INFORMATION AND COMMUNICATIONS TECHNOLOGY AND DISASTER RISK REDUCTION DIVISION

Visualizing Broadband Speeds in Asia and the Pacific

Siope Vakataki ‘Ofa
Cristina Bernal Aparicio

ASIA-PACIFIC INFORMATON SUPERHIGHWAY
WORKING PAPER SERIES NO. 02 MAY 2021

UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

Disclaimer: The views expressed through the Asia-Pacific Information Superhighway Working Paper Series should not be reported as representing the views of the United Nations, but as views of the author(s). Working Papers describe research in progress by the author(s) and are published to elicit comments for further debate. They are issued without formal editing. The shaded areas of the map indicate ESCAP members and associate members. The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The United Nations bears no responsibility for the availability or functioning of URLs. Opinions, figures and estimates set forth in this publication are the responsibility of the authors and should not necessarily be considered as reflecting the views or carrying the endorsement of the United Nations. Any errors are the responsibility of the authors. Mention of firm names and commercial products does not imply the endorsement of the United Nations.

Please cite this paper as: 'Ofa, SV. and Aparicio, CB. (2021). Visualizing Broadband Speeds in Asia and the Pacific. Asia-Pacific Information Superhighway Working Paper No. 02/2021. United Nations ESCAP, ICT and Disaster Risk Reduction Division, May 2021. Bangkok.

Available at: http://www.unescap.org/kp

Tracking number: ESCAP / 5-WP / 5

About the author: Siope Vakataki 'Ofa is an Economic Affairs Officer and Cristina Bernal Aparicio is an individual contractor at the ICT and Disaster Risk Reduction Division, United Nations Nations Economic and Social Commission for Asia and the Pacific.

This working paper was prepared under the guidance of Tiziana Bonapace, Director, of the Information and Communications Technology and Disaster Risk Reduction Division of the United Nations Economic and Social Commission for Asia and the Pacific and direct supervision of Tae Hyung Kim, Chief of ICT and Development Section. Visual maps used in this working paper were developed by GISPO Limited. Chang Yong Son and Aida Karazhanova provided substantive inputs and facilitation of appropriate funding support towards the development of the report. The manuscript was edited by Anoushka Ali. The graphic design and layout were prepared by Xiao Dong. Administrative support on the issuance of the working paper was provided by Tarnkamon Chantarawat and Sakollerd Limkriangkrai.

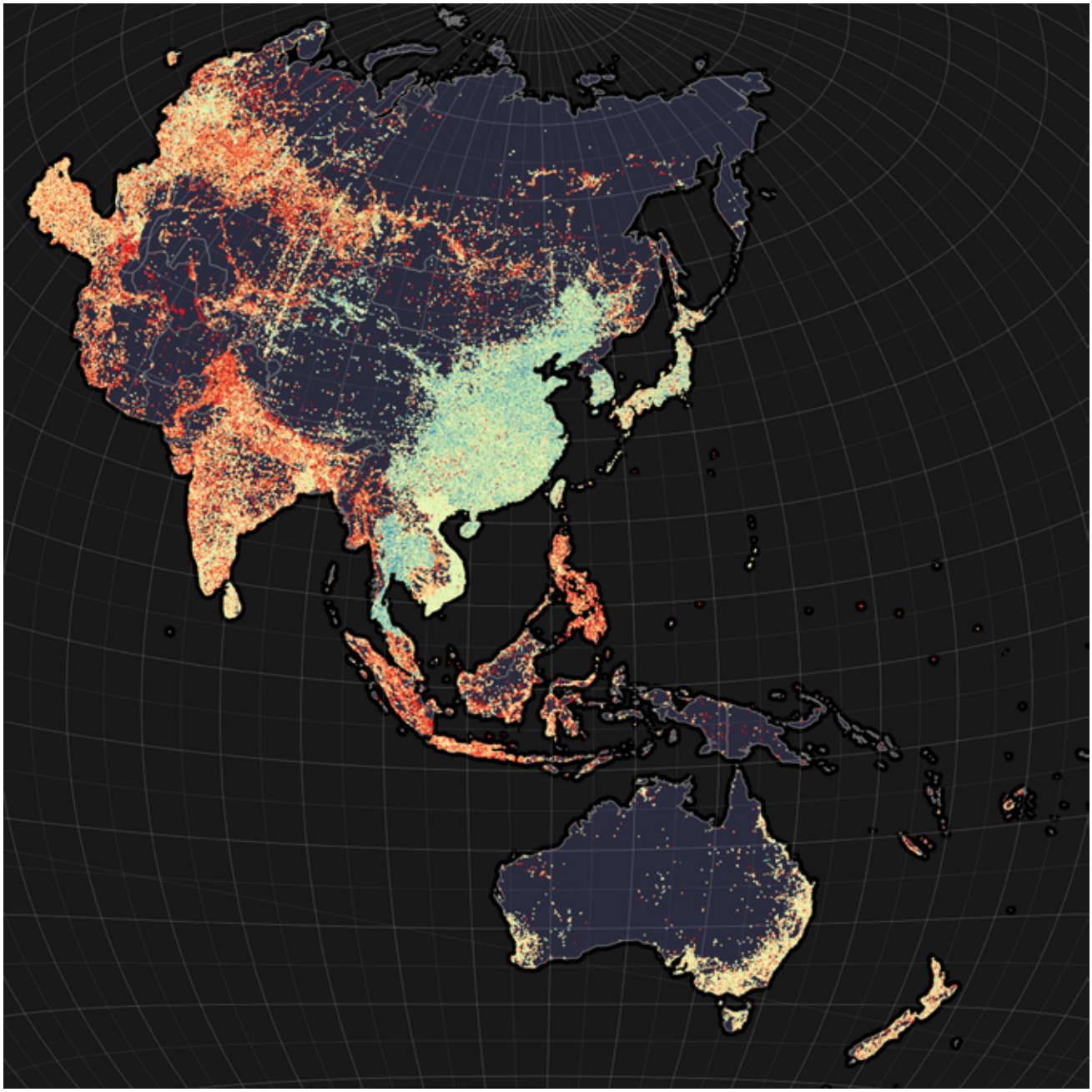
Abstract

The COVID-19 global pandemic restrictions that intensified in 2020 highlighted the critical role of digital connectivity on ensuring continued operations of critical infrastructure and services, as well as working and schooling from home. While previous research analyses have highlighted the digital divide (lack of access to broadband (fixed and mobile)) as an important challenge that risks creating new inequalities, less attention has been given to the quality (speed and latency) of broadband access. Using a new geospatial data from the speed test by Ookla on broadband speed, this working paper examines the broadband download speed differences within Asia-Pacific countries (urban and rural areas) and between Asia-Pacific subregions.

The working paper findings indicate that broadband speed differs significantly between Asia-Pacific countries during the COVID-19 pandemic in 2020. In addition, stark differences were identified on urban and rural broadband download speed within many Asia-Pacific countries, and Asia-Pacific landlocked countries were found to have lower broadband download speed compared to other Asia-Pacific subregions. These findings have important policy implications for Asia-Pacific countries on ensuring quality and affordable broadband access is achieved for sustainable development.

JEL: L88,L96, O38, R12, Y91

Keywords: Broadband Speed, Geospatial, Visualisation, Digital divide, Asia, Pacific



Description: Asia-Pacific geospatial map indicating fixed-broadband download speed in 2020. Bluish colour indicates higher download speed, orangish colour indicates slower download speed.

United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)

Map: GISPO Ltd/Topi Tjukanov 2021. Licensed under CC BY-ND 4.0

Data: Speedtest by Ookla Global Fixed and Mobile Network Performance Map Tiles (http://github.com/teamookla/ookla-open-data)

Disclaimer: The boundaries and names shown, and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

1. Introduction

When restrictions were introduced due to the COVID-19 pandemic, in early 2020, it quickly became apparent that broadband (fixed and mobile) connectivity would play an important role in the provision of critical services, for remote online schooling and for everyone who began working from home. However, the access to affordable and fast broadband connectivity varies significantly across countries within the Asia-Pacific region. Furthermore, countries with special needs, such as, least developed countries (LDCs), land-locked developing countries (LLDCs) and the small island developing States (SIDS), within Asia and the Pacific, have limited access to affordable and fast broadband connectivity, thereby further exacerbating an already widening digital divide and creating inequalities.

The objective of this report is to identify the trends in broadband download speed, during the COVID-19 pandemic, in countries within Asia and the Pacific and find meaningful policy implications for senior policymakers through the analysis of data and visual data maps. The data includes differences in broadband download speeds within a country (urban, rural or nationwide) and between the United Nations Economic and Social Comission for Asia and the Pacific (ESCAP) subregions. Using speed tests and geospatial data from Ookla, between January and September of 2020, this report examines the broadband download speed patterns of countries within the Asia-Pacific region (urban-rural distribution) and between the Asia-Pacific subregions (East and North-East Asia, North and Central Asia, Pacific, South-East Asia and South and South-West Asia) by illustrating, via maps, geospatial data for broadband speeds.

According to statistics from the International Telecommunications Union (ITU) statistics,1 the fixed broadband download speed (measured in megabits per second (Mb/s)) has significantly improved in the Asia-Pacific region in the last decade. The average total number of fixed broadband subscriptions with at least 10 Mb/s download speed, in the region, increased from 2 million subscriptions in 2010 to 154 million subscriptions in 2019. This impressive growth is the highest in any major region including Europe, North America, Latin America and the Caribbean and Africa. In addition, the release of Internet speed test data from Ookla, in 2020, has enabled further in-depth analysis of the download speed of users in the region. The speed test data from Ookla provided disaggregated data of Internet speed, which was classified into eight categories from the lowest download speed of (<3 Mb/s) to a highest download speed (>100 Mb/s).

1 Computation by ESCAP based on International Telecommunication Union (ITU), "World Telecommunication/ICT Indicators 2020 Database (24th Edition, December 2020)" January 2021. Available at https://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx

Access to fixed broadband subscriptions vary significantly between the Asia-Pacific subregions. With 15 per cent2 of the 4.5 billion population in Asia and the Pacific, in 2019, estimated to have access to fixed broadband subscriptions, the Pacific (strongly driven by Australia and New Zealand) reported 33 per cent of its total population as having fixed broadband subscriptions, followed by East and North-East Asia (32 per cent), North and Central Asia (20 per cent), South-East Asia (8 per cent), and South and South-West Asia (3 per cent). Mobile broadband subscriptions have experienced a stronger growth where 88 per cent of the 4.5 billion population, in Asia and the Pacific, are estimated to have access to mobile broadband subscriptions. At the subregional level, the Pacific, East and North-East Asia, North and Central Asia, and South-East Asia reported more than 80 per cent of their populations as having mobile broadband subscriptions with the exception of South and South-West Asia (48 per cent). In addition, the price of smart devices that are 4G (fourth generation mobile technology) or 5G (fifth generation mobile technology) enabled, are still restrictive for millions of users. The prices of broadband (fixed and mobile) have continued to decline, in the last decade, in the region. The average prices of fixed broadband in Asia and the Pacific have dropped by 36 percentage points from US$ 14.54, in 2010, to US$ 9.26 in 2019. At the much lower price level, the mobile broadband prices dropped by 32 percentage points from $5.70, in 2010, to $3.86 in 2019. The Asia-Pacific subregions experienced price declines on fixed broadband subscriptions. When factoring income levels to demonstrate the affordability of broadband prices in different economies in the Asia-Pacific region, (measured by monthly expenditure on broadband services as a percentage of gross national income per capita), the affordability of fixed broadband subscriptions improved from 7 per cent in 2010 to 3 per cent in 2019. Mobile broadband affordability improved from 2.88 per cent, in 2010, to 1 per cent in 2019. Therefore, mobile broadband is considered as being affordable in the region, according to the United Nations Broadband Commission target, where less than 2 per cent of gross national income per capita is spent on broadband services. At the subregional level, while affordability has improved in the last decade for the Pacific, East and North-East Asia, North and Central Asia, South-East Asia and South and South-West Asia, only East and North-East Asia is considered affordable with 0.63 per cent for fixed broadband subscriptions and 0.41 per cent for mobile broadband subscriptions.

