Digital Transformation
COVID-19 Digital Transformation for Digital Economies@COVID-19 in the Asia-Pacific Region

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Joint study by ITU Asia-Pacific, Windsor Place Consulting and Huawei for the ITU work in the areas of policy, regulation, infrastructure and network development in Asia and the Pacific

Introduction

- The world has entered the **first global pandemic of the Internet age**. As part of an effective response to COVID-19, ICT infrastructure and systems are core inputs for economies and the well-being of societies.

- Governments around the world have emphasised ***'flattening the curve'*** to minimise the spread of the virus. However, flattening the curve involves practising social distancing and lockdown, which come at enormous economic cost. Significantly, information and communication systems can lower such economic costs and increase the effectiveness of overall responses to the virus.

- The **main objective today is to assess the digital connectivity gap analysis in Asia-Pacific, how wireless and mobile broadband digital technologies promote digital inclusion and to identify the key regulatory initiatives in response to the COVID-19 pandemic**. From there, such experiences need to learnt from in order to drive global and regional recovery and the arrive at the 'new normal'

Overview

1. Overall broadband status and it's impact to national economic/ social development

2. Study on the importance of digital infrastructure to Asia-Pacific socioeconomic transformation

3. Supportive Policies in Response to COVID-19

4. Optimal Spectrum Management

5. Conclusions and Recommendations

1. Overall broadband status and it's impact to national economic/ social development

Global policy settings – Broadband Targets

- In 2018 the Broadband Commission launched a revised framework *2025 Targets: "Connecting the Other Half".*

2025 Targets: Connecting the Other Half	
#1	**All countries should have a funded national broadband plan or strategy, or include broadband in their universal access and services definition**
#2	**Entry-level broadband services should be made affordable in developing countries, at less than 2% of monthly gross national income per capita**
#3	**Broadband-Internet user penetration should reach: 75% worldwide, 65% in developing countries, and 35% in least developed countries**
#4	60% of youth and adults should have achieved at least a minimum level of proficiency in sustainable digital skills
#5	40% of the world's population should be using digital financial services.
#6	Un-connectedness of Micro-, Small- and Medium-sized Enterprises should be reduced by 50%, by sector
#7	Gender equality should be achieved across all targets

- **These targets which intended to be both aspirational and achievable should also be embraced by Asian countries.** There is considerable value large urban areas (with generally lower costs of provisioning) to set even more challenging targets for higher speed broadband access.

BROADBAND COMMISSION FOR SUSTAINABLE DEVELOPMENT

The growing importance of broadband to national economic/ social development (1)

Broadband and economic and social benefits:

BROADBAND CHARACTERISTICS
- coverage
- penetration
- cost
- speed
- reliability

PRIMARY EFFECTS
- lower cost and higher quality communications
- lower cost of information
- better access to products and services

ECONOMIC IMPACTS
- greater productivity and efficiency
- easier to expand markets geographically
- enabling new business models – ‘digital disruption’
- enabling Smart Cities
- new products for consumers
- cheaper service delivery
- telecommuting and online marketing

SOCIAL IMPACTS
- better access to information and education
- social inclusion
- better access to government services
- enabling UN Sustainable Goals
- digital banking services
- improved safety and security

Importance of the digital economy

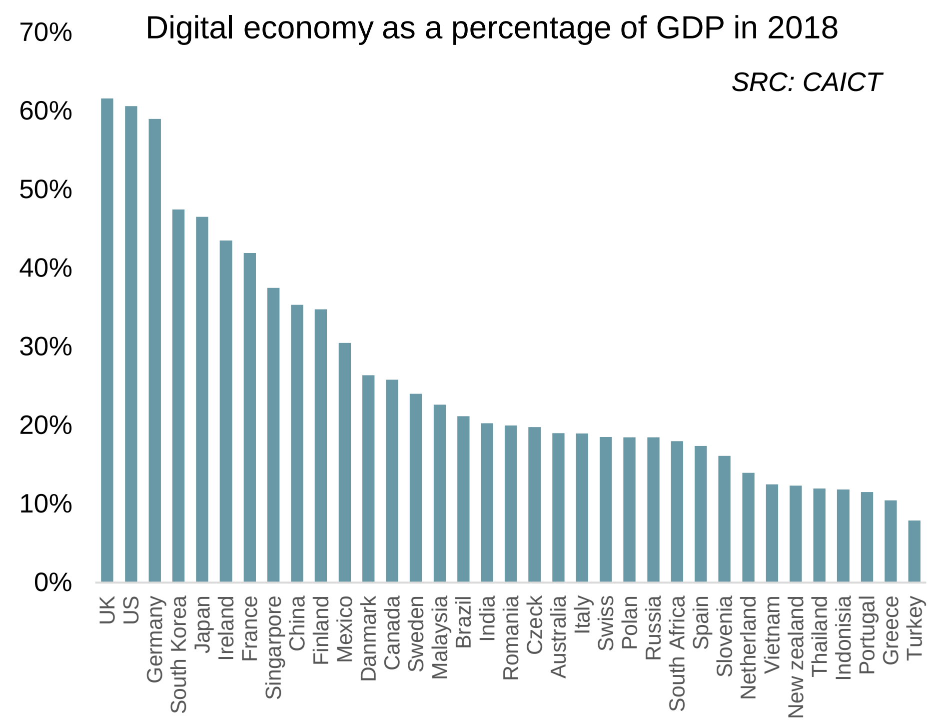
Table Potential impacts on value creation and capture from an expanding digital economy, by its components and actors

	ACTORS				
DIGITAL ECONOMY COMPONENT	**Individuals (as users/ consumers and workers)**	**MSMEs**	**Multinational enterprises/ digital platforms**	**Governments**	**ECONOMY-WIDE IMPLICATIONS**
Core, digital sector	New jobs for building and instaling ICT infrastructure. New jobs in telecom and ICT sector, especially ICT services.	Greater inclusion under suitable circumstances or spillovers/domestic linkages. Increased competition from cloud-service providers.	Investment opportunities for companies that meet high capital, technological and skills requirements.	Attracting investment. Tax revenues from the economic activity created.	Increased growth, productivity and value added. Employment creation. Investment and diffusion of technologies; R&D likely located in high-income countries. Mixed trade impacts.
Digital economy	New jobs in digital services, especially for highly skilled people. New forms of digital work, including for the less skilled.	New opportunities in digital ecosystems. Increased competition from foreign digital firms.	Enhanced productivity from data-driven business models. Greater control of value chains using platform-based business models. New opportunities in the sharing economy.	More tax revenue resulting from increased economic activity and formalization of enterprises. Lost customs revenue from digitalization of products.	Higher growth, productivity and value added. Employment creation/ losses. Higher investment. Aggregation of digital firms in some locations. Mixed trade impacts. Market concentration.
Digitalized economy	New jobs in ICT occupations across industries. Need for new skills as higher-value roles are redesigned using digital tools. Greater efficiency of services received. Job losses or transformation due to digitalization. Risk of worsened working conditions. Improved connectivity. More choice, convenience, customization of products for users and consumers. Lower consumer prices.	Platform-enabled market access. Reduced transaction costs. Risk of "race to the bottom" in markets vs. ability to find a niche. Lost opportunities due to automation (e.g. logistics, business processes). New roles in service provision. New business opportunities for digitalized enterprises.	Emergence of platform firms with data-driven models. Gains from efficiency, productivity and quality. Opportunities for the monetization of data. Increased competitive advantage of digital platforms Increased market power and control of data value chain. Leading digitalization in different sectors.	Increased efficiency of services through e-government. Increased revenue from customs automation. Unclear impact on tax revenue: increases from higher economic activity; losses from tax optimization practices by digital platforms and MNEs. Data-driven opportunities to meet various SDGs.	Growth through improved efficiency in sectors and value chains. Productivity improvements. Innovation impacts. Potential crowding out of local firms in digitally disrupted sectors Potential automation in low and medium-skill jobs. Wider inequality. Mixed trade impacts. Impacts on structural change.

A 2019 UNCTAD Report on the digital economy highlighted the potential impacts
on value creation on embracing the digital economy.

Source: UN, *Digital Economy Report 2019, Value Creation and Capture for Developing countries*.
Available at https://unctad.org/en/PublicationsLibrary/der2019_overview_en.pdf

Digitalization is a key contributor to nations' economy



Digital economy refers to an economy that is based on digital computing technologies, although we increasingly the common meaning is conducting business through markets based on the internet and the WWW.

The growing importance of broadband to national economic/ social development (2)

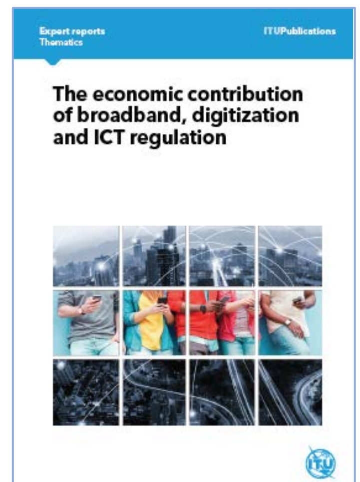
Communications technologies contribute to economic growth and development: In multiple studies the positive influence on economic growth of telecommunications infrastructure, mobile telephony adoption and broadband penetration has repeatedly been demonstrated. Various studies cited by ITU reach conclusions such as:

- a 10% increase in broadband penetration is associated with 3.6% increase in efficiency (46 US States during the period 2001-2005);
- a 10% increase in broadband penetration raises per-capita GDP growth by 0.9-1.5 percentage points (25 OECD countries between 1996 and 2007); and
- a 10 % increase in broadband penetration yielded an additional 1.38 in GDP growth (120 low- and middle-income countries 1980-2002).

Quantifying the impact of mobile broadband on GDP :

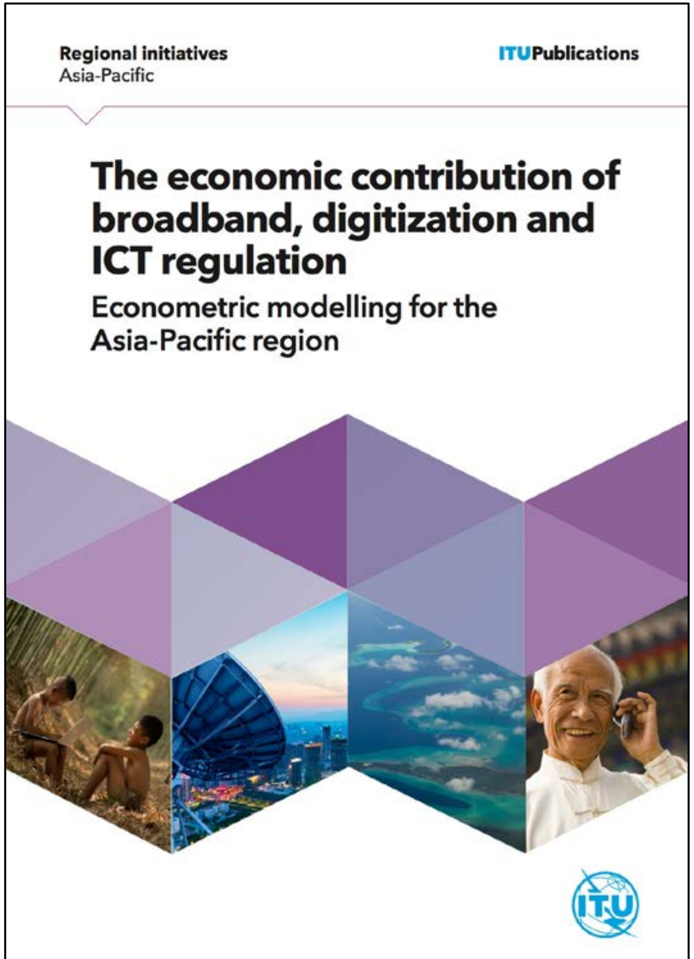
A major UK study found that "on average a 10 percent increase of mobile broadband adoption causes a 0.6–2.8 percent increase in economic growth depending on the model specifications"

