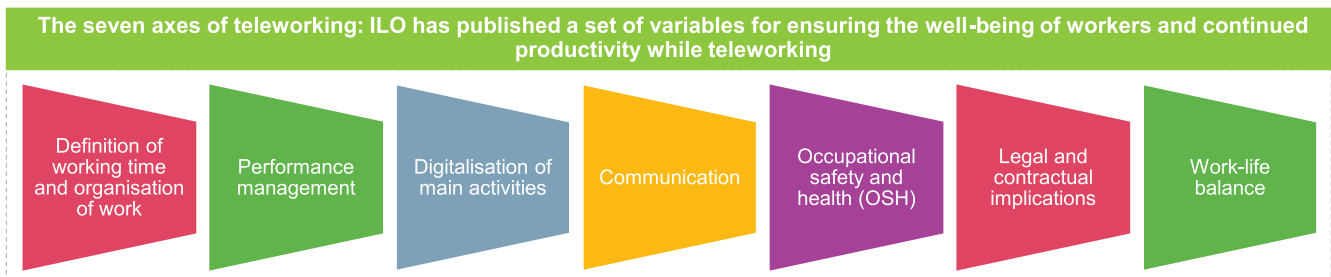
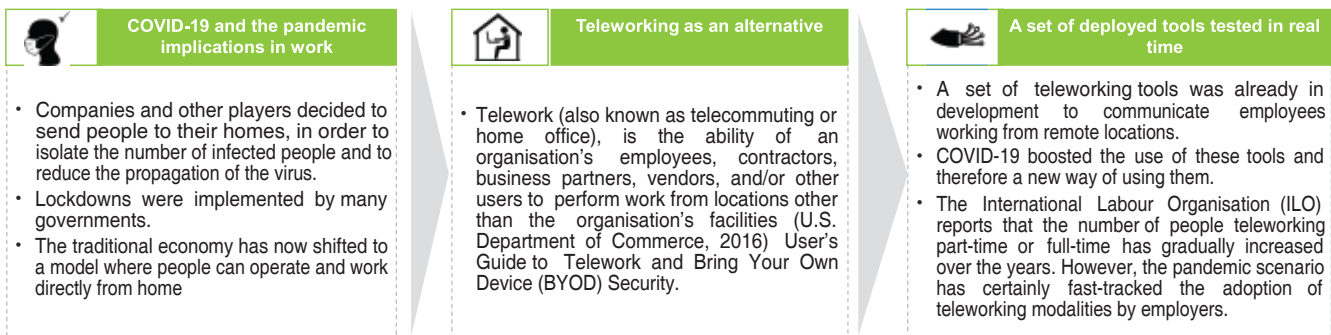
Economic consequences of the COVID-19 crisis

With many players impacted by COVID-19, from commercial to cultural, telcos played a truly cross-cutting role in keeping the economy up and running through teleworking solutions.



(*) International organisations such as WHO or the World Bank are considered external resource bodies to government, a 'State helper'

COVID-19 boosted the prevalence of teleworking tools in the lockdowns (1/3)



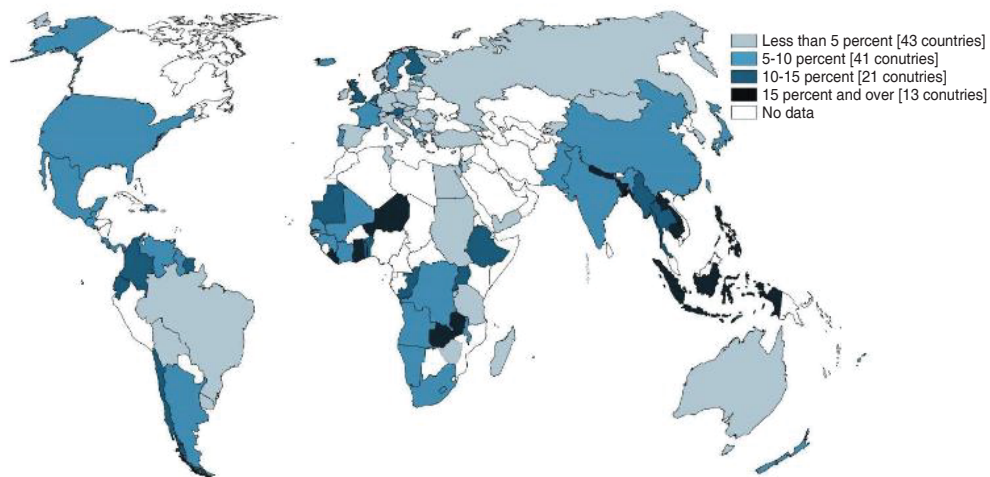
COVID-19 boosted the prevalence of teleworking tools in the lockdowns (2/3)

Teleworking was already without doubt 'an option' for many players before COVID-19. Some of them have faced up to reality during the pandemic period

Europe: A growing trend before COVID-19

- Before COVID, regular or occasional teleworking (home-based telework and mobile telework combined) varied from 30% or more in Denmark, the Netherlands and Sweden. More than 10% observed in the Czech Republic, Greece, Italy and Poland. (Eurofound and ILO, 2017)

Percentage of workers that are home-based (all employment statuses), 2019 - ILO



Note: This figure includes all types of home-based workers, including teleworkers.

Source: ILO, World Bank

Americas: North America leading the teleworking option

- Before COVID, 20% of US workforce were regularly or occasionally working from home or an alternative location. More than 5% were fully home-based.
- Argentina reports that 1.6% of the workforce was teleworkers in 2019.
- In Canada, a financial services institution typically had only 5% of its workforce working remotely before COVID-19 crisis. The pandemic situation prompted the bank to make a sweeping reappraisal of its workplace policies. It anticipated that as much as 80% of its staff—about 36,000 employees—may adopt new flexible working.

APAC: A region with teleworking already implanted in large economies

- Before COVID, ILO registered 16% of teleworkers in Japan.

COVID-19 boosted the prevalence of teleworking in the lockdowns (3/3)

Once lockdowns were implemented in March 2020, network traffic was boosted. This challenged available capacity mainly by growth in teleworking, academic activities and recreational interests.

Data traffic was impacted in all existing types

Traffic classification	Peak traffic	<ul style="list-style-type: none"> • It measures traffic in very demanding periods, at times when network usage is high. • It challenges network capacity for telecom players, helping them to understand how to better dimension its infrastructure. • Video content (from video conferences in remote working or just video on demand) is a service that affects peak traffic.
	Total traffic volume	<ul style="list-style-type: none"> • It measures the total data that is exchanged among users. • Data is registered in time intervals and helps to understand real network usages • Total traffic volumes may vary with time according to content demands and new ways of using Internet.

On average, peak traffic now has reach a new normal – at least more than 20% above the peak traffic levels before COVID-19

1.3 billion	Number of inhabitants of OECD countries. A large portion of this number is working and studying from home.
+35%	Increase in global Internet bandwidth during 2020, compared to +26% growth in 2019
618 Tbps	Total international bandwidth during 2020, three times more bandwidth than at end 2016.
+48%	Average increase of total international Internet traffic volume during 2020.
+47%	Average increase in peak Internet traffic during 2020.
+60%	Increase in Internet traffic experienced by main Internet Exchange Points (IXP) after lockdowns

Source: OECD, Nokia, Telegeography