The capacity (bandwidth data usage per user) of Internet networks, within countries in Asia and the Pacific, also affects the speed of broadband connectivity. For the Asia-Pacific region, the bandwidth data usage per user measured a 28 fold increase, from 7 Kb/s, in 2010, to 195 Kb/s in 2019. All subregions have also reported a significant improvement in bandwidth capacity with stronger growth in East and North-East Asia. Mobile networks, with at least the third generation technology (3G), covered almost 96 per cent of the Asia-Pacific region indicating strong investments in mobile network towers. At the subregional level, all subregions have over 87 per cent of their population using 3G or higher technology.

2 Internet subscriptions using copper wire (other than digital subscriber line (telephone line), or cable modem, or fibre connection shows that half of the 4.5 billion population in Asia and the Pacific had Internet access in 2019.

2. Broadband Download Speed Data

The chapters below provide a subregional illustration of broadband (fixed and mobile) speed data that was extracted from the speed test public online data of Ookla.[1] The data used for analysis included all available speed test data from three quarters in 2020 (Quarter 1, Quarter 2 and Quarter 3), at the time of producing the maps. The original data from Ookla was aggregated to tiles sized approximately 610.8 meters by 610.8 meters at the equator. As these maps are focused on country and continent level scales, this data was aggregated further to hexagon grids roughly 40 kilometers in size. All the points from the original data, which fell inside these grids were aggregated on the new scale (i.e., the number of tests were summed and download speeds were averaged).

Ookla's speed test is widely used and, thus can be used as a proxy for broadband speed. However, local differences do apply to the data coverage. In general, data quality was satisfactory with one abnormal longitude (around 70° E), and some speed tests with outliers that may be attributed to possible rounding errors in the original data. In addition, the grid resolution highlights the number of speed tests with averaged download speed in a geographic grid. However, broadband coverage is not necessarily indicated if no user has been tested from a particular geographic grid. Missing data were also recorded, mostly in the Pacific island countries, where users did not use the speed test for testing Internet speed.

Broadband (fixed and mobile) download speeds refers to how fast (measured in megabits per second (Mb/s)) data travels from the World Wide Web to a device with an Internet connection. The disaggregated broadband speed data are classified into eight speed categories (<3 Mb/s; 3-5 Mb/s; 5-10 Mb/s; 10-20 Mb/s; 20-50 Mb/s; 50-100 Mb/s; 100-200 Mb/s; and >200 Mb/s). The legend integrated in the maps below depicts the average Internet download speeds, across the eight speed categories, using a color palette that ranges from red, which shows the lowest broadband download speeds, to blue, which indicates the fastest broadband download speeds. Lack of data is represented in those land areas that are black (not showing any color), and can be interpreted as areas where there was no broadband speed test performed or where there is no broadband connectivity available.

1 For further details on dataset see GitHub, "Speedtest by Ookla global Fixed and Mobile Network Performance Map Tiles". Available at https://github.com/teamookla/ookla-open-data

The analysis on trends in each map will adopt a four-category broadband speed for simplicity:

1. Low broadband speed: < 5 Mb/s;
2. Lower-middle broadband speed: 6-49 Mb/s;
3. Upper-middle broadband speed: 50-99 Mb/s; and
4. High broadband speed: 100 Mb/s.

In general, with broadband speeds lower than 20 Mb/s, users may experience connectivity issues, including buffering when streaming videos and difficulty connecting multiple devices. On the other hand, broadband speeds of 100 Mb/s or higher are considered fast and capable of handling multiple online activities for multiple users at one time without major interruptions in service. As an example, a slow broadband speed with less than 5 Mb/s may take between 16 and 80 seconds to download a 10 Mb/s file compared to a fast broadband speed (≥ 100 Mb/s) with less than one second.

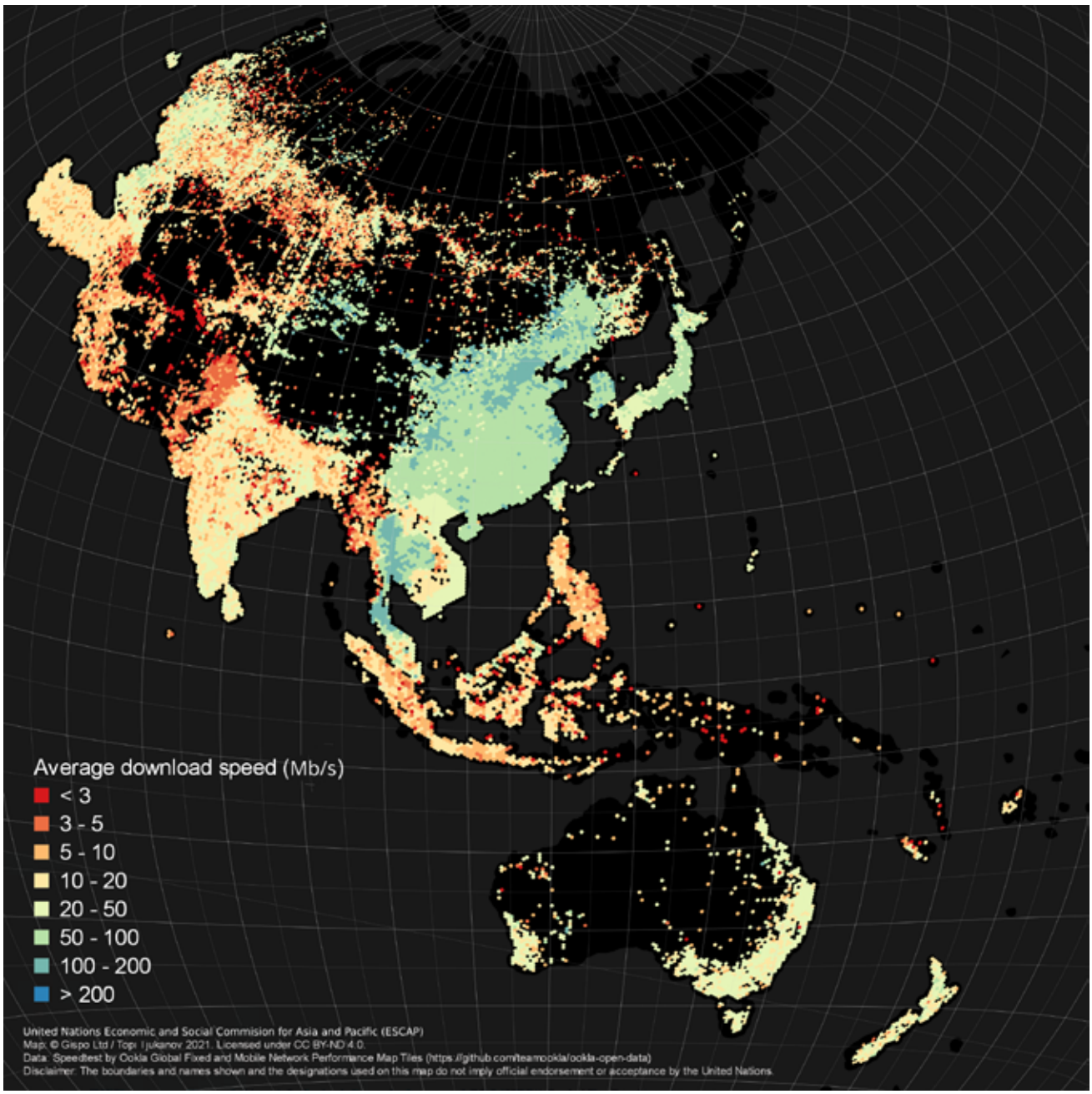
Countries within the Asia-Pacific region are categorized into five subregions as follows: East and North-East Asia, North and Central Asia, the Pacific, South-East Asia and South and South-West Asia.[2] Between the Asia-Pacific subregions, East and North-East Asia recorded the highest average broadband (for both fixed and mobile) speed driven strongly by Hong Kong, China, Thailand, the Republic of Korea, China and Australia.

The next section will showcase the maps that illustrate broadband download speed data of the Asia-Pacific region, as well as the five Asia-Pacific subregions, together with the Asia-Pacific landlocked countries and the Asia-Pacific countries in the United Nations Special Programme for the Economies of Central Asia (SPECA).

2 For a list of countries included in each Asia-Pacific subregion, please see: https://www.unescap.org/subregional-office

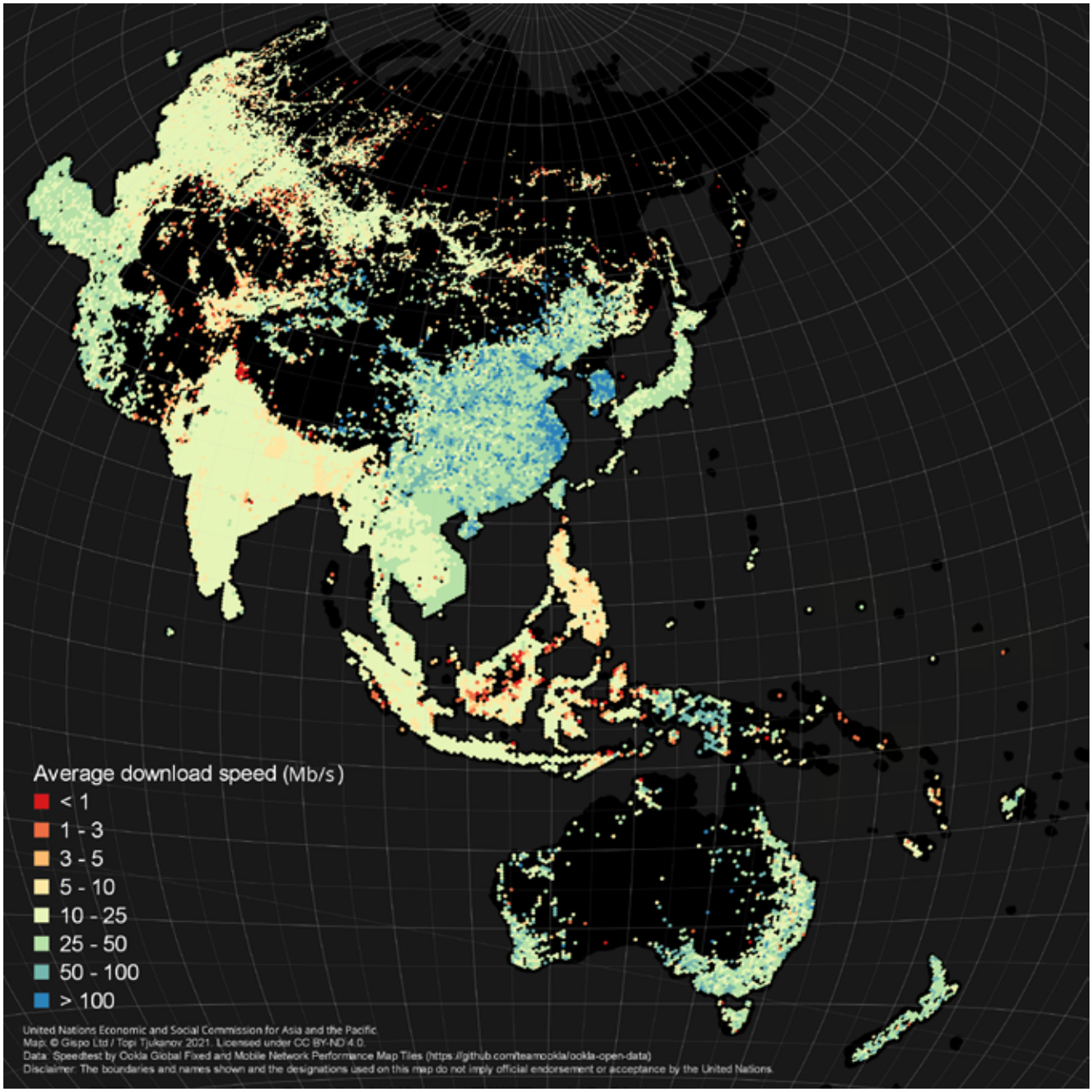
3. Asia and the Pacific

Map 3.1 Fixed broadband speed in Asia and the Pacific



Regional average speed	Upper-middle download speed (55 Mb/s).
Top 5 highest download speed economies	Hong Kong, China (125 Mb/s), Thailand (109 Mb/s), the Republic of Korea (103 Mb/s), Macau, China (102 Mb/s), and China (93 Mb/s).
Subregion with highest broadband speed	East and North-East Asia (90 Mb/s). Urban and rural fixed broadband download speed differences exist in the region.