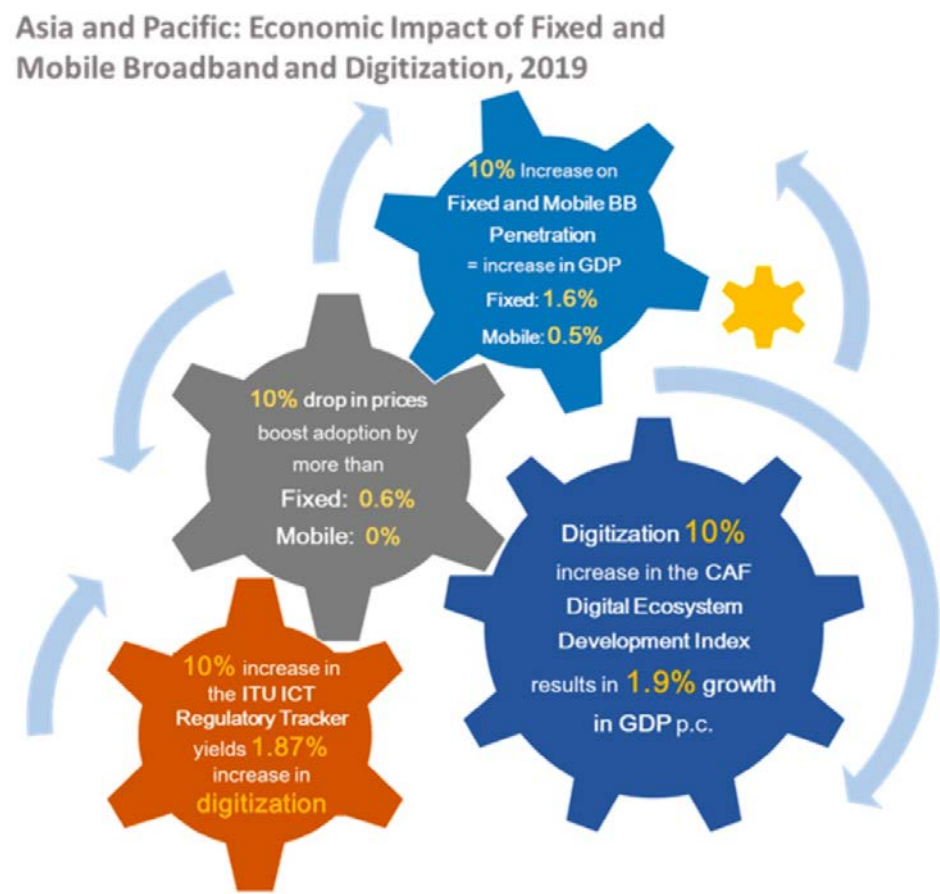
Source:https://spiral.imperial.ac.uk/bitstream/10044/1/46208/2/Goodridge%202017-05.pdf



In the period 2004 to 2015, the economic impact of mobile broadband is higher than digitization and fixed broadband. A 10% increase in MB produced a 1.5% in GDP

The growing importance of broadband to national economic/ social development (3)



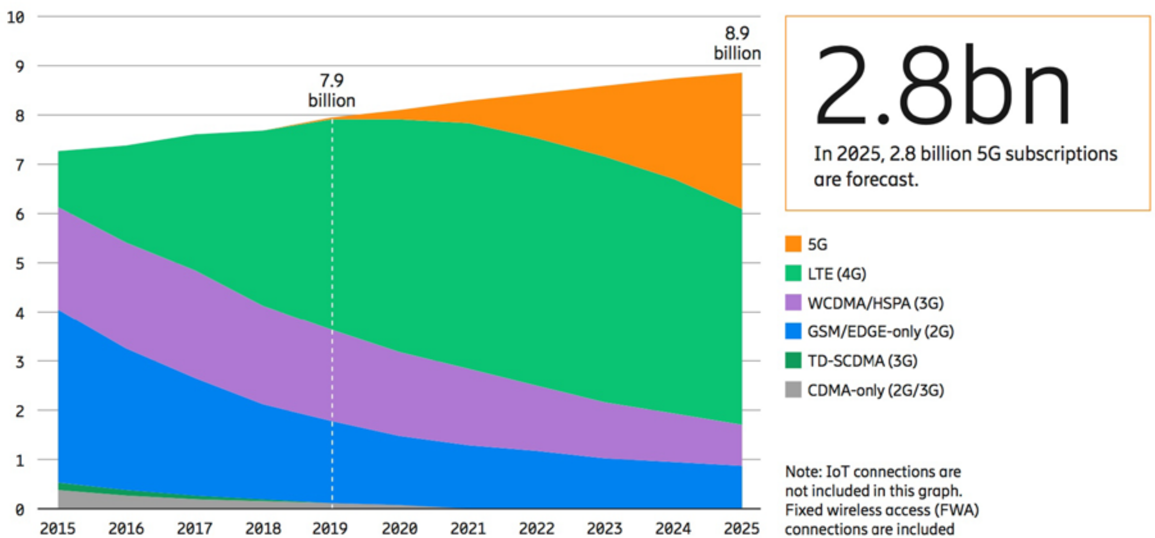


https://www.itu.int/pub/D-PREF-EF.BDT_AP-2019

Global state of play - WBB

4G/LTE networks support approximately 4.2 billion subscriptions – more than half of total world mobile subscriptions of 7.9 billion in 2020. 5G provides the next step in the evolution of mobile wireless communications technology revolution, promising improved connectivity, greater network speeds and bandwidth. In contract, legacy 2G/3G networks will fall globally from 3.8 billion currently to 1.8 billion services in 2025.

Mobile subscriptions by technology (billion) June 2020



[1] Ericsson and GSA (May 2020)
[2] A 5G subscription is counted as such when associated with a device that supports New Radio (NR), as specified in 3GPP Release 15, and is connected to a 5G-enabled network
[3] Ericsson Mobility Report (November 2019)

Global state of play – Fixed & Satellite broadband

- Consistent with the ITU's *Connecting the Unconnected* goals **innovative and future technologies** may be utilised to address gaps in terrestrial fixed and mobile broadband service coverage. **Fixed broadband services total 1.1 billion** (ITU, *State of Broadband* 2019). This is a very important step for the development of an information society with more inclusion and reliability.

- Driven by customer demand, **satellite operators** have invested in cutting-edge high-throughput satellites which increase Internet capacities by hundreds of orders of magnitude while greatly lowering the cost per megabyte. Internet speeds and prices might be comparable to terrestrial services, but with ubiquitous satellite coverage non- geostationary (GEO) satellite constellations also aim at providing affordable coverage and services. Previously unserved and underserved communities, which may not have been viable to serve by land-based networks, would then be connected.

- Furthermore, solar-powered lightweight high altitude platform systems (HAPS) are examples of the current state-of-the-art of a technology that can be used to support affordable broadband connectivity in unserved areas.

2. Study on the importance of digital infrastructure to Asia-Pacific socioeconomic transformation

20 Countries which are our focus today

- Afghanistan
- Bangladesh
- Bhutan
- Brunei Darussalam
- Cambodia
- India
- Indonesia
- Iran
- Lao PDR
- Malaysia
- Maldives
- Mongolia
- Myanmar
- Nepal
- Pakistan
- Philippines
- Singapore
- Sri Lanka
- Thailand
- Vietnam

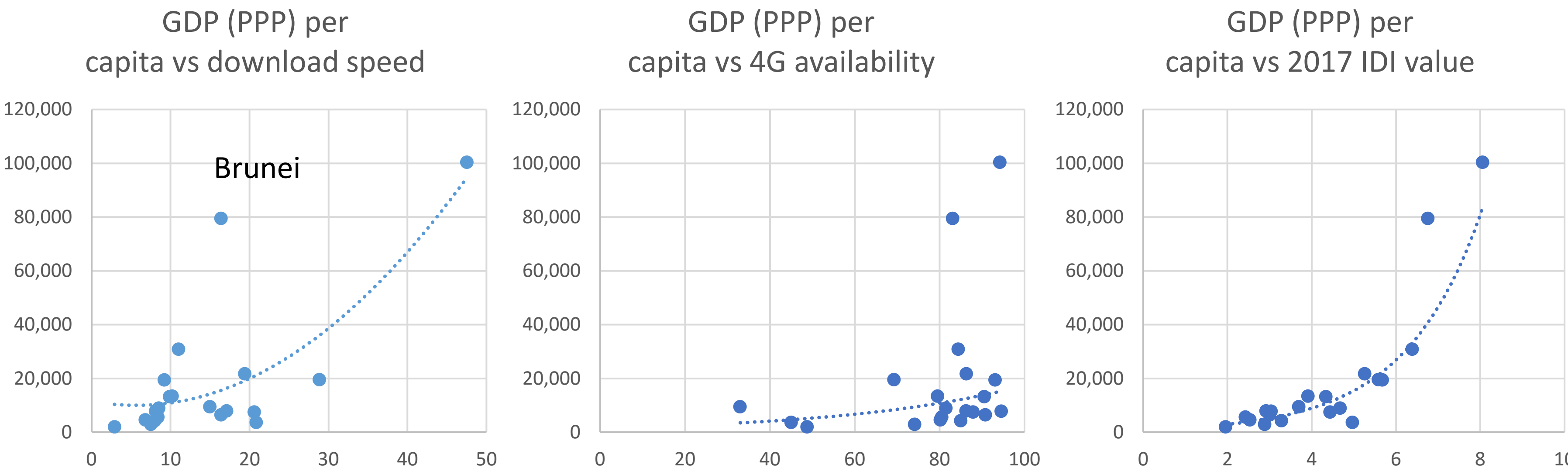
Assessment of Network Connectivity (1)

UPDATED WITH 2019 ITU DATA

Country	Population	GDP (PPP) per capita	Mobile pen per 100 (2019)	Mobile BB pen. per 100	Fixed broadband per 100 (2019)	2017 IDI Rank	2017 IDI Value	Download Speeds (Mbps)	4G avail (% time)	GSMA Mobile Connectivity
Afghanistan	32,729,934	2,017	59.36	19.2	0.05	159	1.95	2.9	48.8	25.5
Bangladesh	162,284,752	4,620	101.55	52.8	4.96	147	2.53	6.8	80.2	48
Bhutan	786,625	9,540	95.56	99.9	1.15	121	3.69	14.9	33	52.7
Brunei Darussalam	433,798	79,530	111.68	127.8	12.51	53	6.75	16.4	83.1	67.3
Cambodia	15,939,563	4,335	129.92	96.4	1.12	128	3.28	8.0	85	47.1
India	1,297,074,829	7,874	84.27	49.4	1.45	134	3.03	8.1	94.5	55.6
Indonesia	258,552,717	13,230	127.49	81.2	3.48	111	4.33	9.9	90.5	61.8
Iran	80,460,185	19,557	142.39	80.2	10.4	81	5.58	28.8	69.2	60.7
Lao PDR	7,146,206	7,925	60.84	48.6	1.06	139	2.91	17.1	86.2	43.9
Malaysia	31,105,696	30,860	139.6	126.5	9.28	63	6.38	11.0	84.4	67.4
Maldives	364,207	21,760	155.95	50.6	9.94	85	5.25	19.4	86.3	N/A
Mongolia	2,963,708	3,718	137.01	98.1	9.84	91	4.96	20.8	45	56.5
Myanmar	54,590,588	6,511	113.84	92.7	0.24	135	3.00	16.4	90.8	51.4
Nepal	28,756,891	2,905	139.45	47.5	2.82	140	2.88	7.5	74.1	43.6
Pakistan	191,176,793	5,680	76.38	35.2	0.81	148	2.42	8.4	80.5	39.8
Philippines	103,508,697	8,936	115.4	67.2	3.87	101	4.67	8.5	81.5	61.6
Singapore	5,717,082	100,345	147.23	156.4	25.81	18	8.05	47.5	94.2	86.6
Sri Lanka	21,770,748	13,397	114.31	65	7.27	117	3.91	10.2	79.5	54.3
Thailand	67,540,824	19,476	186.16	86.7	14.52	78	5.67	9.2	93.1	68.3
Vietnam	94,191,025	7,510	141.23	72.5	15.35	108	4.43	20.6	87.9	65

Source: WPC, August 2020.
Data from: ITU, *World Telecommunication/ICT Indicators Database 2020 (24th Edition/July 2020)* : https://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx
https://www.itu.int/net4/ITU-D/idi/2017/index.html, https://www.mobileconnectivityindex.com/#year=2018,
https://theinclusiveinternet.eiu.com/explore/countries/performance/availability/infrastructure/network-coverage-min-4g?highlighted=MN, https://www.speedtest.net/global-index.
www.opensignal.com – *The State of Mobile Network Experience 2020: One year into the 5G Era.*, May 2020

Assessment of Network Connectivity (1)



Exception point: Brunei, the reason is small country with high GDP per capita due to oil revenues

Conclusion: **Put simply, accelerating ICT development supports economic activities for GDP growth**

Assessment of Network Connectivity (2)

- In broad terms, superior MBB/WBB networks (a key digital infrastructure) promote digital/social inclusion (which is key ITU objective) and contribute to GDP and GDP per capita increases. Countries with such infrastructure may have less impact from COVID-19, because they have more digital alternatives to withstand the external shock of COVID-19.

WPC BB Index	COUNTRY	WPC WBB index	Pre-COVID-19 GDP Growth Rates (on left country list)	COUNTRY	GSMA Mobile Connectivity
94.7	**Singapore**	68.9	1.9	**Singapore**	86.6
70.7	**Brunei Darussalam**	58.2	7.1	**Thailand**	68.3
66.6	**Malaysia**	57.3	3.6	**Malaysia**	67.4
65.9	**Thailand**	51.4	2.4	**Brunei Darussalam**	67.3
50.0	**Indonesia**	46.5	4.9	**Vietnam**	65.0
45.3	**Myanmar**	45.1	5.9	**Indonesia**	61.8
46.0	**Cambodia**	44.9	7.0	**Philippines**	61.6
60.1	**Vietnam**	44.7	6.5	**Iran**	60.7
54.6	**Iran**	44.2	2.7	**Mongolia**	56.5
52.8	**Maldives**	42.9	6.9	**India**	55.6
46.7	**Philippines**	42.8	6.7	**Sri Lanka**	54.3
47.4	**Sri Lanka**	40.1	2.4	**Bhutan**	52.7
49.3	**Mongolia**	39.4	5.1	**Myanmar**	51.4
40.6	**India**	39.1	4.1	**Bangladesh**	48.0
37.7	**Lao PDR**	36.7	6.5	**Cambodia**	47.1
39.8	**Bangladesh**	34.9	7.9	**Lao PDR**	43.9
34.7	**Bhutan**	33.5	4.7	**Nepal**	43.6
36.2	**Nepal**	33.4	7.0	**Pakistan**	39.8
32.7	**Pakistan**	31.8	5.5	**Afghanistan**	25.5
20.2	**Afghanistan**	20.2	1.6	**Maldives**	N/A

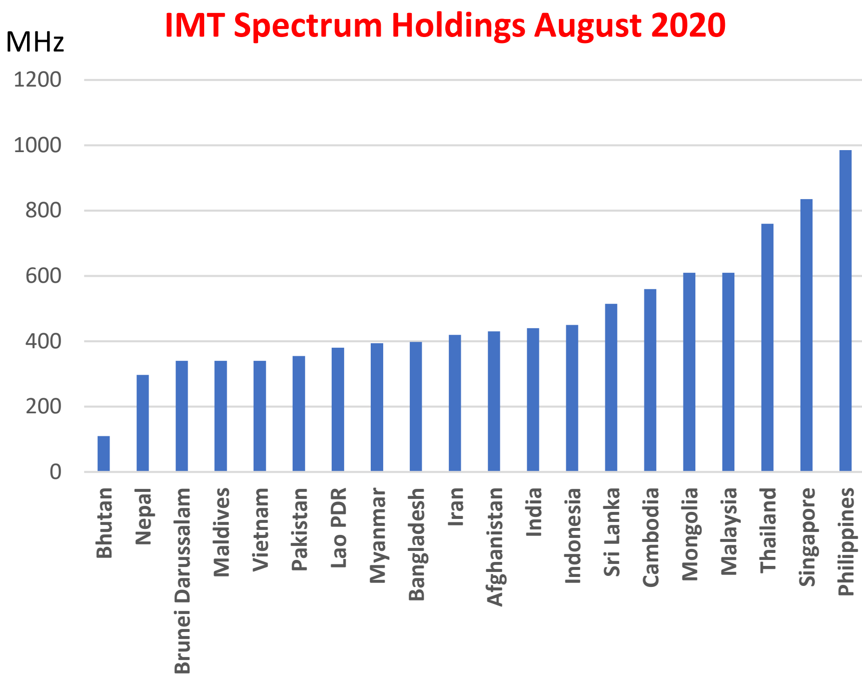
NB. Going forward we expect to see significant increases for Thailand given the release of additional spectrum for 5G and for Myanmar given significant changes in their mobile penetration & the IDI.

Vietnam, Iran, Maldives, Mongolia, & Sri Lanka have higher WPC BB Index scores including fixed broadband due to higher relative fixed broadband penetration.

NB: WPC index of the countries focused on WBB, WPC combined ITU data (mobile penetration, IDI) with recent Opensignal statistics on download speeds and 4G availability) and rebasing it out of 100. August 2020. Pre-COVID-19 growth rates for some countries like Singapore & Thailand, Iran, Sri Lanka were affected by the trade wars, oil price shocks, trade embargos, terrorism etc Post COVID-10 economic figures are showing recession/depression depending on the market

Assessment of Network Connectivity (3)

- Assessing the total IMT spectrum allocated (in terms of High, Medium & Low) and competition in the market (using the number of MNOs as a proxy pressure).



Source: WPC August 2020 update of LSTelcom, April 2019. Does not include any mmWave holdings (eg Singapore)

NB. Vietnam, India, Indonesia, Myanmar & Sri Lanka have plans to release more spectrum. Pakistan has just started a World Bank project looking at IMT spectrum roadmaps etc

COUNTRY	Number of MNOs	Total IMT spectrum
Singapore	4	High
Brunei Darussalam	2	High (given population)
Malaysia	5 + BWA	High
Thailand	3	High (now)
Indonesia	5	Medium
Myanmar	4	Medium
Cambodia	3 + smaller	Medium
Vietnam	3 large/2 others	Low
Iran	3	Medium
Maldives	2	High (given population)
Philippines	2 + 1 new MNO	High
Sri Lanka	4	Medium (now)
Mongolia	4	Medium
India	Multiple circles	Medium
Lao PDR	3 + ISPs	Medium
Bangladesh	4 + ISPs/others	Medium
Bhutan	2	Medium (given population)
Nepal	3	Low
Pakistan	4	Low
Afghanistan	3	Medium

Assessment of Network Connectivity (4)

- Ranking of focus countries by download speeds and 4G availability

OPENSIGNAL

	Download Speeds	4G Availability
Singapore	47.5	94.2
Iran	28.8	69.3
Mongolia	20.8	45.0
Vietnam	20.6	87.9
Maldives	19.4	86.3
Lao PDR	17.1	86.2
Brunei Darussalam	16.4	83.1
Myanmar	16.4	90.8
Bhutan	15.0	33.0
Malaysia	11.0	84.4
Sri Lanka	10.2	79.5
Indonesia	9.9	90.5
Thailand	9.2	93.1
Philippines	8.5	81.5
Pakistan	8.4	80.5
India	8.1	94.5
Cambodia	8.0	85.0
Nepal	7.5	74.1
Bangladesh	6.8	80.2
Afghanistan	2.9	48.8

	Download Speeds	4G Availability
India	8.1	94.5
Singapore	47.5	94.2
Thailand	9.2	93.1
Myanmar	16.4	90.8
Indonesia	9.9	90.5
Vietnam	20.6	87.9
Maldives	19.4	86.3
Lao PDR	17.1	86.2
Cambodia	8.0	85.0
Malaysia	11.0	84.4
Brunei Darussalam	16.4	83.1
Philippines	8.5	81.5
Pakistan	8.4	80.5
Bangladesh	6.8	80.2
Sri Lanka	10.2	79.5
Nepal	7.5	74.1
Iran	28.8	69.3
Afghanistan	2.9	48.8
Mongolia	20.8	45.0
Bhutan	15.0	33.0

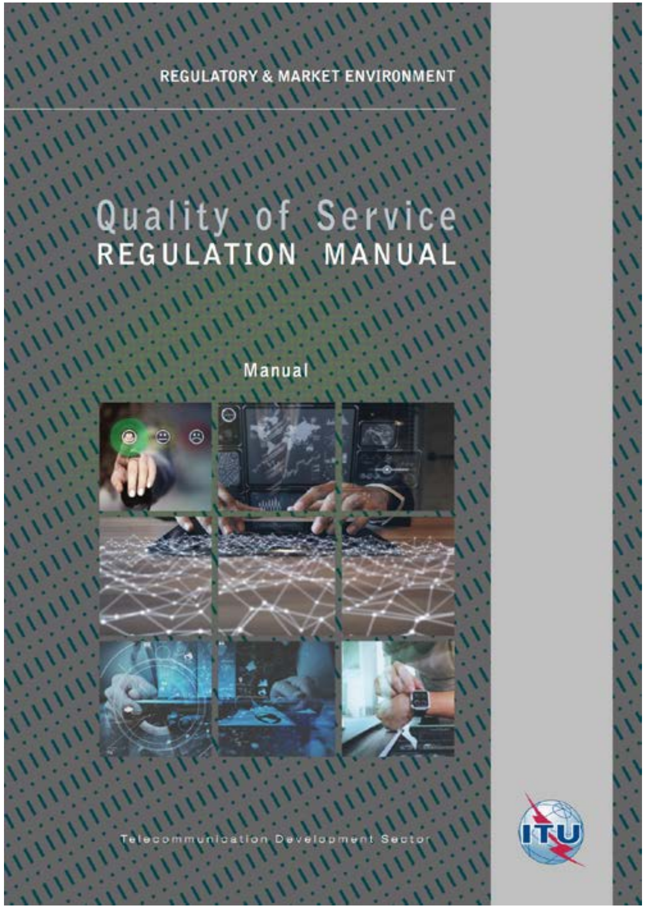
WPC review of the data finds:

(1) Download speeds can be correlated with the quantity of overall IMT spectrum released in the market except for small markets and whether markets do not face strong competition (eg Philippines).

(2) Markets with strong mobile competition typically see high 4G availability as MNOs compete for higher value ARPU customers and broadband services

Source Opensignal except when when not available and then Ookla

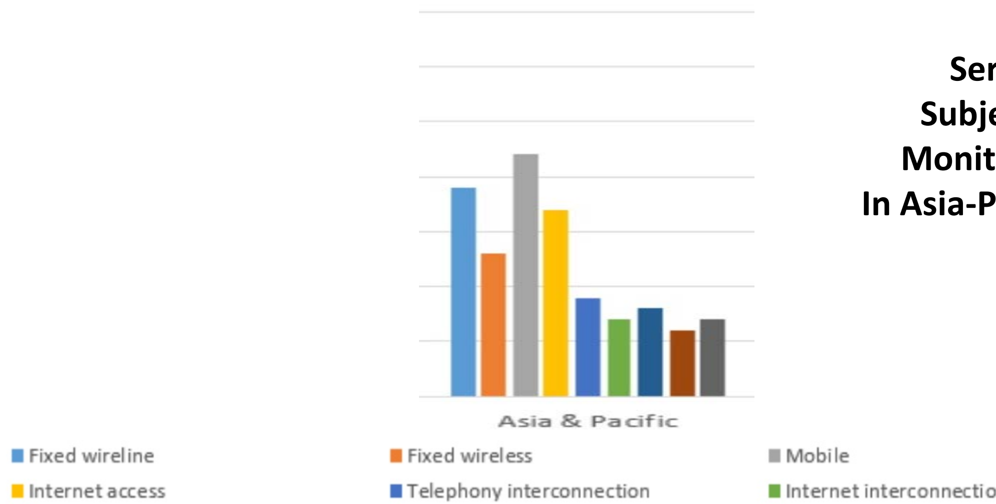
Improving Quality of Service (QoS)



In 2017, the ITU released a **Quality of Service Manual.** It is intended to be used as a guiding tool for telecommunication regulators or ministries in charge of QoS and QoE (quality of experience) parameters and measurements as defined by ITU-T, as well as enforcement mechanisms.

It further introduces more hands-on information regarding the QoS and QoE big picture, and outlines practical approaches in QoS regulation. QoS is **particularly important for broadband users**. Significant part of the utility of broadband services comes from their combined characteristics of high speed and always-on functionality.

Services Subject to Monitoring In Asia-Pacific 2018



https://www.itu.int/en/ITU-D/Regulatory-Market/Pages/Quality-of-Service-Regulation.aspx

Improving Quality of Service (QoS)

Summary of ITU's recommendations on effective QoS frameworks

Activity	Recommendations
Defining measure-ments	• Measurements should prioritise improvements in service for those most affected (e.g. persons with disabilities); • Measurements should be made over sufficiently short periods of time and small geographical areas to determine when/where problems occur ; • Measurements should be comparable across services, especially for services that are substitutes; • Measurements should be practical for operators and cover aspects of service they can control; • Measurements should be comparable across operators.
Setting targets	• Targets are typically set by the regulator to ensure consistency and enforceability, although industry guidelines may be effective for certain services; • Typically bandwidth is more limited in IP access networks than IP core networks, meaning IP access networks may need additional mechanisms to ensure real time services (e.g. voice communication) are of acceptable quality; • Targets should be set based on what is possible for operators to achieve; • Targets should avoid limiting the availability of choice for consumers regarding quality or service and price (e.g. differences in Internet service quality due to different actual bandwidth may justify price differences between connections with the same bandwidth).
Measuring performance	• Subjective measurements such as survey results may be easy to implement but may present a biased result; • Survey results may result in a large distribution that cannot be meaningfully summarised (i.e. with a median opinion score); • End-to-end network measurements are more helpful for consumers, however operators may have les control over the result if the measurement covers multiple networks.
Publishing performance results	• Results should be published in a way suitable for its intended audience (customers, media outlets, etc.); • Results should be accessible and prominently displayed/widely distributed; • Results should focus on areas of greatest concern to customers; • Results should be published in a way that allows comparisons between operators; • Results should distinguish between different services where possible (e.g. residential and business); • Operators should be given a "right of reply" or opportunity to explain why a service was below standard/what they are doing to rectify the problem.