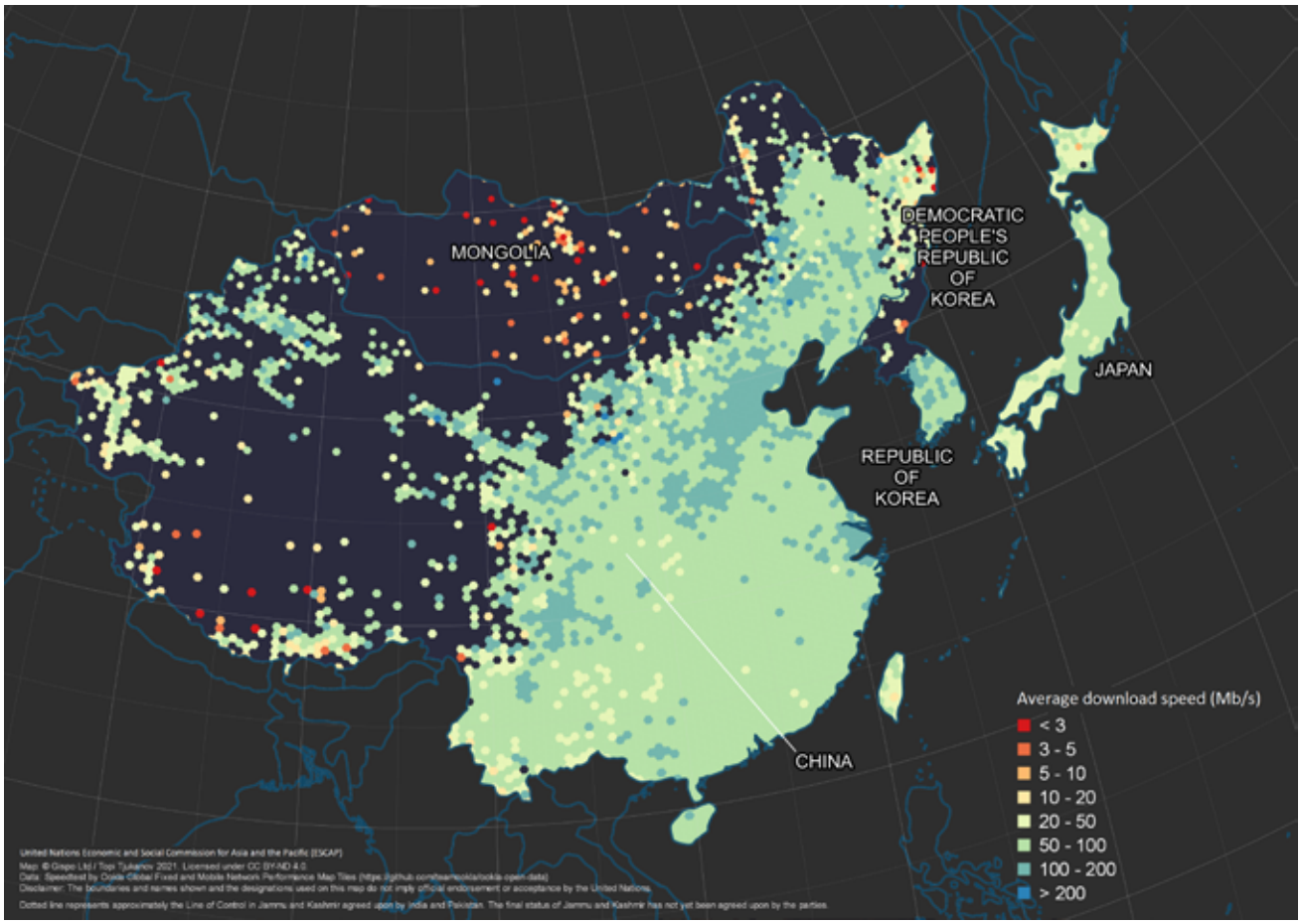
Map 3.2 Mobile broadband speed in Asia and the Pacific



Regional average speed	Lower-middle download speed (31 Mb/s).
Top 5 highest download speed economies	Macao, China (202 Mb/s), the Republic of Korea (122 Mb/s), China (78 Mb/s), Hong Kong, China (125 Mb/s), and Australia (60 Mb/s).
Subregion with highest broadband speed	East and North-East Asia (73 Mb/s). Urban and rural mobile broadband download speed differences exist in the region.

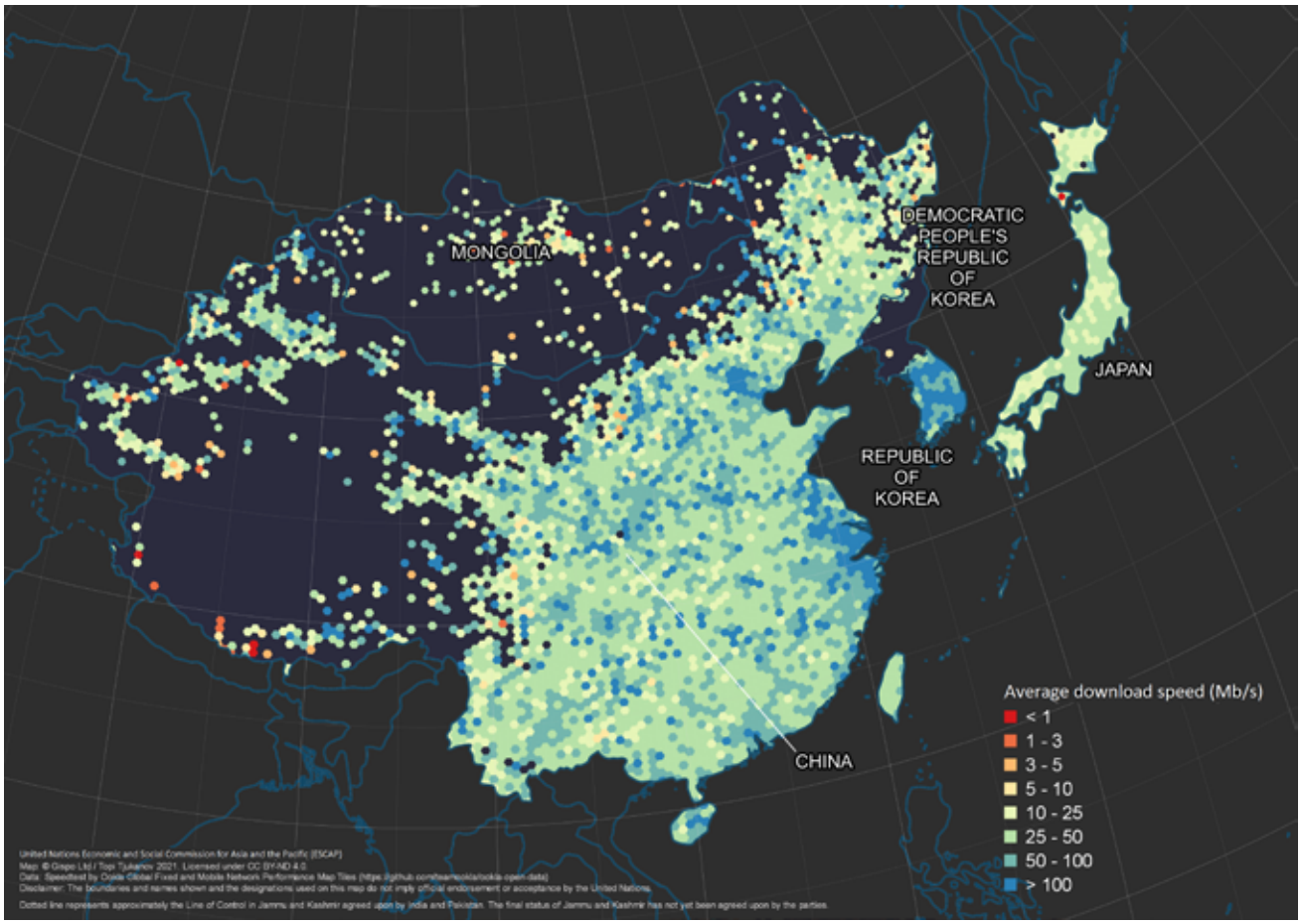
4. East and North-East Asia

Map 4.1 Fixed broadband speed in East and North-East Asia



Subregional average speed	Upper-middle download speed (90 Mb/s).
Top 2 highest download speed economies	Hong Kong, China (125 Mb/s) and the Republic of Korea (103 Mb/s).
Urban/rural download speed differences	Hong Kong, China, Macao, China, the Republic of Korea and Japan demonstrated the least fixed broadband download speed differences nationwide. Uneven mobile broadband download speeds between urban and rural areas was evident in Mongolia and Western China. Hong Kong, China recorded the highest fixed broadband download speed, with an average of 125 Mb/s, followed by the Republic of Korea (103 Mb/s), Macao, China (102 Mb/s), China (93 Mb/s), Japan (62 Mb/s) and Mongolia (17 Mb/s). No sufficient data was available for the Democratic People's Republic of Korea.

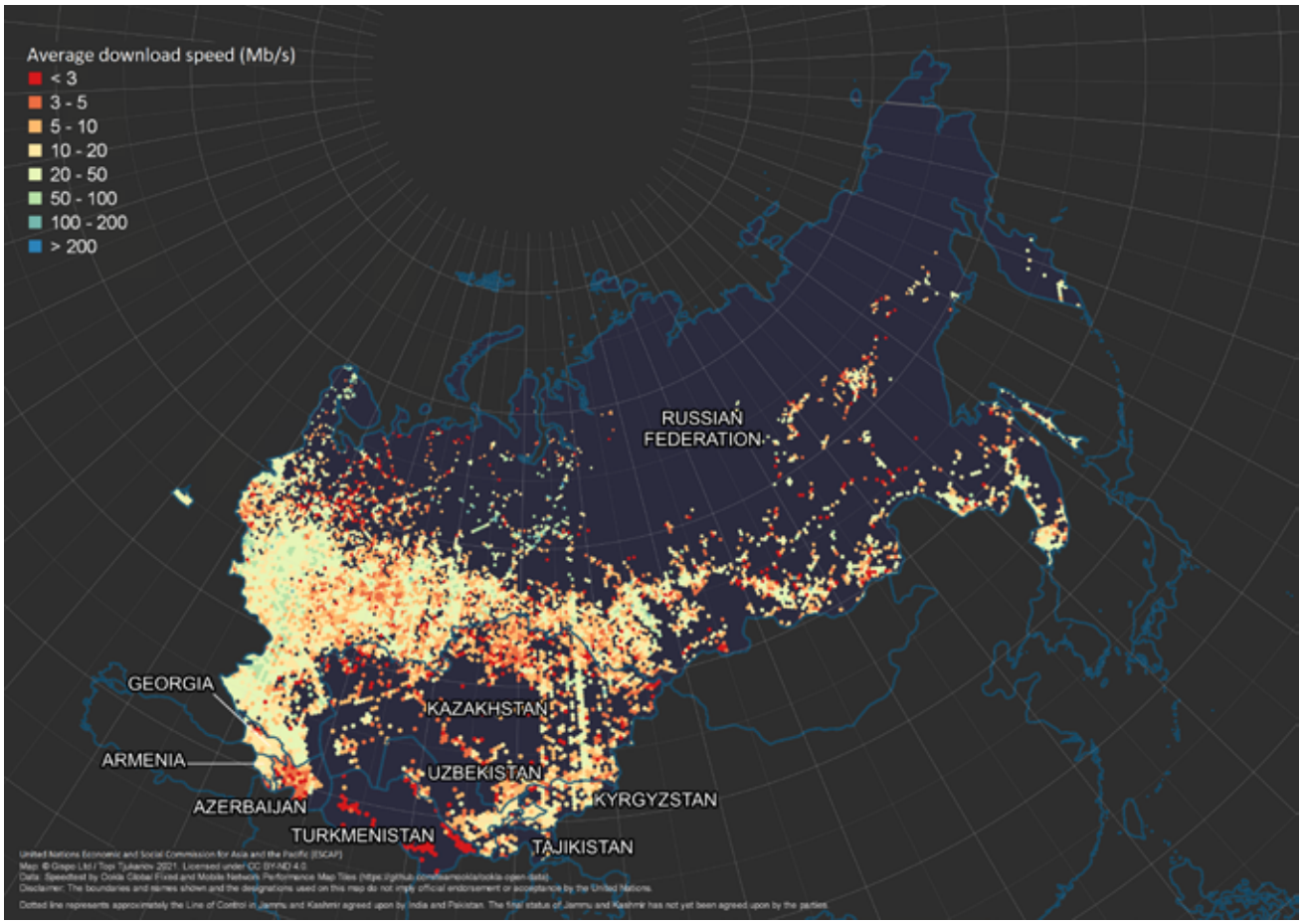
Map 4.2 Mobile broadband speed in East and North-East Asia



Subregional average speed	Upper-middle download speed (73 Mb/s).
Top 2 highest download speed economies	Macao, China (202 Mb/s) and the Republic of Korea (122 Mb/s).
Urban/rural download speed differences	Macao, China, the Republic of Korea, Japan and Hong Kong, China demonstrated the least mobile broadband download speed differences nationwide. Uneven mobile-broadband download speeds between urban and rural areas was evident in Mongolia and Western China. Macao, China recorded the highest mobile broadband download speed, with an average of 202 Mb/s, followed by the Republic of Korea (122 Mb/s), China (78 Mb/s), Hong Kong, China (49 Mb/s), Japan (29 Mb/s) and Mongolia (22 Mb/s). No sufficient data was available for the Democratic People's Republic of Korea.