Improving WBB Quality of Service (QoS)

- In broad terms, QoS delivered to users is a function of demand and supply factors including:

Key Supply Factors which can impact QoS	Key Demand Factors which can impact QoS
• Total quantum of IMT spectrum allocated, flexibility of use and not subject to any harmful interference	• Population and urbanization levels. Large and dense cities provide the greatest challenges for
• Technology deployed – 2G, 3G, 3G, 5G etc. Newer technologies are more spectrally efficient	• Retail Prices for WBB/MBB services if affordable or without any caps can result in high demand (eg GB per month per user)
• Location characteristics – terrain, water, building types, and associated cell planning can have major impact on cell planning and deployment	• Device/handset prices if newer devices are too expensive then users do not upgrade to new smartphones which support 4G/5G and an increasing number of spectrum bands & VoLTE
• Number and location of tower and base station sites - if lower land and other rules preclude new towers and related infrastructure then increasing demand levels cannot	• Peak demand and type of demand (ie if that demand is for low latency voice services, and consistent high speed bandwidth for HD video) can be challenging for MNOs
• Backhaul connectivity (degree of fiberisation, high speed microwave etc) and international links determines the throughout of broadband services	• Availability of substitute fixed broadband networks. In countries without extensive fixed broadband services, wireless services must do the 'heavy lifting' in relation in country broadband demand
• Capital investment in quality network infrastructure determines the type of equipment, the deployment of newer technologies (eg MIMO) and now of sites	• Service/content offerings especially video especially (i) if locally customized and (ii) including key football/ movie content can drive much higher levels of video downloads,
• For voice services, interconnection arrangements and capacity between networks and for data IXs	
• Cloud infrastructure availability – CDNs, local caching etc	

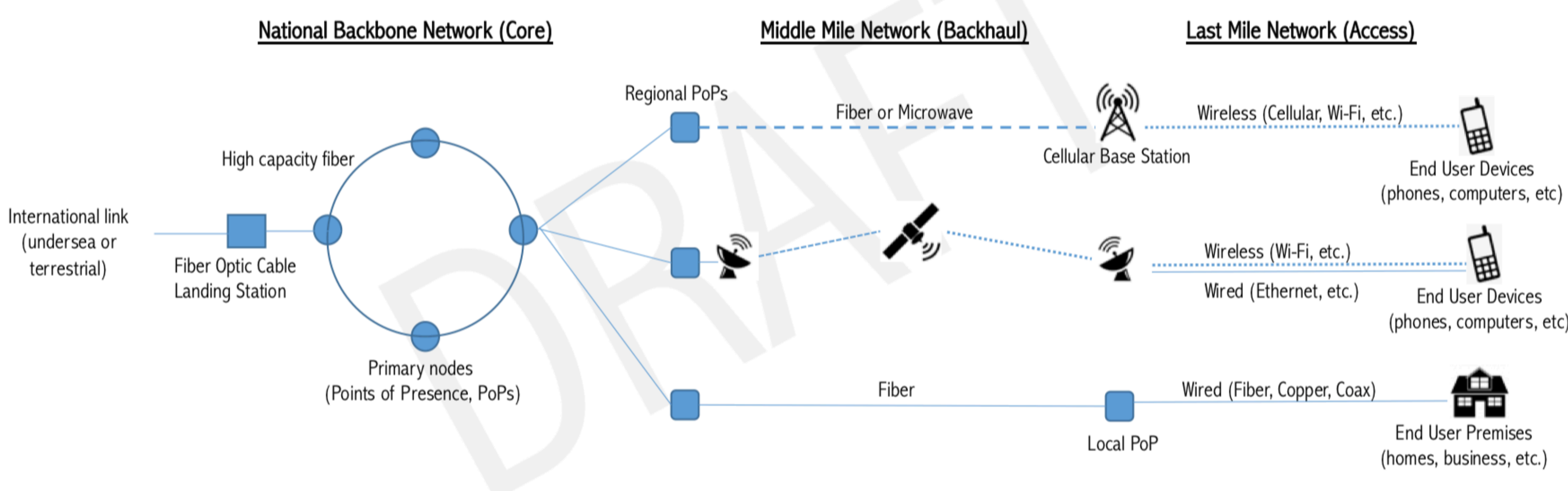
Source: WPC, July 2020.

ITU Last-Mile Internet Connectivity Toolkit

ITU Toolkits can assist in regulators and other stakeholders in the emerging markets

- **Last-Mile Network**
  – Also called the Access Network - where the internet reaches the end users, and includes the Local access network, including local loop, central office, exchanges, wireless masts.

Figure: Telecommunications Network Components Supporting Last Mile Interventions in Developing Countries



ITU Last-Mile Internet Connectivity Toolkit (2)

Step 1: Identify unconnected communities

- The first step in solving for lack of connectivity service is identifying the geographic limits of network infrastructure in relation to the location of population.

Step 2: Review options from the classification of existing solutions

- 2a – Review the case study database of last-mile connectivity solutions
- 2b – Understand major characteristics, and trade-offs, of different interventions
- 2c – Utilize the categorization / typology of interventions

Step 3: Select best fit solutions by matching viability subject to constraints

- 3a –Selecting an appropriate last mile connectivity solution
- 3b- Additional tools to assess solutions

Step 4: Implement interventions to extend connectivity service

- 4a – Options for intervention - market efficiency actions
- 4b - Options for intervention- financing (smart subsidy)
- 4c - Options for intervention- financing (reoccurring subsidy)
- 4d - Examples of options (from case study submissions)

ITU Last-Mile Internet Connectivity Toolkit (3)

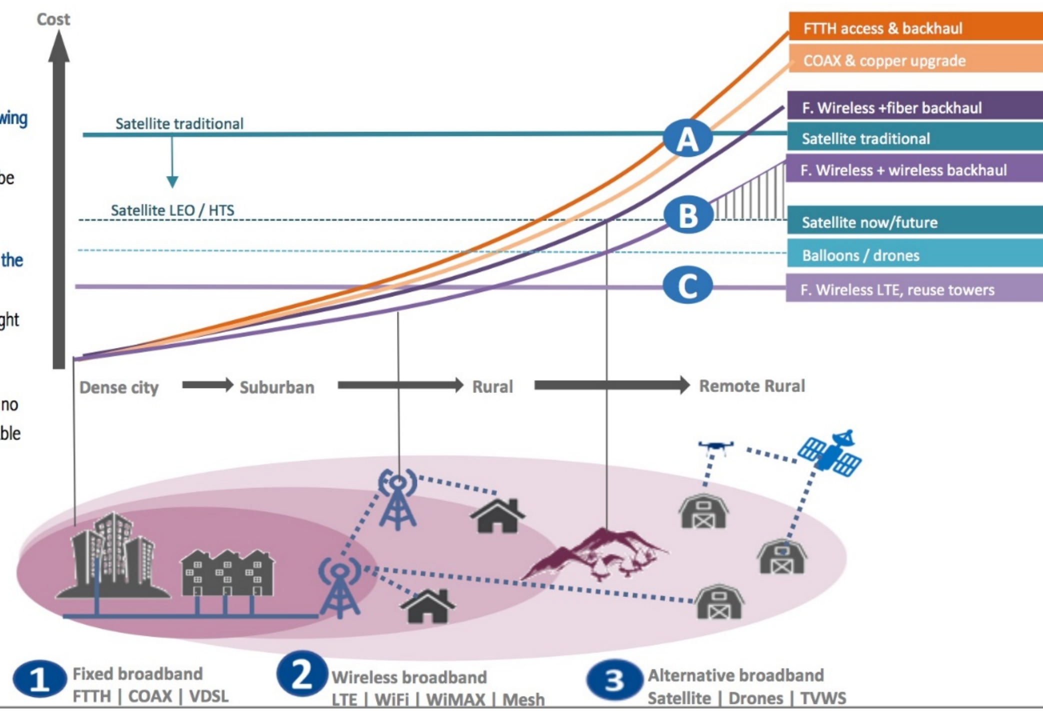
Population density, as an input into overall total potential revenue, serves a key factor in determining the viability of various technology options as shown below. The relative costs of providing access vary by technology

A Fiber to the Home (FTTH), Cable, Copper upgrades and other fixed technologies have exponential growing cost as the distance from the serving node increases and the HH density decreases. Their applicability in rural environments is very limited unless there is existing copper/cable that could be upgraded or there is utility network that could provide backhaul solution.

B Fixed Wireless Technologies with microwave backhaul have been providing more adequate solution for the rural connectivity problem as the cost will always be lower than deploying fibre over long distance. However there is a point (marked with B at the figure) from where only the alternative technologies might be commercially viable.

C Alternative technologies that are not distance related are the only solutions for very rural areas where no infrastructure exists. The introduction Low Earth Orbit (LEO) and High Throughput Satellites (HTS) enable the offering of good quality Internet service at lower average cost of delivery (Example: OneWeb).

LTE based fixed wireless with dedicated frequencies are emerging as very viable solutions if the households could be reached from the existing mobile towers (up to 10km line of sight).



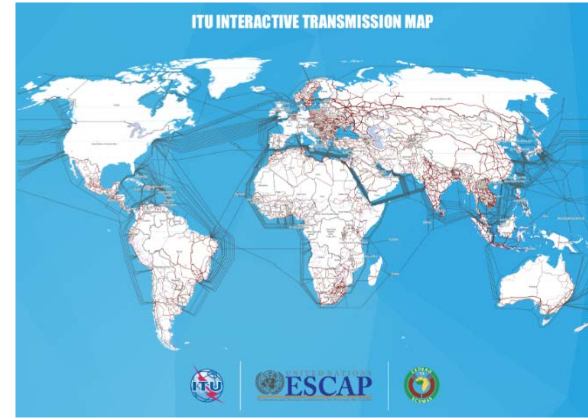
Source: World Bank, TMG/Salience Consulting
http://documents.worldbank.org/curated/en/674601544534500678/pdf/132845-7-12-2018-17-20-11-InnovativeBusinessModels.pdf

ITU BB Transmission Maps

ITU Toolkits can assist in regulators and other stakeholders

- **Broadband Maps**

  – The ICT-data mapping platform takes stock of national backbone connectivity: optical fibres, microwave links, satellite earth stations, and IXPs as well as of other key metrics of the ICT sector.



INDICATORS

SUMMARY - Distance (km)

AFR	AMS	ARB
326.063	385.852	189.516
Operators:93	Operators:63	Operators:41
ASP	**CIS**	**EUR**
812.666	385.852	444.818
Operators:85	Operators:36	Operators:79

Operators: 400 **Global 2.703.066 km**

3. Supportive Policies in Response to COVID-19

Global Network Resiliency Platform (#REG4COVID)

The Global Network Resiliency Platform **(#REG4COVID)** is a place where regulators, policy makers and other interested stakeholders can share information, view what initiatives and measures have been introduced around the world designed to help ensure communities remain connected, that we support one another, and that we harness the full power and potential of ICTs during this crisis and to prepare for the medium and long-term recovery from COVID-19.

https://reg4covid.itu.int/

Pandemic in the Internet Age: Communications Industry Responses

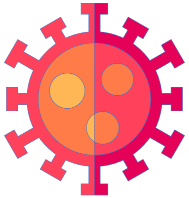
- The ITU in June 2020 published a new **GSR2020 Discussion Paper *Pandemic in the Internet Age: Communications Industry Responses*** based on ITU's Global Network Resiliency (REG4COVID) platform. The ICT/telecommunications sector has so far demonstrated significant flexibility in its response to the COVID-19 crisis. The three Phases in the response timeline are denoted 'Emergency', 'Recovery', and 'new normal'. These could be thought of as representing the short, medium and long-term responses. The Phases are not defined by elapsed time, but rather by government policy settings in response to actual and perceived threats from COVID-19.

- The ***Emergency Phase*** is characterised by temporary measures by ICT stakeholders to ensure immediate responses to the challenge of maintaining normal services despite extreme demand.

- In terms of the COVID-19 ***Recovery Phase***, a number of reforms have been identified which would significantly facilitate this phase globally. They address both the pandemic issues directly and ameliorate the adverse economic impacts of COVID-19 by continuing to support work from home/school from home activities where possible.

- The ***'new normal' Phase*** can be considered only speculatively at this stage because of the considerable uncertainty involved in looking further out. Nevertheless, key factors have been identified on what is likely to comprise that 'new normal' for the telecommunications sector.

COVID-19: RESPONSE TIMELINE



	EMERGENCY 0 to 6 months	RECOVERY 6 to 18 months	NEW NORMAL from 18 months
INDIVIDUALS	• social distancing mandated • move to online work, education, socialising, commerce and retailing	• embed social distancing practices • adapt to new work, education, social practices	• social distancing as new normal • wearing masks becomes fashion • online proficiency improvement
BUSINESS/ CORPORATE SECTOR	• implement work from home • adapt on-site work practices to minimise contact	• design and embed new work practices • redesign workplaces for reduced contact and crowding	• what is better online stays online • ongoing economic weakness • new logistics & supply chains • reduced business travel
TELECOMMUNICATIONS OPERATORS	• manage immediate demand • provide immediate relief to customers • expand data caps • expand available spectrum and capacity	• expand infrastructure and total capacity • adapt network capacity for video content • develop superior video technologies	• continue to build capacity • adapt networks to increased video traffic, improve quality and reliability • accelerate 4G/5G deployments
GOVERNMENT	• require social distancing • impose lockdowns • limit international travel • testing and tracing • expand medical capacity • source scarce PPE • enhance social safety net • short-term fiscal stimulus	• cautiously adjust lockdown parameters • embed ongoing testing and tracing • assess post emergency phase COVID-19 and need for sovereign strategic production capabilities • focus on economic efficiency • longer term fiscal stimulus emphasising productive infrastructure • more collaboration among sectors	• promote economy wide efficiency measures • embed 'surge capacity' healthcare systems • find efficient policy to support strategic production and storage (e.g., PPE, fuel, critical medical equipment and reagents) • focus on debt reduction
TECHNOLOGY SECTOR	• offer productivity & remote education/ working tools • tracking, tracing outbreaks • quickly help businesses go online	• address COVID-19 fake news • big data responses/data processing • Improve remote cybersecurity • new tools for safe public transport, workplaces, education, health	• build services on new deployed digital infrastructure • mobile payments replacing money • Innovation driving digital markets

Source: ITU - WPC, May 2020

COVID-19 Emergency Phase (1)

COVID-19: TELECOMMUNICATIONS SECTOR RESPONSES

NETWORK RESPONSES

EXISTING TELECOMS NETWORKS

- manage demand/allow shaping
- expand/flexible IMT spectrum available
- increase broadband speeds
- facilitate digital telco payments/ mobile money

NEW CAPACITY & NETWORKS

- increase transmission/backhaul
- optimize network capacity
- new 4G/5G Fixed Wireless Access (FWA) deployments

TECHNOLOGY SECTOR

- big data - disease management
- tracking, tracing outbreaks
- productivity & remote education /working tools – video communication platforms

BANDWIDTH DEMAND

Massive growth in overall demand for bandwidth

Increased demand for bandwidth for emergency and health care

ECONOMIC IMPACTS

- lockdowns
- business failures
- unemployment
- debt
- additional operational costs

GOVERNMENT/CONSUMERS

GOVERNMENT INITIATIVES

- facilitate increased broadband speeds
- relief from licence fees/regulation
- increase transmission/backhaul
- direct subsidies
- address COVID-19 'fake news'

CONSUMERS

- free access/ health information
- discounts/extra GB limits
- extra time to pay
- facilitate electronic payment/ commerce

BUSINESS/WORKERS/STUDENTS

- work from home
- education from home
- better remote working tools
- assistance from governments

Source: ITU- WPC, May 2020

COVID-19 Emergency Phase (2)

Initiative	Description
Increasing Broadband capacity/speeds	Regulatory bodies have been encouraging MNOs and wholesale providers to increase broadband speeds for customers to ensure quality of service (QoS) is maintained.
Providing free services to customers	Regulators have also supported other initiatives such as free access to educational websites as well as free data allowances to citizens during COVID lockdown periods.
Providing info services on COVID-19	Policymakers in a number of countries have introduced new e-services such as a website dedicated to COVID-19 information, as well as a health platform to assist healthcare providers in remote areas to better utilise information technology and mobile health solutions
Network Management	Three forms of network management are common: • Voluntary: Telecom regulators are asking operators to take part in pledges or initiatives to maintain network connectivity and help customers cope with the coronavirus outbreak. Typically, these initiatives are not government mandate, but a voluntary measure on the part of providers. • Mandatory: A smaller number of regulators have also implemented mandatory measures requiring telco cooperation in enhancing network infrastructure, ensuring QoS, etc. in order to address the effects of the pandemic. General: There has also been a regulatory trend towards publishing new guidelines or revising existing ones to better handle congested and overloaded networks.

Source: ITU REG4COVID database and selected industry sources, 2020

COVID-19 Emergency Phase (3)

Initiative	Description
Allowing more flexible IMT spectrum use	Policymakers and regulators have engaged in responses designed to grant temporary IMT spectrum licenses in the midst of the pandemic. Such responses typically involve allowing the use of either vacant spectrum or unused spectrum of existing licensees. These additional temporary IMT spectrum licenses were designed to facilitate operators providing their customers with greater network access and improved quality of service.
Free access to online learning resources	Country governments have been working with operators to ensure access to online learning programs while the pandemic is ongoing.
Generally easing regulatory requirements on licensees	Government and regulators have taken steps to minimize the regulatory and reporting obligations on licensed operators.
New Fixed Wireless Access (FWA) networks	4G/5G FWA has been used in some areas to quickly deploy necessary wireless broadband infrastructure. The need for improved connectivity is due to the need to quickly augment coverage and capacity near health care facilities and/or over cities and urban/suburban areas which may be subject to social distancing requirements.
Addressing misinformation re COVID-19	A number of countries have promulgated rules addressing misinformation in relation to COVID-19 including the link of 5G to the coronavirus.

Source: ITU REG4COVID database and selected industry sources, 2020

COVID-19 Recovery Phase(1)

- COVID-19 Contact Tracing Apps
- Accelerate the assignment of globally harmonised IMT Spectrum
- Accelerate 4G/5G deployment & transition from legacy networks
- Deployment of FWA as complimentary & substitute networks
- Facilitate innovative and future technologies to bridge the 'digital divide' eg non-geo satellites & HAPS etc
- Misinformation and COVID-19 – including 5G & COVID-19
- Cybersecurity and COVID-19 – working from home
- Big data responses/data processing - big data, AI, and machine learning

COVID-19 Recovery Phase (2)

An example: Accelerate the assignment of globally harmonised IMT Spectrum
Comparison of IMT spectrum licensed in each ITU region versus harmonised IMT spectrum

	Region 1 (EU/EFTA)	Region 1 (ASMG)	Region 1 (Africa)	Region 1 (CIS/ Balkans)	Region 2	Region 3 ASIA-PAC
Average spectrum licensed in 2019	757 MHz	556 MHz	477 MHz	430 MHz	426 MHz	549 MHz
Percentage of harmonised spectrum licensed	60%	52%	44%	40%	41%	60%
Typical amount of spectrum yet to be licensed (2019)	**300 to 400 MHz**	**500 to 600 MHz**	**500 to 700 MHz**	**600 to 700 MHz**	**500 to 600 MHz**	**300 to 500 MHz**

Source: LSTelcom, 2019 NB. Analysis undertaken pre -WRC-19 so does not include temporary spectrum

COVID-19 Recovery Phase – FWA (3)

- Fixed wireless broadband access (FWA) has reached a landmark global take-up of over 100 million.

- **FWA is a viable substitute as well as complement to FTTx**. Early FWA provisioning not only makes emerging country businesses more competitive, but also offers a way to quickly and cost-effectively bring high-speed broadband services to high-rise residential buildings in urban areas. FWA deployment offers a stepping-stone towards future deployments of fixed networks.

- **From a spectrum management perspective, regulators should acknowledge the growing use of FWA, and include such services in their spectrum roadmaps and demand analysis.** It must also be recognised that 4G, and especially 5G, work best if harmonized IMT spectrum using the 2.3, 2.6 or 3.5 GHz spectrum bands is allocated to licensees in larger contiguous blocks. Larger spectrum allocations – if they can be done at reasonable prices – allow MNOs to deploy wireless networks which can be shared for both mobile and FWA applications. This provides something of a 'silver bullet' to encourage increased competition in the broadband markets.

- **Artificial limitations on the use of spectrum for "fixed" & "mobile" services should be removed.**

- For example, terms of reference of the new *Australian Broadband Advisory Council* announced 23 July 2020 considers the NBN and 5G together in delivering connectivity, contrasting with previous approaches where fixed and mobile policy was often framed in separate regulatory silos.

COVID-19 'new normal' Phase (1)

- Speculating on the 'new normal'
  - Some short measures eg additional bandwidth will need to become permanent but commercial issues make be challenging; contact tracing and digital mitigation measures needed; changes to temporal demand; critical importance of social inclusion to avoid new forms of digital divide;

  - The new normal means greater coverage and faster broadband speeds. As such the approximately 164 countries which have already have broadband plans as listed by the Broadband Commission should review those plans, say by 2021, in order to assess the whether such plans are compatible with the new normal.

BROADBAND COMMISSION FOR SUSTAINABLE DEVELOPMENT

COVID-19 'new normal' Phase (2)

- Accelerating the move to the digital economy in the 'new normal' - Optimally digital economies which are 'COVID ready' have *the following*:

  - the ability to digitise SMEs and SME retail operations not just larger corporations;
  - online classrooms including for tertiary studies;
  - provision of services to unconnected and vulnerable populations including telehealth and related services.

  - trusted digital payment systems and infrastructure; and
  - legal structures for digital contracting and digital signatures.

  - robust high speed broadband services.

COVID-19 ‘new normal’ Phase (3)

- Facilitating ‘smart cities’

A smart sustainable city is an innovative city that uses ICTs and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects. - UNECE and ITU

- **Smart cities** use deeply embedded digital technology to achieve highly efficient operation both from an economic and an environmental perspective.
- **Facilitating smart villages**. The smart village platform is a multi-stakeholder, cross sectoral initiative that showcases how to cost-effectively accelerate the implementation of the SDGs in remote areas through an integrated development and technology platform model. Through this model governments can aim at increasing the efficiency, security and effectiveness of public services while reducing their cost, promoting transparency and good governance, enhancing traceability of transactions, & data exchanges.

- COVID-19 and competition issues going forward – need to review sector competition impacts between operators and ‘big tech’ under COVID conditions

https://www.itu.int/en/ITU-D/ICT-Applications/Pages/smart-village.aspx ; https://www.itu.int/en/ITU-T/ssc/Pages/default.aspx

Conclusions and Checklist of best practice

BEST PRACTICE

DEMAND SIDE: HELP TO THE CONSUMERS/PUBLIC

- provision of free/discounted services
- free Access to health and education information
- increase broadband capacity and speeds
- addressing COVID-19 ‘fake news’
- facilitate digital telco payments/ mobile money

GOVERNMENT SECTOR SUBSIDIES

- direct subsidies to consumers/ public
- direct subsidies to operators
- discounted offers by Government owned operators
- foregone revenues from licensing fees, spectrum etc.

SUPPLY SIDE: HELP TO INDUSTRY

- manage demand/allow shaping
- expand/flexible IMT spectrum
- relief from licence fees/regulation
- increase transmission/backhaul direct subsidies
- facilitation of new 4G/5G Fixed Wireless Access (FWA) deployments

OPERATOR COMMERCIAL INITIATIVES

- additional data allowances
- retail tariff discounts
- increase broadband capacity
- investment in new capacity/networks
- relaxing of payment terms
- provision of free services for health sector
- free access to online health information
- free access to online education information
- facilitating mobile money transactions
- going digital for recharges, payments
- Innovative assistance (e.g. funds etc)

HELP BY CONTENT & ONLINE SERVICE PROVIDERS

- lift limits on video calls
- reduce download sizes (content resolution)
- increase capacity/capability
- developing new technology (e.g. tracing)
- range of free services e.g. video communication platforms

Source: ITU, June 2020

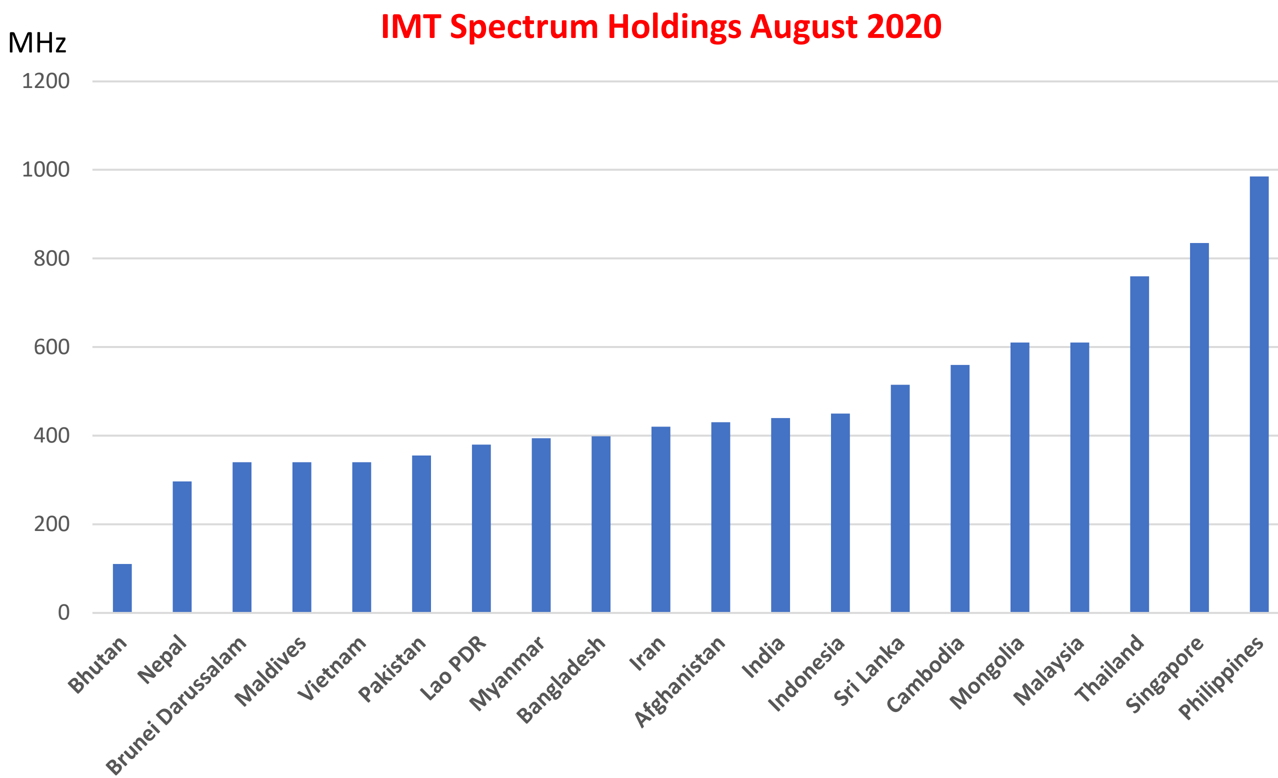
4. Optimal Spectrum Management

IMT Spectrum Management - Overall

- **Optimal Management**

➢ Spectrum should be managed so that it creates the maximum long-term benefit to society.