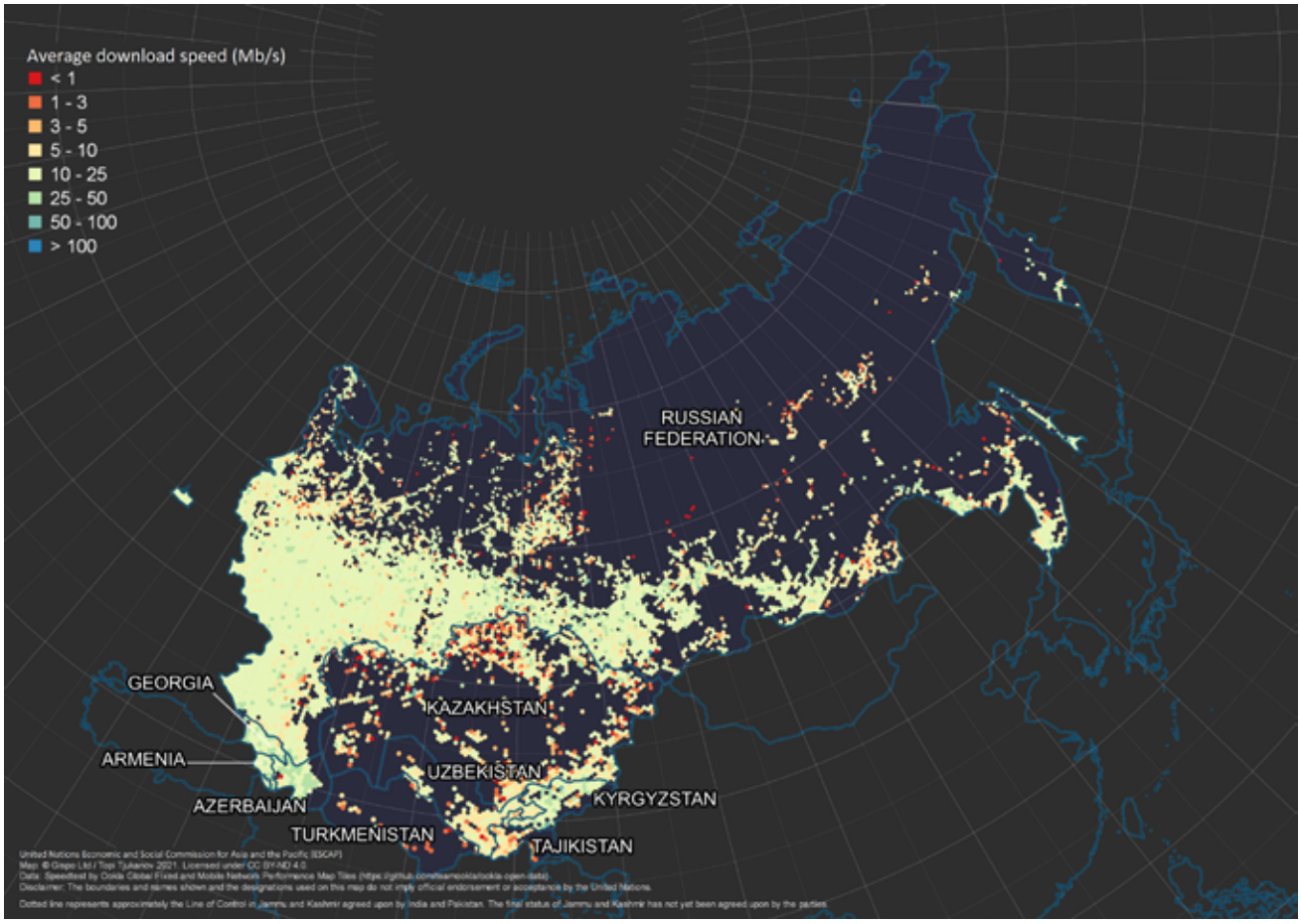
5. North and Central Asia

Map 5.1 Fixed broadband speed in North and Central Asia



Subregional average speed	Lower-middle download speed (32 Mb/s).
Top 2 highest download speed economies	The Russian Federation (36 Mb/s) and Kyrgyzstan (19 Mb/s).
Urban/rural download speed differences	Georgia and Armenia exhibited the least mobile broadband download speed differences between urban and rural areas. Urban and rural fixed broadband download speed differences exist for other economies in this subregion. There is evidence of lower fixed broadband download speed in Turkmenistan. The Russian Federation recorded the highest fixed broadband download speed, with an average of 36 Mb/s, followed by Kyrgyzstan (19 Mb/s), Georgia (16 Mb/s), Armenia (16 Mb/s), and Uzbekistan (15 Mb/s). Kazakhstan, Tajikistan, Azerbaijan and Turkmenistan had fixed broadband download speeds of lower than 15 Mb/s.

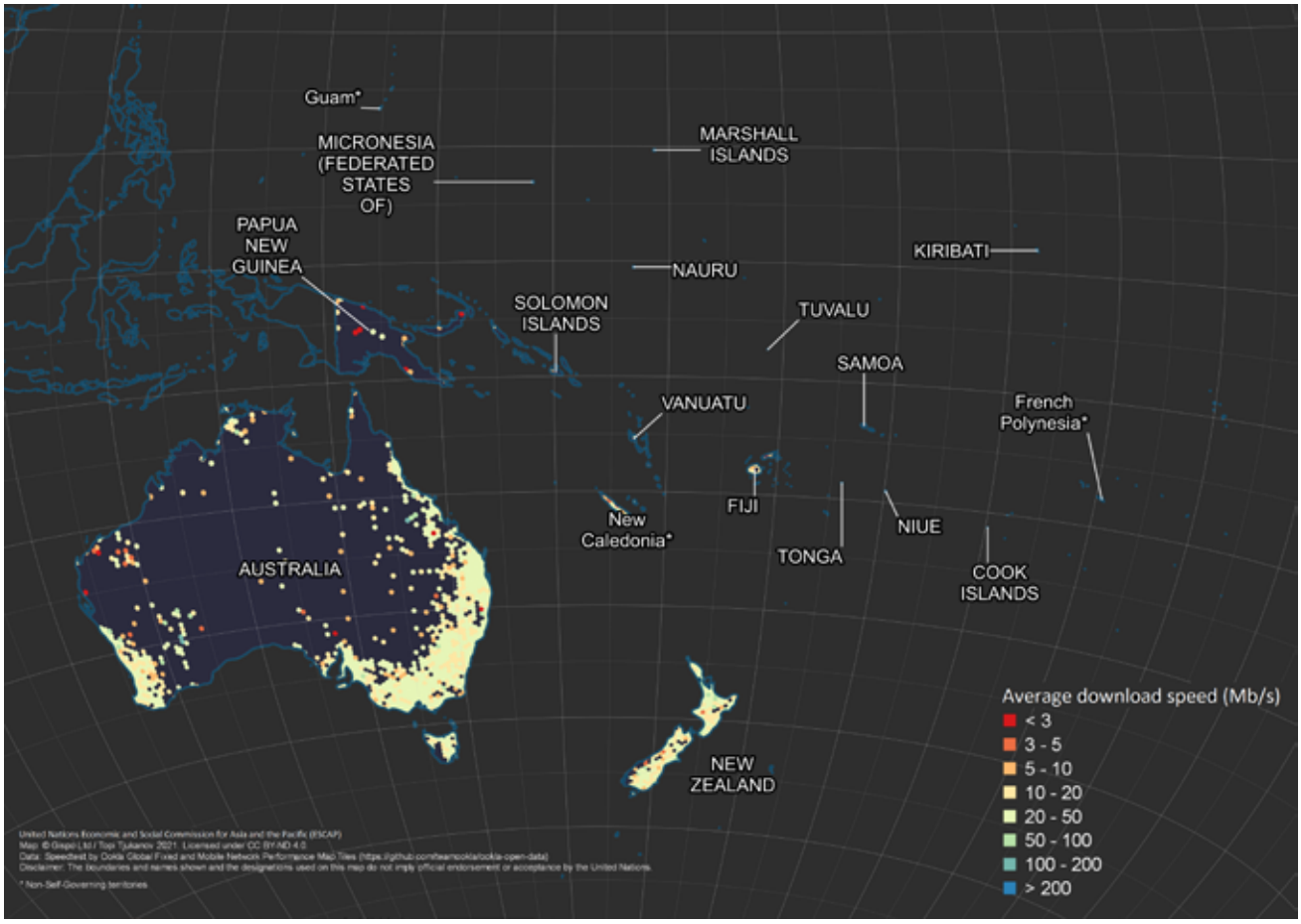
Map 5.2 Mobile broadband speed in North and Central Asia



Subregional average speed	Lower-middle download speed (18 Mb/s).
Top 2 highest download speed economies	Azerbaijan (27 Mb/s) and Georgia (25 Mb/s).
Urban/rural download speed differences	Azerbaijan, Georgia, Armenia and the areas west of the Russian Federation exhibited uniform mobile broadband download speeds between urban and rural areas. Uneven download speeds between urban and rural areas was evident in Turkmenistan. Azerbaijan recorded the highest mobile broadband download speeds, with an average of 27 Mb/s, followed by Georgia (25 Mb/s), Armenia (23 Mb/s), the Russian Federation (18 Mb/s), Kyrgyzstan (18 Mb/s), and Kazakhstan (16 Mb/s). Uzbekistan, Tajikistan and Turkmenistan exhibited mobile broadband download speeds of lower than 16 Mb/s.