➢ ITU Recommendations forecast demand by 2020 is for 1900 MHz of spectrum



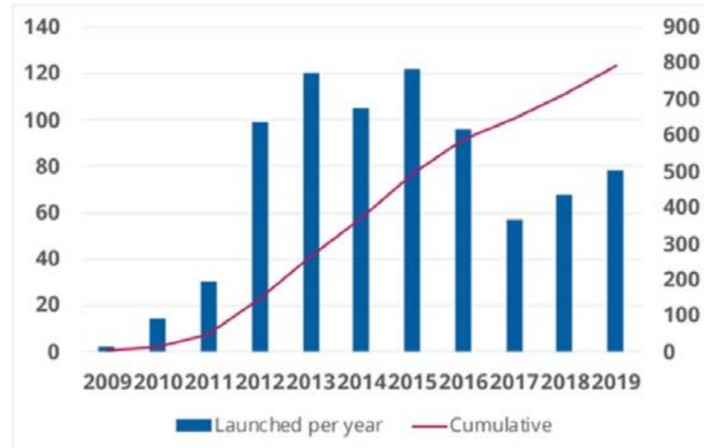
Source: WPC August 2020 update of LSTelcom, April 2019. Does not include any mmWave holdings (eg Singapore)

IMT State of Play (1)

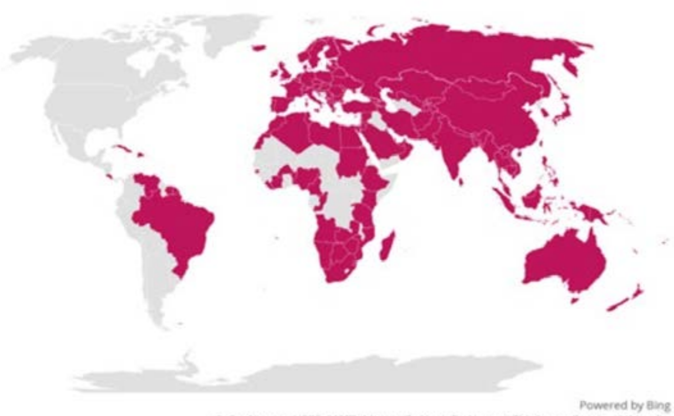
- As at June 2020 there are **797 operators globally with commercially launched 4G/LTE networks** (offering broadband FWA and or mobile services). Some 234 operators hold licences to use spectrum for TD-LTE services. Furthermore, 84 operators in 36 countries have launched one or more 3GPP compliant 5G services (including 66 mobile and 35 FWA).

- The most supported band 4G/LTE globally is 1800 MHz but in some Asian markets (eg Thailand & Bangladesh) all not allocated

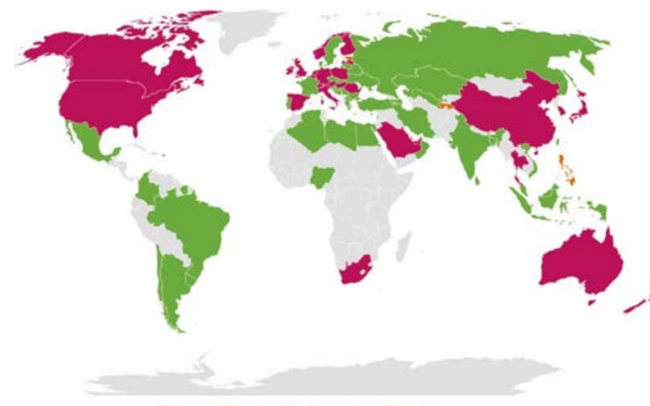
Growth in Global 4G/LTE networks



Global 1800 MHz (Band 3) LTE networks



Global 5G networks



Source: GSA, June 2020

IMT State of Play (2) - Devices

- From a device perspective, the **optimal bands to deploy 4G/LTE in 1800 MHz (b3) then 900 MHz (b8). First priorities.** Other capacity bands include 2100 MHz (b1) second priority, 2300 MHz (b40) and 2600 MHz (b41). Other coverage bands include 700 MHz (b28)

Source: Huawei

Table 1: The main FDD frequency bands supported by LTE-capable devices.

LTE FDD Band	Number of devices
1800 MHz Band 3	11,491
2600 MHz Band 7	9,978
2100 MHz Band 1	9,621
800 MHz Band 20	6,838
850 MHz Band 5	6,499
900 MHz Band 8	6,223
AWS Band 4	4,821
1900 MHz Band 2	4,559
700 MHz Band 17	2,928
APT700 Band 28	2,466
700 MHz Band 12	2,287
700 MHz Band 13	1,901
1900 MHz Band 25	1,055

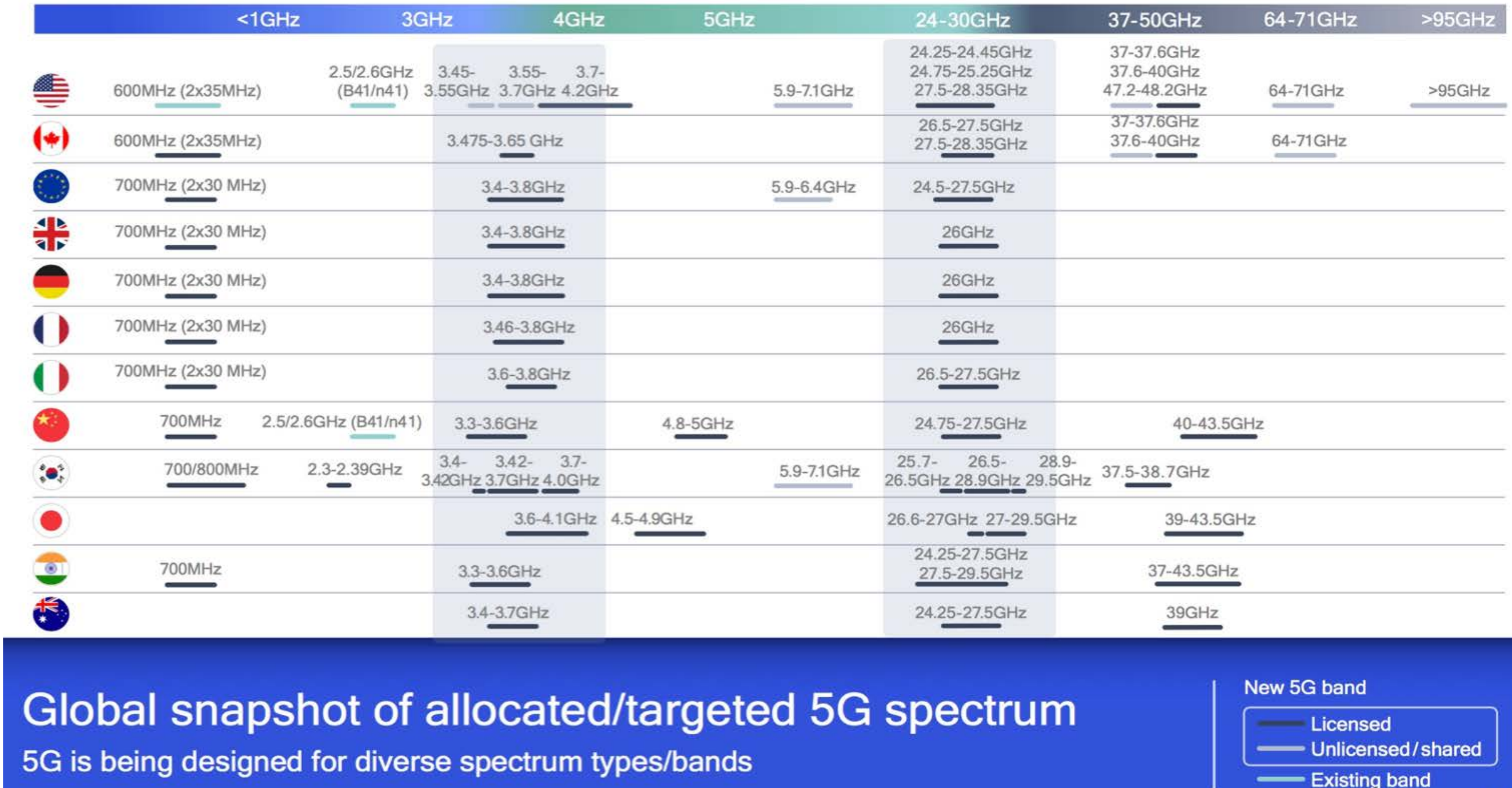
Table 2: The main TDD frequency bands supported by LTE-capable devices

LTE TDD Band	Number of devices
2300 MHz Band 40	5,921
2600 MHz Band 38	4,600
2600 MHz Band 41	4,568
1900 MHz Band 39	3,214
2000 MHz Band 34	484
3500 MHz Band 42	355
3700 MHz Band 43	260

Source: GSA, July 2020

4G ecosystem is very mature, it is an essential technology for digital economy

5G Spectrum (1)

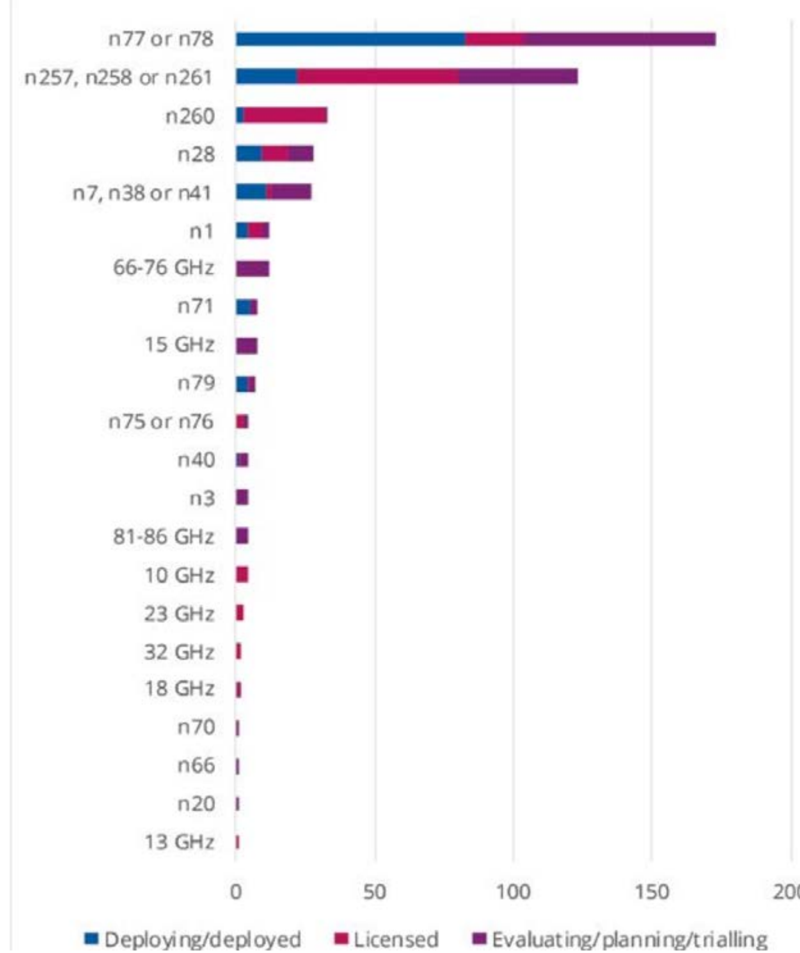


Source: Qualcomm, Spectrum for 4G and 5G, April 2020

5G Spectrum (2)

- **Global 5G Status**
- 5G is now or near now. There are now 84 commercial 5G networks in 38 countries. As of May 2020, there are 385 MNOs in 97 countries who have announced they are investing in 5G.

- The mid-band between 1 and 6 GHz is currently the focus of near-term 5G deployments globally with the 3.5 GHz band (namely n77/78) being the most globally supported band. Due to its propagation characteristics and the potential for large contiguous bandwidths, this band is ideal as it is able to provide both capacity (data bandwidth) and coverage (propagation distance).