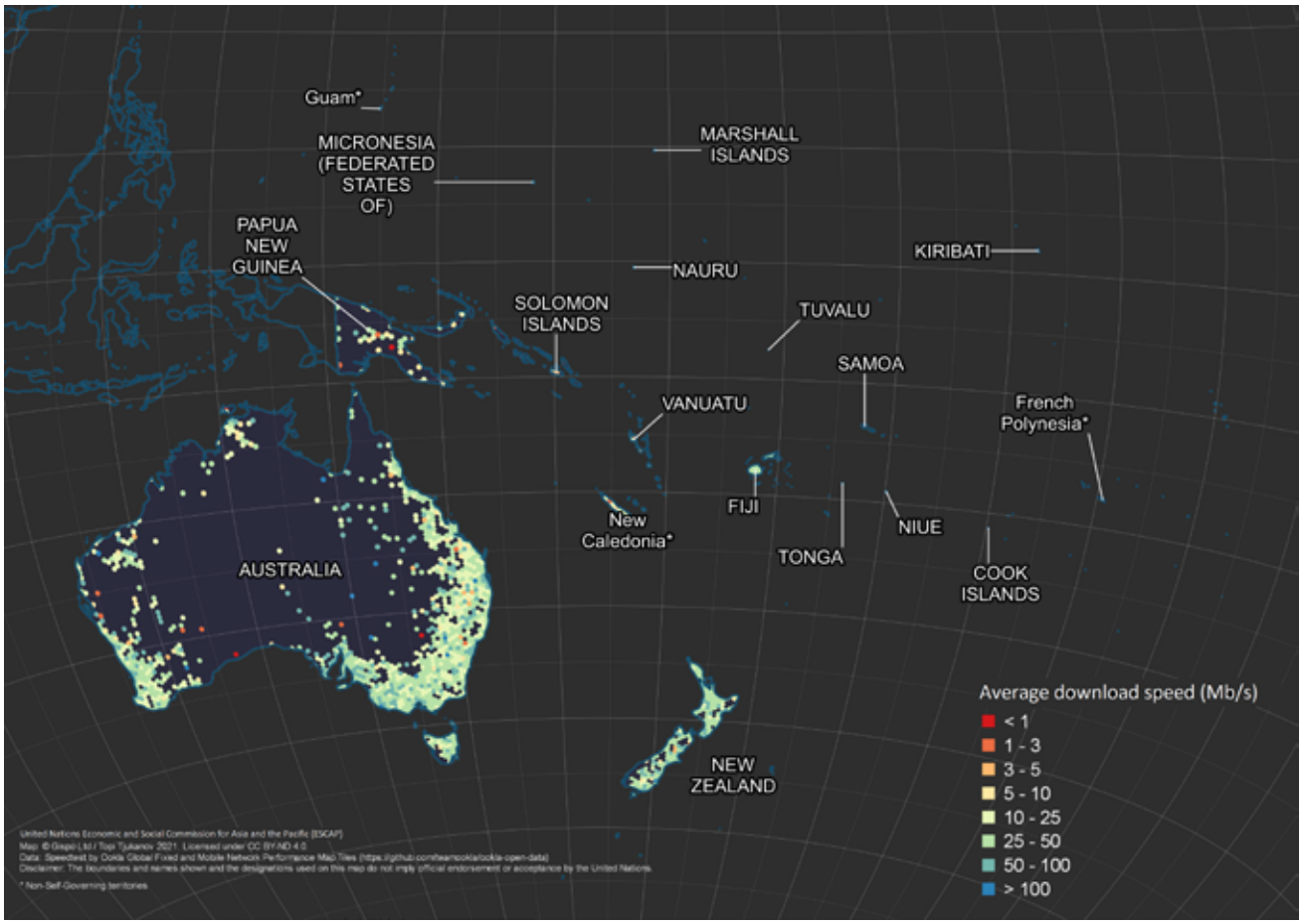
6. Pacific

Map 6.1 Fixed broadband speed in the Pacific



Subregional average speed	Lower-middle download speed (34 Mb/s).
Top 2 highest download speed economies	New Zealand (44 Mb/s), Australia (60 Mb/s), and Guam (32 Mb/s).
Urban/rural download speed differences	Higher fixed broadband download speeds found in urban areas of Australia and New Zealand. Urban and rural fixed broadband download speed differences exist in this subregion. New Zealand recorded the highest fixed broadband download speeds, with an average of 44 Mb/s, followed by Australia (32 Mb/s), Guam (32 Mb/s), the Federated States of Micronesia (24 Mb/s), Papua New Guinea (23 Mb/s), and New Caledonia (24 Mb/s). The rest of the countries had fixed broadband download speeds lower than 16 Mb/s. There was no sufficient data found for American Samoa, French Polynesia, the Marshall Islands, Samoa, Tonga and Tuvalu.

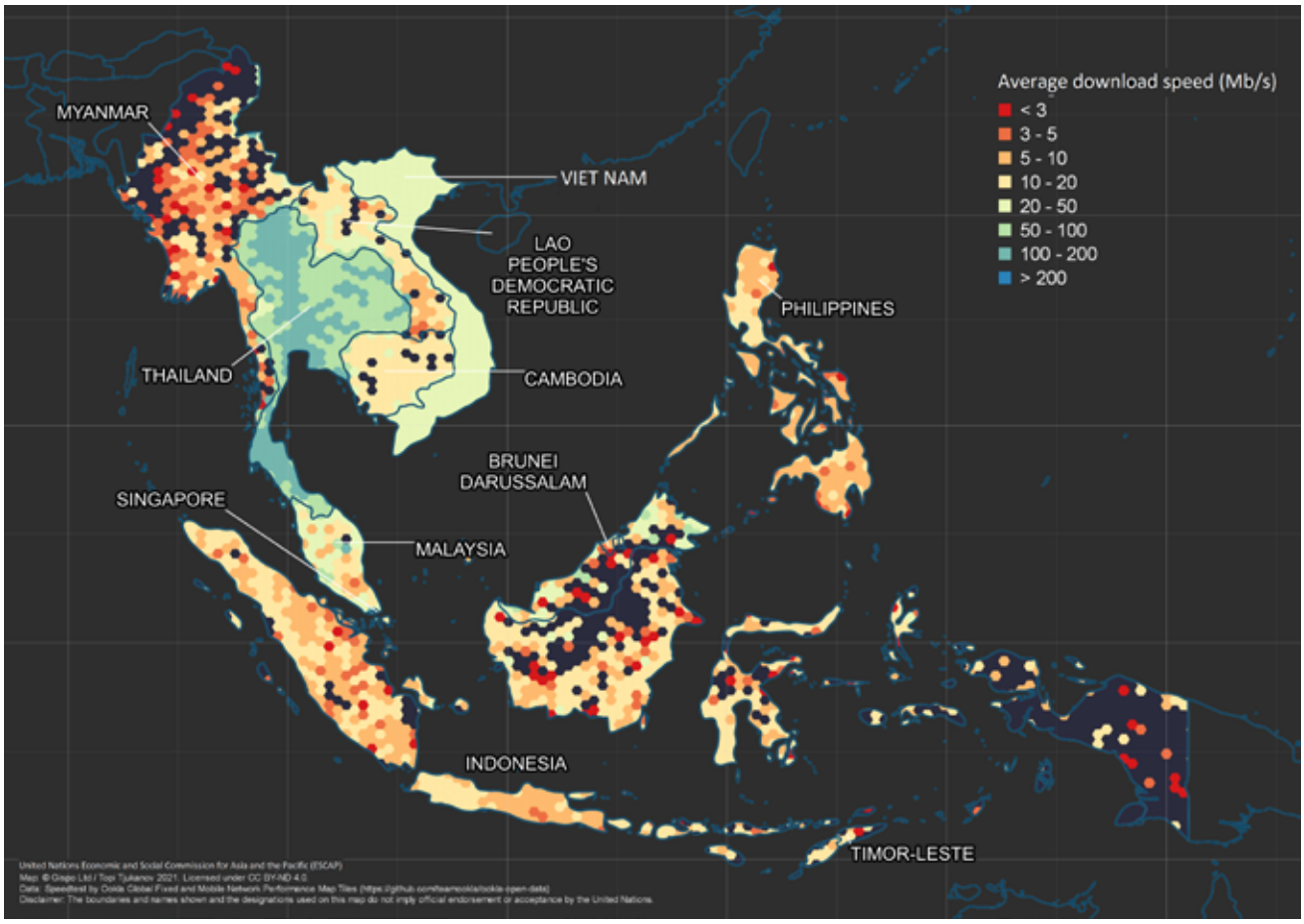
Map 6.2 Mobile broadband speed in the Pacific



Subregional average speed	Upper-middle download speed (57 Mb/s).
Top 2 highest download speed economies	Australia (60 Mb/s) and New Zealand (46 Mb/s).
Urban/rural download speed differences	Higher mobile broadband download speeds in Australia and New Zealand found in urban areas. Urban and rural mobile broadband download speed differences exist in this subregion. Australia recorded the highest mobile broadband download speeds, with an average of 60 Mb/s, followed by New Zealand (46 Mb/s), Fiji (29 Mb/s), the Federated States of Micronesia (24 Mb/s), Papua New Guinea (23 Mb/s), Guam (21 Mb/s), Palau (19 Mb/s), and New Caledonia (16 Mb/s). Nauru, Solomon Islands and Vanuatu had mobile broadband download speeds of lower than 16 Mb/s. No sufficient data was found for Kiribati, American Samoa, French Polynesia, the Marshall Islands, Samoa, Tonga and Tuvalu.

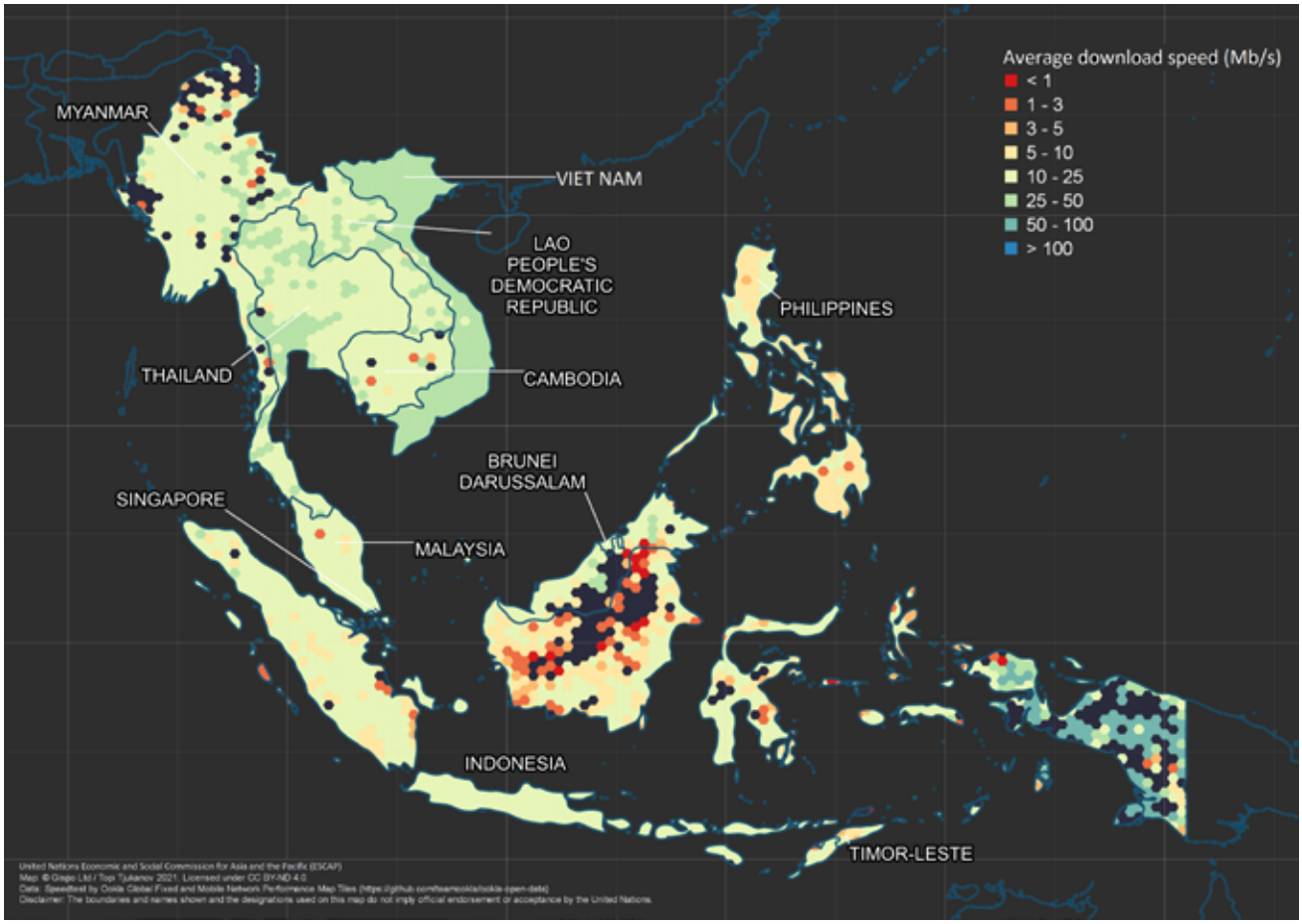
7. South-East Asia

Map 7.1 Fixed broadband speed in South-East Asia



Subregional average speed	Lower-middle download speed (44 Mb/s).
Top 2 highest download speed economies	Thailand (109 Mb/s) and Malaysia (44 Mb/s).
Urban/rural download speed differences	Thailand and Viet Nam demonstrated higher fixed broadband download speeds nationwide. However, urban and rural fixed broadband download speed differences exist for other economies in this subregion. Thailand recorded the highest fixed broadband download speeds, with an average of 109 Mb/s, followed by Malaysia (44 Mb/s), Viet Nam (36 Mb/s), the Lao People's Democratic Republic (27 Mb/s), Brunei Darussalam (18 Mb/s), and Cambodia (16 Mb/s). Singapore, Indonesia, Myanmar, the Philippines and Timor-Leste had fixed broadband download speed of less than 16 Mb/s.

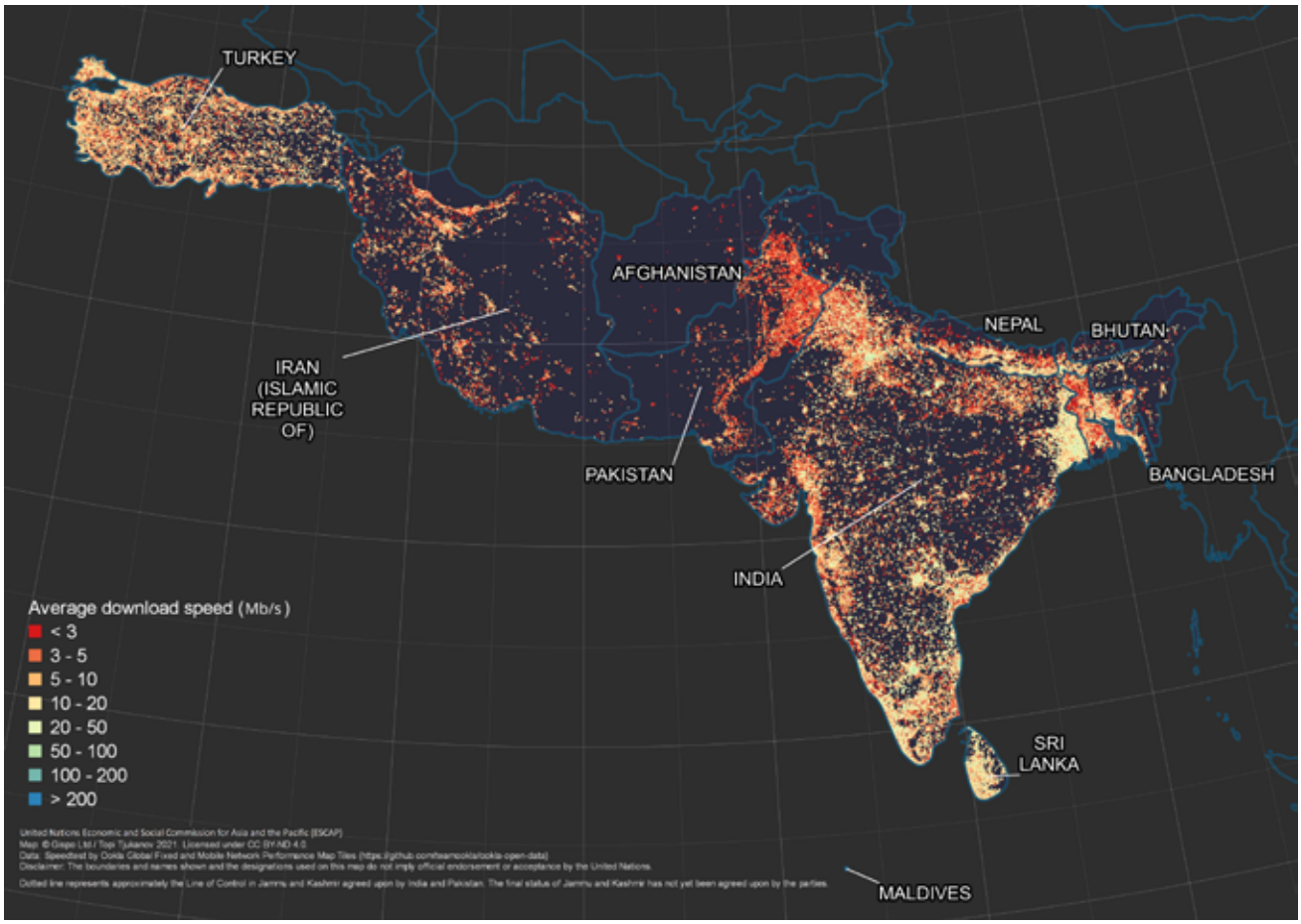
Map 7.2 Mobile broadband speed in South-East Asia



Subregional average speed	Lower-middle download speed (20 Mb/s).
Top 2 highest download speed economies	Viet Nam (34 Mb/s) and Thailand (24 Mb/s).
Urban/rural download speed differences	Mobile broadband download speeds in Viet Nam, Thailand and the Lao People's Democratic Republic, exhibited few urban and rural differences nationwide. However, urban and rural mobile broadband download speed differences exist for other economies in this subregion. Viet Nam recorded the highest mobile broadband download speeds, with an average of 34 Mb/s, followed by Thailand (24 Mb/s), the Lao People's Democratic Republic (23 Mb/s), Brunei Darussalam (21 Mb/s), and Malaysia (20 Mb/s). Singapore, Indonesia, Cambodia, Myanmar, the Philippines and Timor-Leste had mobile broadband download speeds of less than 20 Mb/s.

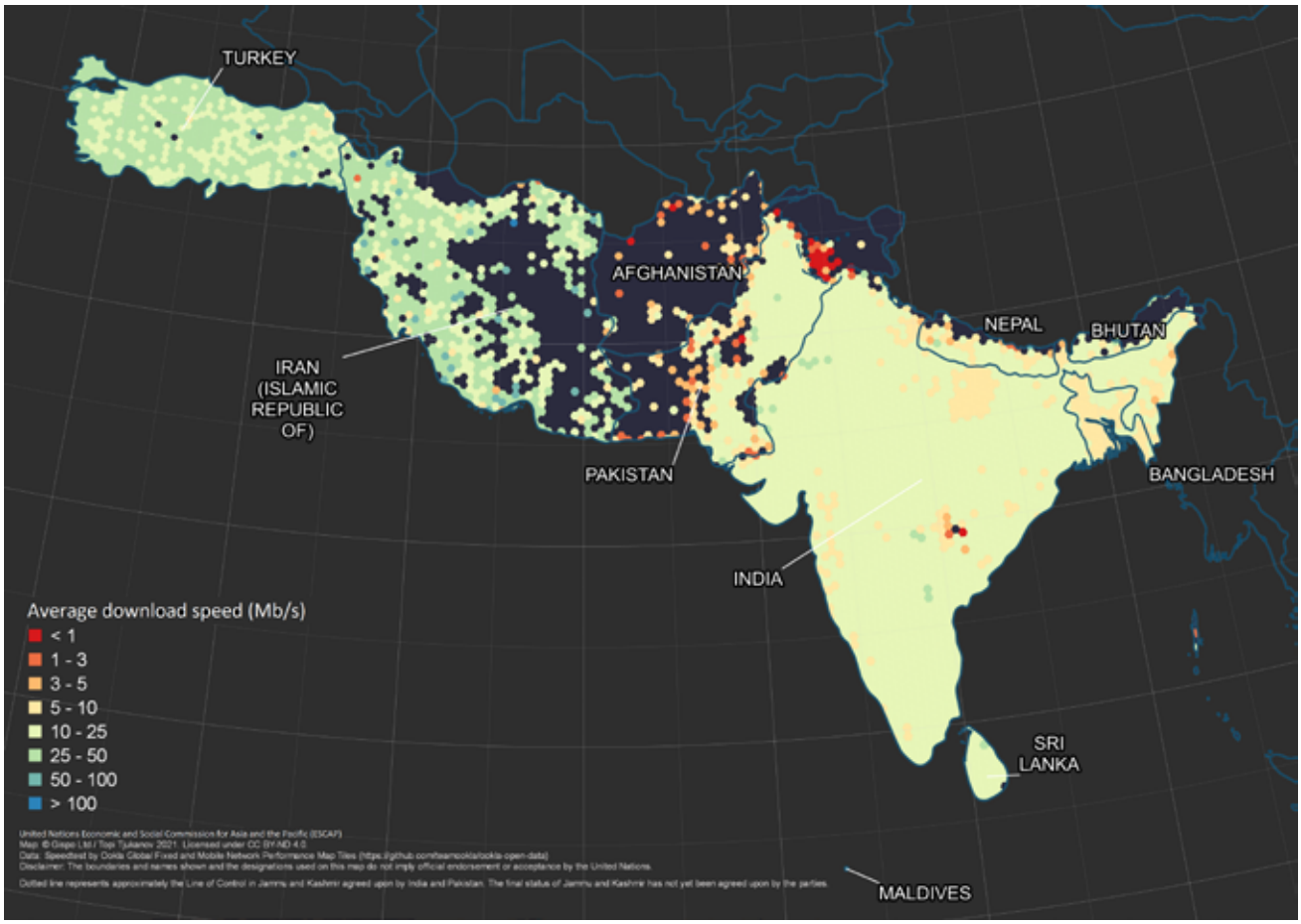
8. South and South-West Asia

Map 8.1 Fixed broadband speed in South and South-West Asia



Subregional average speed	Lower-middle download speed (17 Mb/s).
Top 2 highest download speed economies	India (21 Mb/s) and Sri Lanka (20 Mb/s).
Urban/rural download speed differences	Sri Lanka and Turkey exhibited few differences in fixed broadband download speeds between urban and rural areas. However, urban and rural fixed broadband download speed differences exist in other economies of the subregion. India recorded the highest fixed broadband download speeds, with an average of 21 Mb/s, followed by Sri Lanka (20 Mb/s), Turkey (15 Mb/s), Nepal (15 Mb/s), Bangladesh (13 Mb/s), the Islamic Republic of Iran (10 Mb/s), and Bhutan (10 Mb/s). Pakistan and Afghanistan recorded download speed of less than 10 Mb/s. No data was available for Maldives.

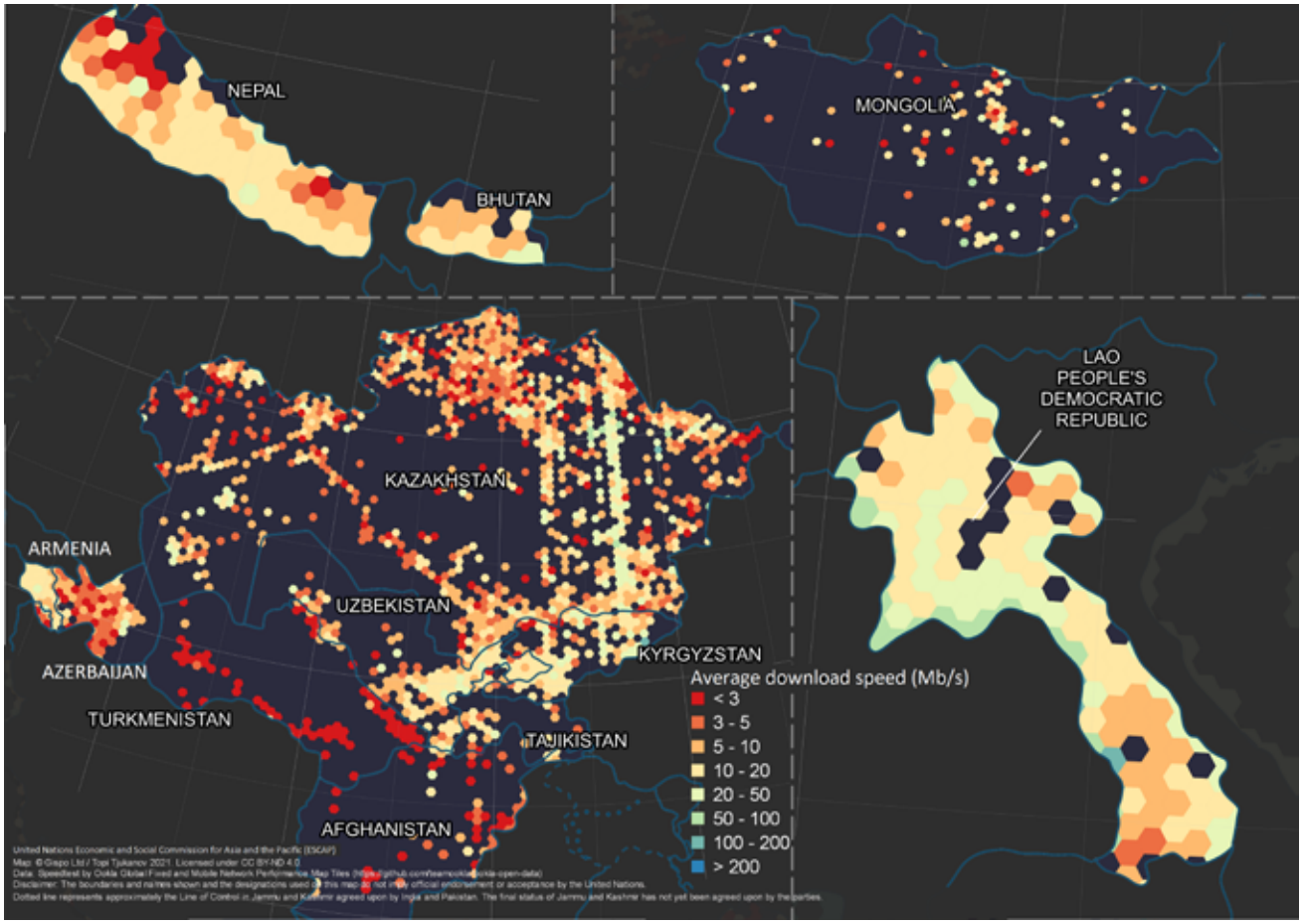
Map 8.2 Mobile broadband speed in South and South-West Asia



Subregional average speed	Lower-middle download speed (15 Mb/s).
Top 2 highest download speed economies	Turkey (31 Mb/s) and the Islamic Republic of Iran (28 Mb/s).
Urban/rural download speed differences	Sri Lanka and Turkey exhibited few differences in mobile broadband download speeds between urban and rural areas. Urban and rural mobile broadband download speed differences exist in other economies of the subregion. Turkey recorded the highest mobile broadband download speeds, with a national average of 31 Mb/s, followed by the Islamic Republic of Iran (28 Mb/s), Sri Lanka (18 Mb/s), Pakistan (15 Mb/s), Nepal (14 Mb/s), Bhutan (14 Mb/s) and India (13 Mb/s). Bangladesh and Afghanistan recorded download speeds of less than 10 Mb/s. No data was available for Maldives.