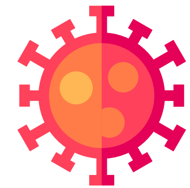
Source: GSA, 5G Market: Snapshot, 2 June 2020

5G Spectrum – 3.5 GHz allocations (3)

Global Status of 3.5 GHz band allocations (May 2020)

Assignment Completed	Planned/Under consultation
Ireland (May 2017)	Czech Republic (July 2020)
Czechia (July 2017)	Estonia (2020)
Slovakia (October 2017)	Greece (2020)
UK 3.4 GHz (April 2018)	Sweden (October 2020)
South Korea (June 2018)	India (2020)
Spain (July 2018)	Hungary (2020)
Latvia (September 2018)	Belgium (2020)
Lesotho (October 2018)	Ukraine (2020)
Finland (October 2018)	Romania (3rd quarter, 2020)
Italy (October 2018)	UK 3.6-3.8 GHz (2020)
UAE (November 2018)	Luxembourg (2020)
Oman (December 2018)	France (2020)
Australia (December 2018)	Norway (2020)
Qatar (January 2019)	Poland (2020)
Switzerland (February 2019)	Canada (2020)
Saudi Arabia (March 2019)	Myanmar (2020/21)
Austria (March 2019)	United States (June 2020)
Japan (April 2019)	Mexico 3.3 GHz (2020)
Germany (June 2019)	Uzbekistan (2020)
Mexico 3.5 GHz (October 2019)	Netherlands (2021/22)
Hong Kong (October 2019)	Brazil (2021/22)
Taiwan (December 2019)	
China (February 2020)	
Singapore (April 2020)	
South Africa (April 2020 - temporary)	
New Zealand (May 2020)	

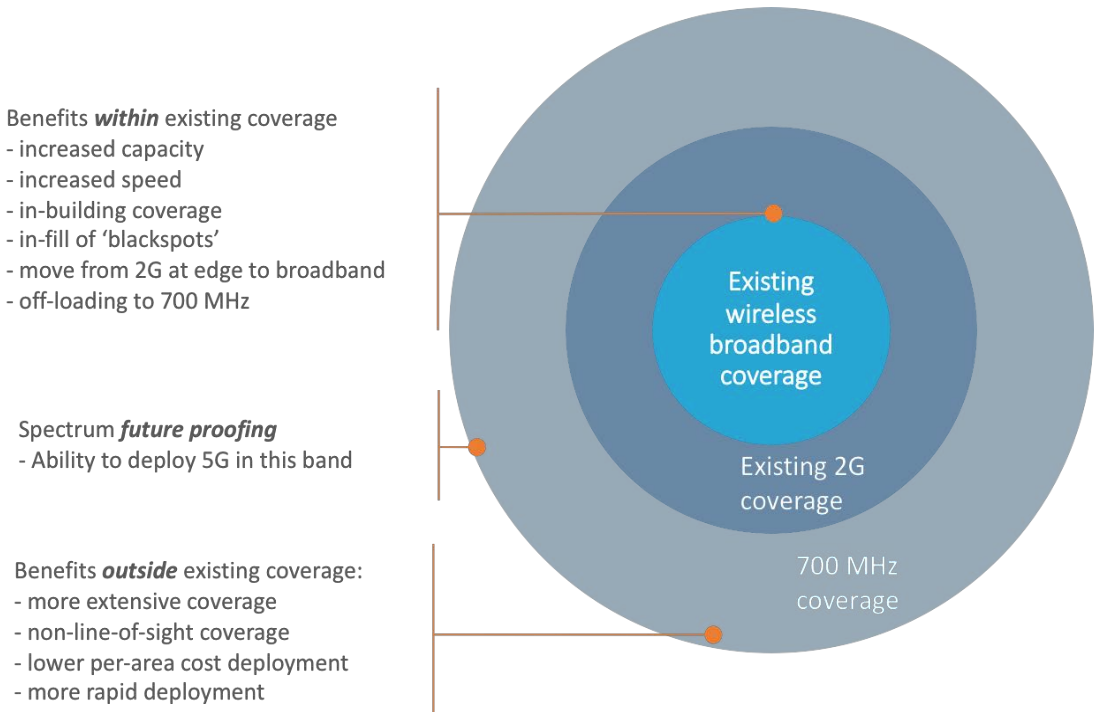
Source: GSMA updated by WPC May 2020



Many auctions have been
Impacted by COVID-19 but
A range of markets are
Proceeding with their auctions
eg Netherlands

5G Spectrum – 700 MHz allocations (4)

In addition to assigning the 3.5 GHz bands, there are benefits from assigning the 700 MHz band (APT700) and coverage band for 5G deployment. Securing the digital dividend in Asia has been particularly difficult and slow. There is a need to redouble the sector's effort on this ….

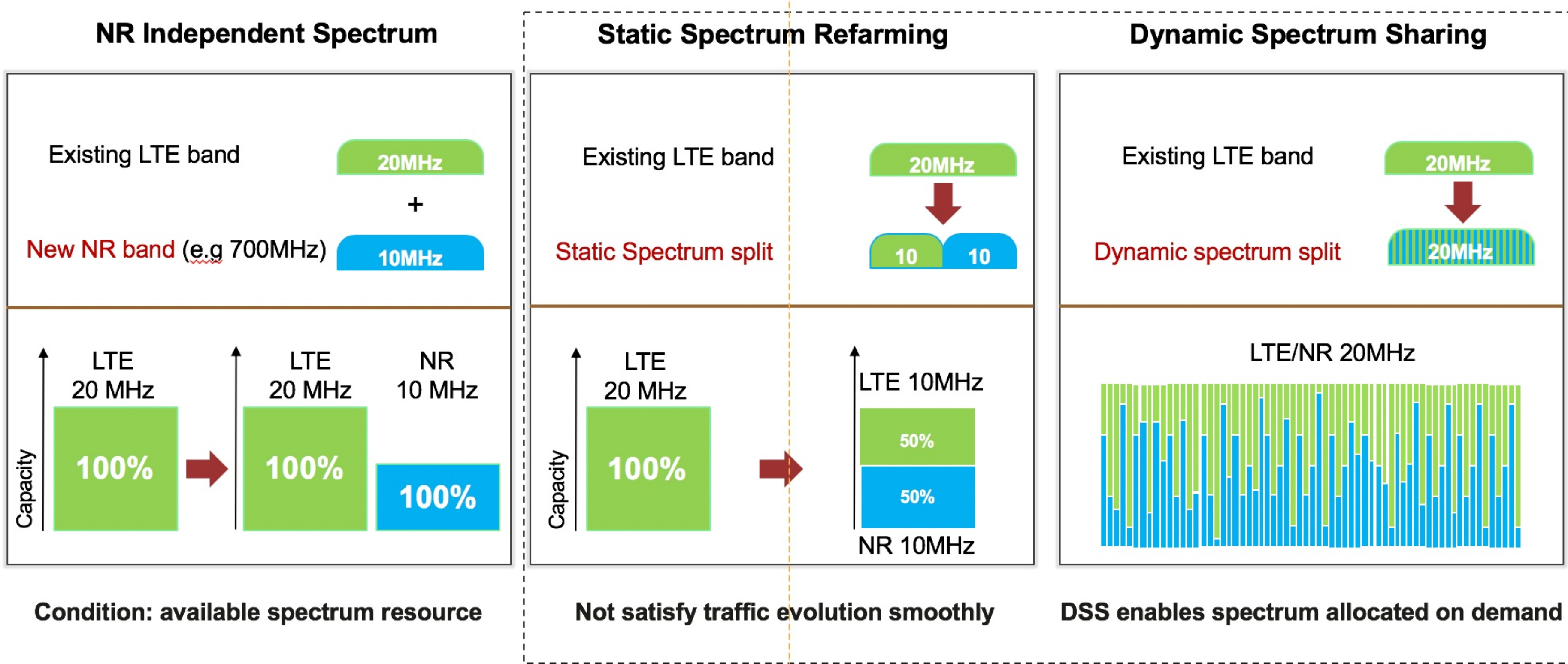


Source: GSMA, 2018 with updating modifications by the WPC, April 2020

Great to hear that markets like Vietnam which are now completing the digital TV migration and allocating 700 MHz are starting to look at the second digital dividend in the 600 MHz as a 5G band

5G – Ways to introduce FDD NR

In addition allocating new 5G spectrum, refarming spectrum for 5G, Dynamic Spectrum Sharing is an excellent solution to fully utilise scarce IMT spectrum – eg in the 2100 and 1800 MHz bands.



Source: Huawei, July 2020

Best Practices for spectrum refarming (1)

Best Practices

- Clearly set out and agree on the approach to refarming and renewal in advance (preferably at least 3 – 4 years prior to expiry) to avoid network investment being postponed
- In the case of renewal, government should work on the presumption of renewal and incumbent licensees should have the Rights of First Refusal – *however subject to overriding policy criteria including competition and efficient use of spectrum*
- Provide stability, certainty and transparency through long-term planning, i.e. develop spectrum roadmaps
- Progressively remove service and technology restrictions in existing mobile spectrum usage rights
- Introduce flexible regulatory tools, such as spectrum trading and sharing, to facilitate better spectrum utilisation
- Evaluate spectrum value in a holistic approach, and focus on long-term socio- economic impact

Refer to https://www.gsma.com/spectrum/wp-content/uploads/2017/11/10-Day-2-Session-3-How-to-Implement-Spectrum-Refarming-Shola-Sanni.pdf

Best Practices for spectrum refarming (2)

Technology Neutrality

- Allows for non-interfering technology (typically more advanced and spectrally efficient) to be deployed by the license holder in a given allocation of spectrum.
- Allows for licensees to evolve technologies deployed & services delivered as markets develop.
- It enhances the user experience, improves spectrum efficiency and facilitates higher bandwidth services
- Original mobile licenses (and other spectrum licenses) were technology-specific, e.g., the GSM Directive in the EU specified that only GSM technology could be deployed in the 900 band — EU policy like most countries is technology-neutral.
- In a neutral regime, deployed technology must not create interference with incumbent users, e.g., an incumbent may be able replace GSM with FDD LTE in 1800MHz spectrum, but cannot ‘change’ the use to interfering technology.

For example: Australia, Indonesia (recently), Malaysia (recently), Myanmar, Vietnam (recently) and the EU.

Best Practices for spectrum refarming (3)

- The efficient use of wireless requires government action in the form of spectrum refarming, the clearing of frequencies from low-value (by economic and/or social criteria) and reassignment to higher-value applications.

- This is a complex and difficult task in that the occupants of the frequencies to be reassigned are unlikely to be pleased by the change, because of disruptions to their activities. Across Asia, this can be a very political process and without any consensus there is inertia (ie no change).

- There are **arguments for relocating users to be compensated on a replacement-cost basis via a spectrum refarming fund**. Clearly this ought be done on a discretionary basis and should not be a right. The funds for compensation must be raised from the beneficiaries of refarming, ideally as part of tender or auction proceeds. Alternatively direct Government funding, or deposit monies from the early auctioning of spectrum (ie auction in 2020 with spectrum only available in 2021/22) could be used. Structural adjustment monies from international donors or agencies may also be available.

- There are **global precedents for such compensation** and covering the cost of the relocation of certain spectrum users.

Estimating the cost of delaying 5G spectrum (1)

- While a systematic estimate of the national economic benefits of 5G deployment in Indonesia is would require a detailed study, it is possible, however, to provide indicative estimates on the basis of the studies in comparative countries.

- **Indonesia's 2019 GDP is estimated by the IMF at USD1.200 trillion or USD3.740 trillion on a purchasing power parity (PPP) basis.** It is typically the case that emerging economies have significantly higher GDP at PPP compared to their nominal GDP.

- A South Korean study undertaken by KT Economic Management Research in 2018 which was a key motivation for the South Korean Government to accelerate 5G services in South Korea **estimated that by 2025 5G deployments would add 1.51% to South Korean GDP or 2.08% by 2030.**

- In order to estimate the impacts of 5G deployment on the Indonesian economy, we can use these estimates for the South Korean context. We can assume that the KT Economic Management estimates were based on deployment of 5G networks commencing in South Korea in 2019. **If we were to assume that 5G deployments began in Indonesia in 2020 then we could use the South Korean estimates to forecast the impact on Indonesian GDP in 2025 and 2030 based on the same 1.51% and 2.08% increments to GDP over these periods respectively.**

Estimating the cost of delaying 5G spectrum (2)

- The table shows the estimated impacts on Indonesian GDP from 5G deployments using the estimated impacts from the South Korean study. Note the 2019 starting points for international GDP are at USD1.2 trillion or USD3.74 trillion in purchasing power parity (PPP) terms.

	US$ billion	INCREASE in GDP by 2025 USD billion	INCREASE in GDP by 2030 USD billion
2019 GDP nominal	1,200		
2019 GDP PPP (US$ billion)	3,740		
1.51% increase to GDP by 2025		18.1 (55.9 in PPP terms)	
2.08% increase to GDP by 2030			25 (78.0 in PPP terms)

- According to the estimated impacts from the KT Economic Management study, **by 2025 commencing deployment of 5G in Indonesia in 2020 would add USD18.1 billion per year to nominal GDP or USD55.9 billion at PPP. By 2030, the respective figures are USD25 billion nominal or USD78 billion PPP. Postponing 5G means that such growth is lost to the Indonesian economy.**

Estimating the cost of delaying 5G spectrum (3)

- These increments to GDP are *annual*, that is, in every year following the 5- or 10-year period after the commencement of 5G deployment, GDP is *higher than it would otherwise be*. Furthermore, these increases are *cumulative and compounding*. **In the long term the economic benefits are very substantial.**

- **Under any cost benefit analysis freeing up such 5G capable spectrum – even if it involved material compensation to current spectrum holders for the early handback of spectrum and/or the purchase of spectrum holders would be supported in economic terms. The CBR ratio is high.**

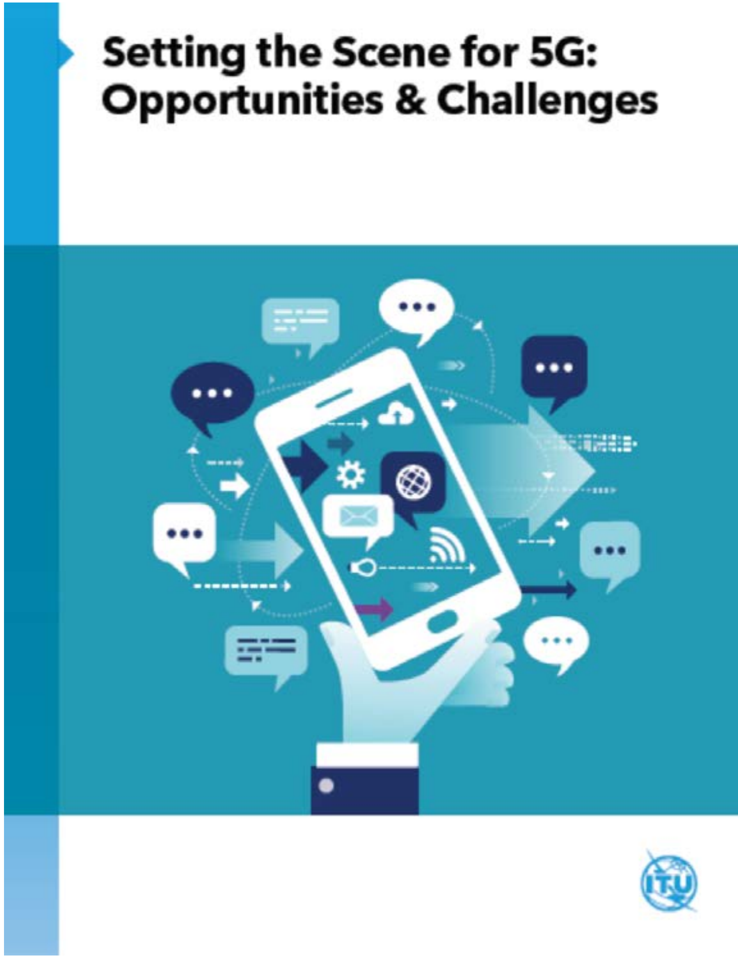
- Obviously, such high-level indicative calculations need to be treated with a significant degree of caution. An important factor is that South Korea has extensive fixed broadband infrastructure. On this basis, **it is likely that 5G deployments will have a *greater relative impact* on the Indonesian economy than on South Korea**. This is because several economic studies including from the ITU and the World Bank have shown that WBB deployments in emerging economies have greater relative impacts than in advanced economies which typically have more extensive fixed networks.