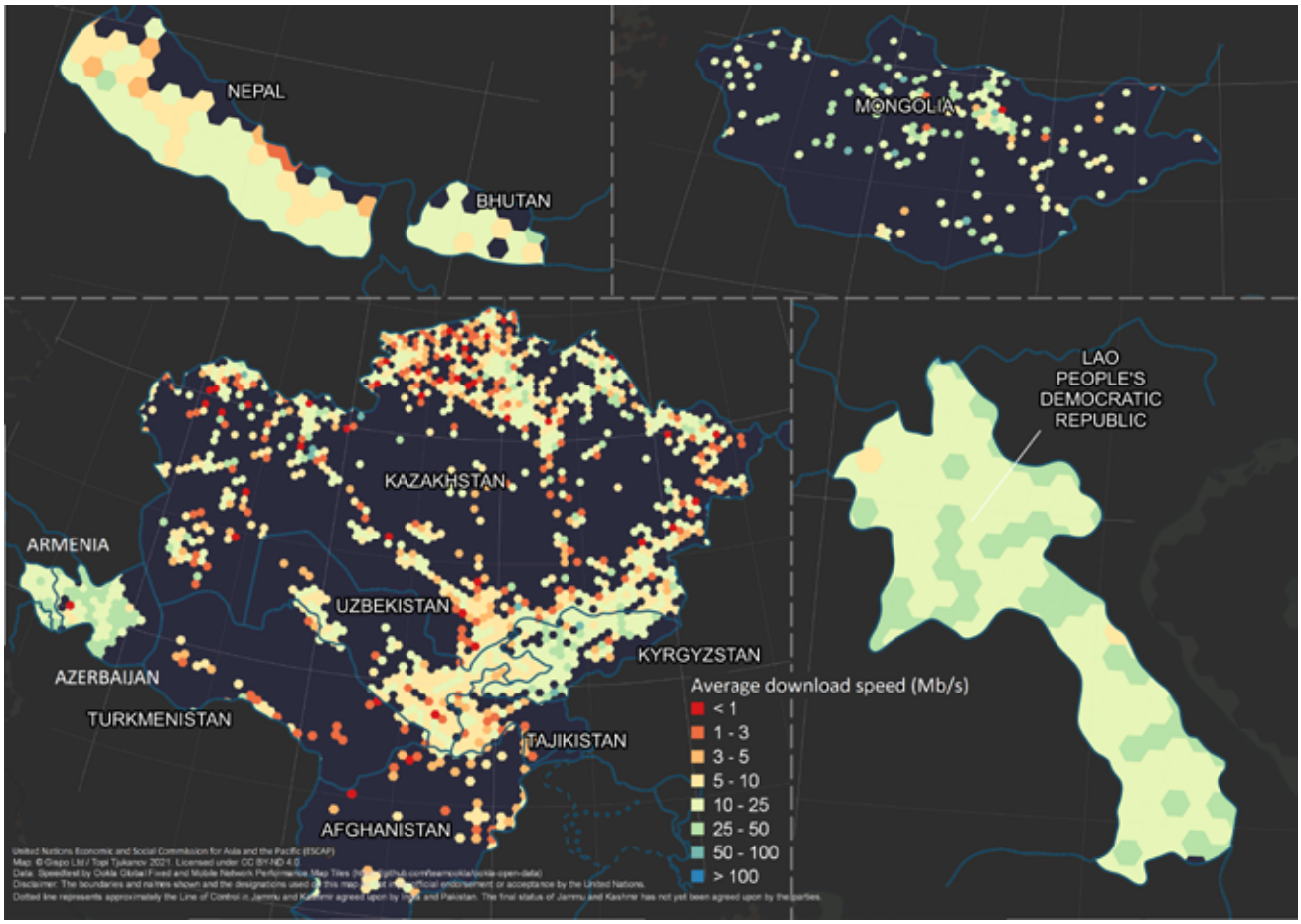
9. Asia-Pacific Landlocked Developing Countries

Map 9.1 Fixed broadband speed in the Asia-Pacific Landlocked Developing Countries



Subregional average speed	Lower-middle download speed (14 Mb/s).
Top 2 highest download speed economies	The Lao People's Democratic Republic (27 Mb/s) and Kyrgyzstan (19 Mb/s).
Urban/rural download speed differences	Armenia exhibits the least urban/rural download speed differences nationwide. However, urban and rural fixed broadband download speed differences exist in the other economies of the subregion. The Lao People's Democratic Republic recorded the highest fixed broadband download speeds with a national average of 27 Mb/s, followed by Kyrgyzstan (19 Mb/s), Mongolia (17 Mb/s), Armenia (16 Mb/s), Nepal (15 Mb/s) and Uzbekistan (15 Mb/s). The remaining economies had fixed broadband download speeds of less than 15 Mb/s.

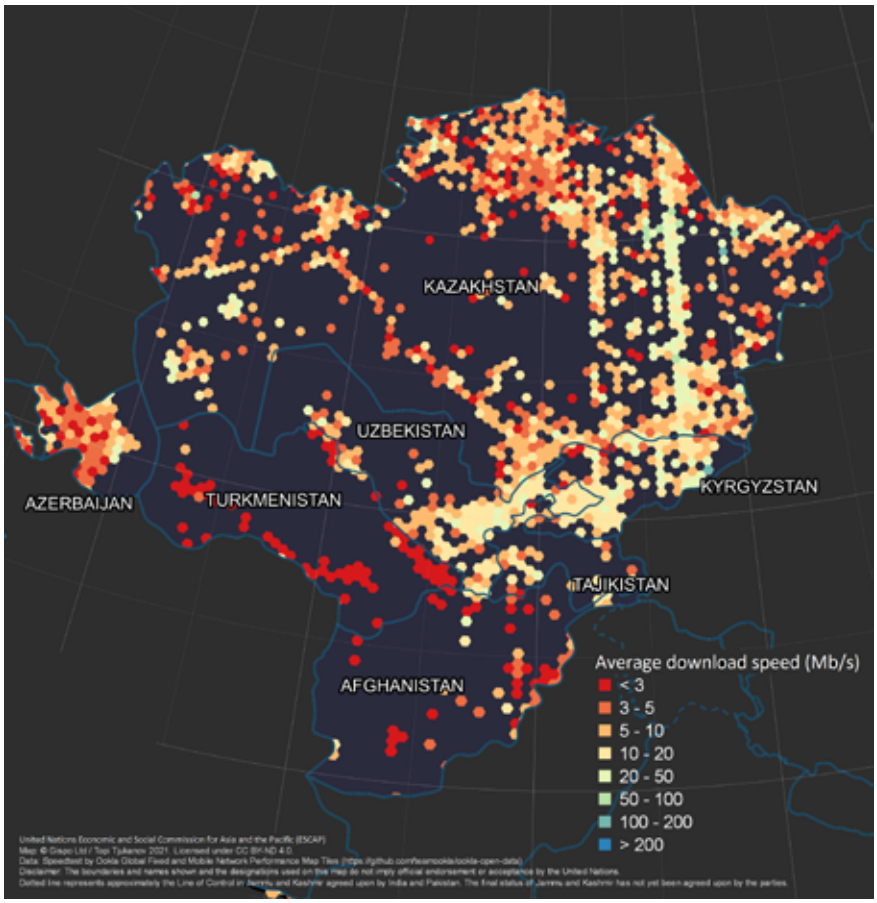
Map 9.2 Mobile broadband speed in the Asia-Pacific Landlocked Developing Countries



Subregional average speed	Lower-middle download speed (17 Mb/s).
Top 2 highest download speed economies	Azerbaijan (27 Mb/s), the Lao People's Democratic Republic (23 Mb/s) and Armenia (23 Mb/s).
Urban/rural download speed differences	Armenia, the Lao People's Democratic Republic and Bhutan exhibited the least urban/rural download speed differences nationwide. However, urban and rural mobile broadband download speed differences exist in the other economies of the subregion. Azerbaijan recorded the highest mobile broadband download speeds with a national average of 27 Mb/s, followed by the Lao People's Democratic Republic (23 Mb/s), Armenia (23 Mb/s), Mongolia (22 Mb/s), Kyrgyzstan (18 Mb/s) and Kazakhstan (16 Mb/s). The remaining economies had mobile broadband download speed of less than 15 Mb/s.

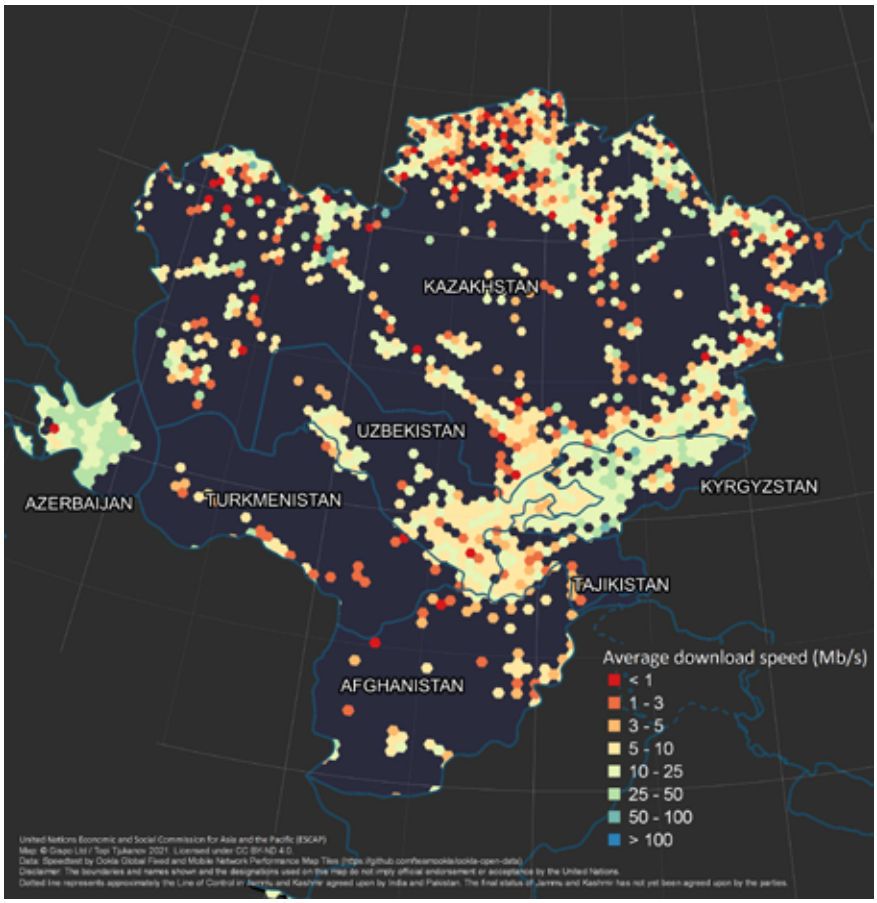
10. United Nations Special Programme for the Economies of Central Asia (SPECA)

Map 10.1 Fixed broadband speed in SPECA countries



Subregional average speed	Lower-middle download speed (12 Mb/s)
Top 2 highest download speed economies	Kyrgyzstan (19 Mb/s) and Uzbekistan (15 Mb/s)
Urban/rural download speed differences	Urban/rural fixed broadband download speed differences exist within the economies of this subregion. Kyrgyzstan recorded the highest fixed broadband download speeds with a national average of 19 Mb/s, followed by Uzbekistan (15 Mb/s), Kazakhstan (14 Mb/s) and Tajikistan (14 Mb/s). The remaining economies had mobile broadband download speeds of less than 10 Mb/s.