- **It should also be noted that such estimates do not include the significant benefits to Government finances (which would be helpful given the current economic impacts of the COVID-19 pandemic) for the sale/auction of this 5G capable spectrum including 700 and 2600 MHz spectrum bands.**

ITU Cost studies on deploying 5G spectrum

Example of costs and investment implications

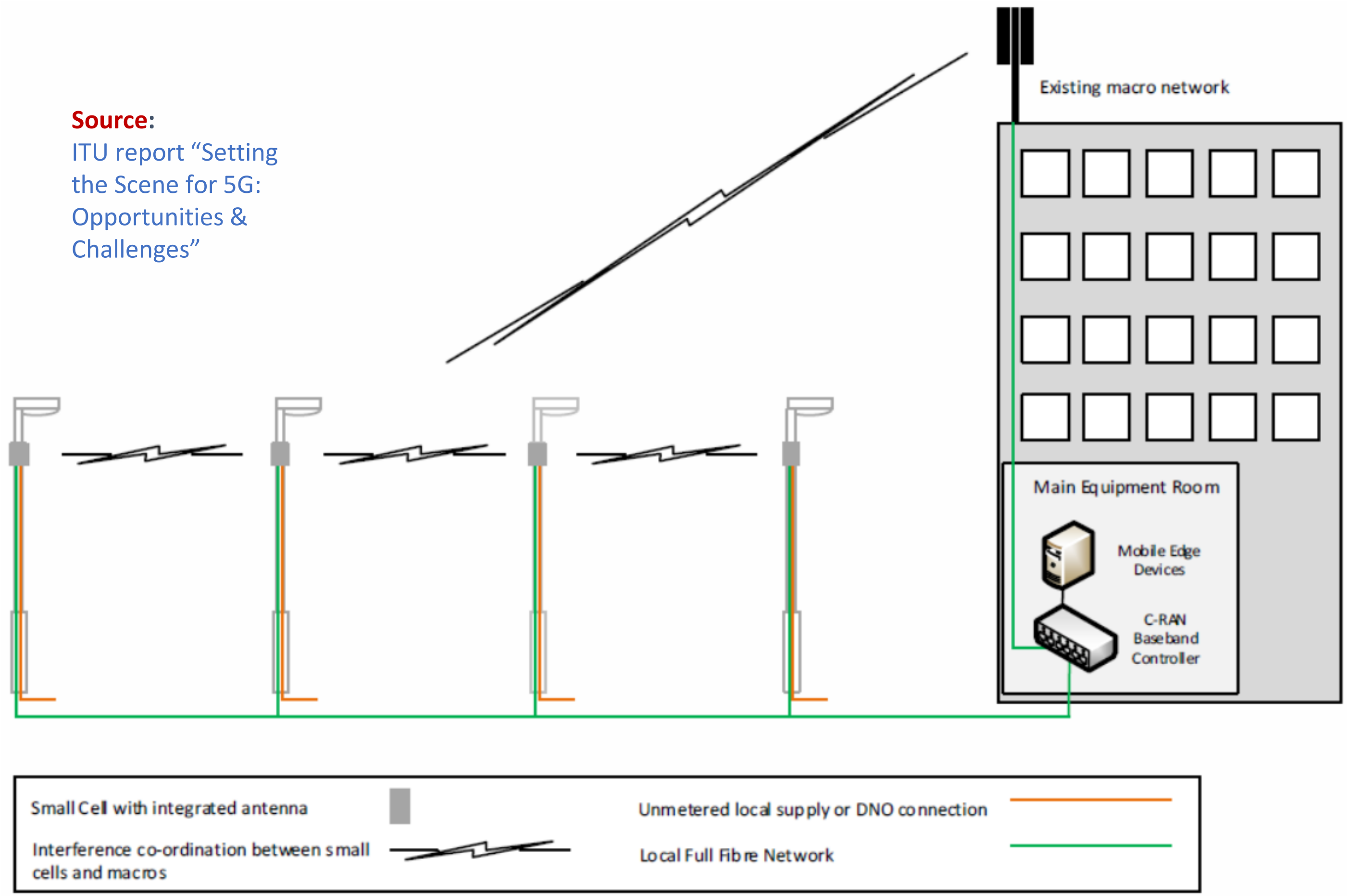
Example of a high-level cost model to estimate the potential investment required by a wireless operator to deploy a 5G-ready small cell network



Source:
ITU report "Setting the Scene for 5G: Opportunities & Challenges", 2018

Typical neutral host wholesale small cell solution

Source:
ITU report "Setting the Scene for 5G: Opportunities & Challenges"



- **Antennae** – discreet high-performance antenna system which shapes the mobile operator's signal to maximize service performance for end users.
- **Street lights** – deployment of antennae on existing street lights to minimize aesthetic disruption.
- **Street cabinets** – shared accommodation hosting mobile operator radio equipment, battery backup and control equipment.
- **Fibre network** – high speed fibre that connects the radio network with the core network. Note that in some cases it may be more cost effective to use wireless backhaul.
- **Main Equipment Rooms (MER)** – A series of localized, shared main equipment

Two case study scenarios

➢ Scenario 1 – large densely populated city

Assumptions

- Proposed urban coverage area: 15 sq km
- Population density of coverage area: 12 000 people per sq km
- Inter-site small cell distance: 150 m.

➢ Scenario 2 – small medium density city

Assumptions

- Proposed urban coverage area: 3 sq km
- Population density of coverage area: 3 298 people per sq km
- Inter-site small cell distance: 200 m.

Source:
ITU report "Setting the Scene for 5G: Opportunities & Challenges" , 2018

Estimated Results – Capex for scenarios

Scenario 1 – large densely populated city

Item	Value
Total CAPEX (USD millions)	**55.5**
Number of small cell sites	1 027
Cost per square km (USD millions)	3.7
CAPEX per site (USD thousands)	54.1

Scenario 2 – small medium density city

Item	Value
Total CAPEX (USD millions)	**6.8**
Number of small cell sites	116
Cost per square km (USD millions)	2.3
CAPEX per site (USD thousands)	58.6

WPC would note that 5G equipment pricing is more competitive in Asia than in North America and has fallen appreciably since 2018 when this ITU Report was prepared

Source:
ITU report "Setting the Scene for 5G: Opportunities & Challenges" , 2018

Estimated Results for the ITU case studies

Small cell distance	Scenario 1	Scenario 2
RAN equipment *(antenna, street cabinet, base station electronics, battery backup and network maintenance modules)*	**25%**	24%
Implementation costs *(design and planning costs, site upgrade costs, permit costs and civils costs to lay street cabinets)*	**50%**	46%
Fibre *(provision of 144 fibre along the route of activated street assets)*	**25%**	30%
MER *(single rack and termination equipment)*	**<0.1%**	<0.1%

Source:
ITU report “Setting the Scene for 5G: Opportunities & Challenges”, 2018

5. Conclusions and Recommendations

Having the right policy & regulatory settings …

The ***ITU Digital Infrastructure Policy and Regulation in Asia-Pacific paper released September 2019*** :

1 Set broadband targets for digital infrastructure

Develop national plans for affordable broadband targeting 65% in developing and 35% in least developed nations

2 Ensure legislation is updated and fit for purpose

Promote independent regulatory bodies, fair non-discriminatory rules, open access and rights of way

3 Incentives for the deployment of digital infrastructure

Balance regulatory and tax imposts of operators to encourage infrastructure deployment

4 Issue new rules addressing rights of way

Overcome barriers to rights of way processes to facilitate more rapid infrastructure deployment

5 Facilitate fixed broadband and 5G infrastructure deployment

Encourage sharing infrastructure for 5G, build check-before-you-dig national database, one-stop approvals

6 Releasing more IMT spectrum for wireless broadband and 5G

Expand allocations to at least 840 MHz in contagious blocks to encourage investments by operators

7 Facilitate switch-off of legacy 2G/3G services

Promote orderly migration to newer technologies for benefits such as spectral efficiency and lower capex and opex

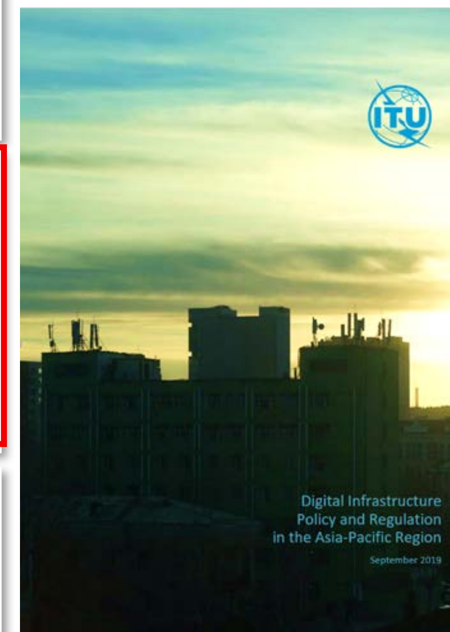
8 Improve quality of broadband services

Require accurate advertising and assessment of actual broadband speeds, encourage higher speed targets

9 Improve regulatory skillsets

Build skillsets in economics, finance, content regulation, cybersecurity, law, competition analysis, tax and cross-government experience.

Key relevant recommendations



Conclusions and Recommendations (1)

Broadband technologies are the most appropriate technology solutions to ease the social and economic impact arising from the COVID-19 pandemic. **The use of the digital tools has facilitated the continuation of a base level of economic activity in many countries notwithstanding the many lockdowns which may have been put in place.** The key recommendations to facilitate wireless broadband and address any deficiencies during the recovery phase and the ‘new normal’ where working from home/studying from home are:

- **Increasing broadband coverage, capacity and speeds.** A target of WBB universal coverage should be set along with a policy of 2G/3G refarming to 4G/5G ideally coupled with public funding in order rural/remote broadband accessibility. Importantly decisions on whether to deploy 5G should be a decision of the MNOs based on their own assessment of the market, customer base, cost of deployment, penetration, demand, 5G device takeup etc – **in essence spectrum should be technology neutral;**
- Innovative and future technologies may be utilised to address gaps in terrestrial fixed and mobile broadband service coverage including **satellite and HAPS services**;
- **Improve ROW access in order to facilitate fixed deployment & incorporate FWA networks into fixed networks/national broadband networks** to connect residential & public sectors;
- **Release more IMT spectrum** (in larger contiguous blocks) at reasonable prices especially due to COVID-19 pricing and additional demand pressures. Both coverage spectrum (600/700 MHz) and capacity spectrum should be released;

Conclusions and Recommendations (2)

- **Improve network resilience and backhaul** including fiberization levels given increased critical nature of digital infrastructure;

- **Facilitate affordable site acquisition** by MNOs/towercos in order to support small cells etc**;**

- **Generally easing regulatory requirements and providing policy incentives** such as taxation concessions or spectrum license fee extension on licensees to promote investment; and

- **Remove or reduce custom duties on telecommunication equipment and consumer devices** to reduce deployment cost, promote BB/WBB utilisation and improve customer affordability for fixed BB equipment and new 4G/5G devices

In the medium and longer term, there will be flexibility for more substantial and sustainable policy responses. It is arguably imperative to urgently bring forward *inter alia* deployment of new digital infrastructure, assignment of in-demand IMT spectrum and new generations of technological standards. This is so that the telecommunications industry can meet heightened demand and expectations with increased ubiquity, better digital skills, and improved affordability in the post COVID-19 world. **The experiences during the COVID era need to learnt from in order to drive regional recovery and the arrive at the 'new normal'!**

Thank You