Map 10.2 Mobile broadband speed in SPECA countries



Subregional average speed	Lower-middle download speed (16 Mb/s)
Top 2 highest download speed economies	Azerbaijan (27 Mb/s) and Kyrgyzstan (18 Mb/s)
Urban/rural download speed differences	Azerbaijan shows the least urban/rural download speed differences nationwide. Urban/rural mobile broadband download speed differences exist within the other economies of this subregion. Azerbaijan recorded the highest mobile broadband download speed with a national average of 27 Mb/s, followed by Kyrgyzstan (18 Mb/s), Kazakhstan (16 Mb/s), Uzbekistan (10 Mb/s) and Tajikistan (10 Mb/s). The remaining economies had mobile broadband download speeds of less than 10 Mb/s.

11. Policy implications and discussions

The objective of this report was to identify broadband download speed trends in countries in the Asia-Pacific region, during the COVID-19 pandemic, and find meaningful policy implications for senior policymakers through the analysis of data and visually, through data maps. Using speed tests geospatial data from Ookla, between January and September of 2020, this report examined the broadband download speed patterns in countries within Asia and the Pacific (urban-rural distribution) and between the Asia-Pacific subregions (East and North-East Asia, North and Central Asia, the Pacific, South-East Asia and South and South-West Asia) and illustrated the data through maps.

The exercise of map visualizations provided three useful policy insights with important implications for policymakers in Asia and the Pacific:

First, broadband speed differed significantly between countries in the Asia-Pacific region during the Covid-19 pandemic, in 2020.

Advanced economies in information and communications technology (ICT), such as China, Japan and the Republic of Korea have exhibited average national mobile broadband download speeds of 202 Mb/s, 29Mb/s and 122 Mb/s respectively, compared to 17 Mb/s in the landlocked countries within Asia and the Pacific. The fixed broadband download speed in Thailand (109 Mb/s) and the Republic of Korea (103 Mb/s) were four times higher than the average in Asia and the Pacific. As a result, the broadband speed divide between countries in Asia and the Pacific affects the digital technologies that relies heavily on higher spectrums. For instance, lower broadband speeds inhibits a user's access to digital audio-visual contents for remote education and work.

Furthermore, with lower broadband speeds and hence the quality of broadband connectivity, the development of local content is also constrained in countries within Asia and the Pacific. Small and medium businesses are negatively affected by sluggish broadband speeds with customers experiencing slow online payments, lags in video conferencing, unreliable file sharing, delays in loading and browsing websites, amongst others. Productivity is also affected if businesses use video conferencing, online payments and e-commerce. Many hours of working time are lost waiting for webpages to load. According to a study on internet speed and productivity,1 using the internet for four hours a day with 5 per cent of that time lost due to a sluggish connection (approximately 15 minutes a day), could mean upto 50 hours of lost annual productivity per employee.

One of the factors affecting slow broadband (fixed and mobile) speed is the network's limited capacity (bandwidth) to support many users and devices accessing multiple online services at the same time. As a result, investment on sufficient fiber-optic cable to feed the increasing

1 DataKom, "How slow internet speeds can impact productivity", 22 July 2016. Available at: https://www.datakom.co.uk/2016/07/how-slow-internet-speeds-can-impact-productivity/ (accessed 24 March 2021).

demand of the local networks (cross-border as well as last mile) is critical to ensuring that sufficient international Internet bandwidth is available. Fiber optic cables continue to carry majority (98 per cent) of international data communications between countries.2 Emerging technologies, such as big data, blockchain, fifth generation technology, Artificial Intelligence, coupled together with countries in the Asia-Pacific region advancing towards smart cities and digital transformation agendas imposes significant pressure on bandwidth demand. As a result, sufficient and innovative investment on fiber-optic deployment through public-private partnerships (PPP) is important to ensuring universal access for all.

Second, the map visualizations provide useful insights on the digital divide, such as the urban and rural broadband speed divide that exists in many countries in Asia and the Pacific.

Some countries in the Asia-Pacific region, including Hong Kong, China, the Republic of Korea, Japan, Thailand, Viet Nam and, to some extent, the Lao People's Democratic Republic, show almost uniform fixed broadband download speeds nationwide. However, some countries in South and South-West Asia, the United Nations Special Programme for the Economies of Central Asia (SPECA), and the Asia-Pacific landlocked countries show significant disparities on broadband speed (fixed and mobile) between urban and rural areas.

One factor affecting broadband speed between urban and rural areas is the inefficient and unbalanced development and management of Internet traffic and networks. In some markets in the Asia-Pacific region that experience slower broadband speeds, the domestic Internet service providers to not directly connect to each other inside the country. As a result, if two customers of two different domestic operators in a country exchange an email or an online message, the traffic goes outside the country (in most cases routed through the United States) before it comes back to the country. This leads to slower speed, longer latency and higher costs.

Consequently, investment on establishing Internet exchange points (IXPs) at the national (to address broadband speed divide between urban and rural areas) and subregional (to address cross-border broadband speed inefficiencies between geographic subregions) levels would address this challenge. ESCAP studies have found evidence of the positive role of IXPs on improving broadband quality (speed and latency) in the Pacific island countries and between Cambodia, the Lao People's Democratic Republic, Myanmar and Viet Nam.3 At the same time, some of these countries, are working towards the establishment of IXPs, showing their commitment to improve their internet connectivity and speed.

2 International Cable Protection Committee (ICPC), "Submarine cables and BBNJ", 1 August 2016. Available at: https://www.un.org/depts/los/biodiversity/prepcom_files/ICC_Submarine_Cables_&_BBNJ_August_2016.pdf (accessed 24 March 2021)

3 For more information on these studies, see ESCAP, "Pacific Internet Exchange Point Feasibility Study", December 2019. Available at: https://www.unescap.org/resources/pacific-internet-exchange-point-feasibility-study ; ESCAP, "Estimating the effects of Internet exchange points on fixed-broadband speed and latency", 9 December 2019. Available at: https://www.unescap.org/resources/estimating-effects-internet-exchange-points-fixed-broadband-speed-and-latency, and ESCAP, "In-depth Study of the Asia-Pacific Information Superhighway in CLMV Countries", 19 March 2020. Available at: https://www.unescap.org/resources/depth-study-asia-pacific-information-superhighway-clmv-countries

Third, Asia-Pacific landlocked countries have significantly lower average broadband (fixed and mobile) speed compared to any other subregions in Asia and the Pacific.

The Asia-Pacific region has four-times higher fixed broadband download speed as compared to the Asia-Pacific landlocked countries. More concretely, the average fixed broadband download speed of the Asia-Pacific landlocked countries was recorded at 14 Mb/s, the second lowest of all the country groupings given in this report. The lowest was the SPECA countries, at 12 Mb/s, which are also part of the Asia-Pacific landlocked countries.

Between different technologies (fixed or mobile), significant differences in broadband speeds are evident in 7 out of 13 Asia-Pacific landlocked countries, which have faster mobile broadband download speed, as compared to fixed broadband speed. Between the Asia-Pacific subregions, only the Asia-Pacific landlocked countries, SPECA countries and the Pacific have higher mobile broadband averages as compared to fixed broadband. Four Asia-Pacific subregions (East and North-East Asia, South-East Asia, North and Central Asia and South and South-West Asia) have higher fixed broadband download speed as compared to mobile broadband speed.

One factor that affects sufficient investment in appropriate digital connectivity infrastructure in the Asia-Pacific landlocked countries (as well as least developing countries and the Pacific small islands developing States) is the high costs of fiber-optic deployment. An ESCAP study highlighted that over 90 per cent of the cost to deploy terrestrial fibre-optic networks is associated with digging, trenching, laying down the conduits and fiber-optic cables, with the cost of the cable materials constituting less than 10 per cent of the total cost. [4] As a result, cost-effective approaches go from fiber-optic deployment through the 'dig once, use many' policy to co-deployment of fiber-optic cables with other infrastructures, such as roads, railway and energy sectors as viable policy options. An ESCAP study found that co-deployment of the fiber-optic cables with roads (compared to separate deployment) in Myanmar saved an estimated $7,379 per kilometer, or a cost-saving of around 57 per cent to the total project cost.[5]

Despite the lower broadband speeds in the Asia-Pacific landlocked countries, it is encouraging to see nationwide Internet coverage in some countries, such as Nepal, Bhutan and Armenia.

ESCAP has promoted digital cooperation and inclusive digitalization in the Asia-Pacific region through the Asia-Pacific Information Superhighway (AP-IS) Platform. The AP-IS initiative has supported regional cooperation to bridge the digital divide and boost digital transformation by promoting seamless regional digital infrastructure. The AP-IS Master Plan 2019-2022 has been implemented to promote digital cooperation and digital development with the focus on four pillars, namely connectivity (promoting fibre-optic broadband network expansion throughout the Asia-Pacific region), Internet traffic and network management (strengthening of efficient traffic and network management for Internet reliability and redundancy), e-resilience (boosting ICT network resilience to support effective disaster management) and broadband for all (promoting affordable broadband access for all).

In 2021, ESCAP has been working to develop the second phase of the action plan of the AP-IS 2022-2026, in collaboration with member States and regional partners, following the recommendations of member States at the third Session of the Committee on Information and Communications Technology, Science, Technology and Innovation (CICTSTI-3), in August 2020. The key focus is to scale up and mainstream digital development and cooperation across all sectors and serve as the regional blueprint for digital transformation.

4 ESCAP, "In-Depth Study of the Asia-Pacific Information Superhighway in CLMV Countries", 19 March 2020.

5 ESCAP, "A Study on Cost-Benefit Analysis of Fiber-Optic Co-deployment with the Asian Highway Connectivity" Asia-Pacific Information Superhighway Working Paper Series, June 2018. Available at: https://www.unescap.org/resources/study-cost-benefit-analysis-fibre-optic-co-deployment-asian-highway-connectivity

References

DataKom (2016). How slow internet speeds can impact productivity, 22 July. Available at https://www.datakom.co.uk/2016/07/how-slow-internet-speeds-can-impact-productivity/. Accessed on 24 March 2021.

GitHub. Speedtest by Ookla global Fixed and Mobile Network Performance Map Tiles. Available at https://github.com/teamookla/ookla-open-data

International Cable Protection Committee (ICPC) (2016). Submarine cables and BBNJ, 1 August. Available at https://www.un.org/depts/los/biodiversity/prepcom_files/ICC_Submarine_Cables_&_BBNJ_August_2016.pdf. Accessed on 24 March 2021)

International Telecommunication Union (ITU) (2021). World Telecommunication/ICT Indicators 2020 Database (24th Edition, December 2020), January. Available at https://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx

United Nations, Economic and Social Comission for Asia and the Pacific (ESCAP) (2019). Estimating the effects of Internet exchange points on fixed-broadband speed and latency, December. Available at https://www.unescap.org/resources/estimating-effects-internet-exchange-points-fixed-broadband-speed-and-latency

---- (2018). A Study on Cost-Benefit Analysis of Fiber-Optic Co-deployment with the Asian Highway Connectivity, Asia-Pacific Information Superhighway Working Paper Series, June. Available at https://www.unescap.org/resources/study-cost-benefit-analysis-fibre-optic-co-deployment-asian-highway-connectivity

---- (2019). Pacific Internet Exchange Point Feasibility Study, December. Available at https://www.unescap.org/resources/pacific-internet-exchange-point-feasibility-study

---- (2020). In-Depth Study of the Asia-Pacific Information Superhighway in CLMV Countries, 19 March. Available at https://www.unescap.org/sites/default/files/AP-IS%20Report%20NIA%20CLMV%20IXP_IDS.pdf