

**Economic and Social Commission for Asia and the Pacific****Seventy-fourth session**

Bangkok, 11–16 May 2018

Item 3 (e) of the provisional agenda*

Review of issues pertinent to the subsidiary structure of the Commission, including the work of the regional institutions: information and communications technology, science, technology and innovation**Report on the challenges and opportunities in the implementation of regional broadband connectivity for all in Asia and the Pacific***Summary*

Information and communications technology (ICT) is both a meta infrastructure and an enabler of socioeconomic development. The impact of ICT on financial, transport and trade facilitation infrastructure and services can encourage innovations and provide a basis for an expanded digital economy that can be harnessed to address longstanding problems of exclusion, the altered climate and the degraded environment.

The Asia-Pacific region continued its robust growth in fixed broadband access. The majority of the world's total fixed-broadband subscriptions are found in the Economic and Social Commission for Asia and the Pacific (ESCAP) region. However, the distribution of fixed-broadband subscriptions has been uneven among ESCAP subregions, with more than 75 per cent of the total fixed-broadband subscriptions found in East and North-East Asia alone in 2016. Mobile broadband expansion in the ESCAP region lagged behind North America and Europe. A recent ESCAP study found that 18 member States have not made noticeable progress in expanding fixed-broadband access, while more advanced economies are steadily improving the coverage, quality and speed of broadband networks, thus widening the digital divide.

Extending broadband connectivity to remote and rural areas has been a persistent challenge in the region. While the socioeconomic benefits created by ICT have been widely recognized over the past decades, broadband connectivity has not reached everyone who would benefit from it. The challenges and opportunities in promoting the availability, the affordability and the resilience of broadband networks in Central Asia, the Pacific and South-East Asia vary widely, and the present document includes policy options to expand broadband connectivity in the region.

The present document contains a summary of the main findings of selected analytical studies of the secretariat to support policy recommendations, for the consideration of the Commission, on the implementation of broadband connectivity for all in Asia and the Pacific through regional cooperation. The Commission may wish to review the report and provide the secretariat with further guidance for the effective implementation of the appropriate resolutions and the regional road map for implementing the 2030 Agenda for Sustainable Development in Asia and the Pacific.

* ESCAP/74/L.1/Rev.1.

I. Background

1. Information and communications technology (ICT) is both a meta infrastructure and an enabler of socioeconomic development. The impact of ICT on financial, transport and trade facilitation infrastructure and services can encourage innovation and provide a basis for a digital economy in Asia and the Pacific. Broadband-enabled technologies, such as artificial intelligence in smart grids, intelligent transport systems, integrated water management systems and single window systems, increase efficiencies that drive growth in various sectors of economy. It also helps to support climate change adaptation and disaster risk reduction, and increase agricultural productivity while delivering education and health services in remote and rural areas. However, these ICT-enabled systems are only effective if all people are able to access them through affordable broadband.

2. The member States of the Economic and Social Commission for Asia and the Pacific (ESCAP) recognized the strategic significance of regional economic cooperation and integration with ICT connectivity as one key component for achieving the 2030 Agenda for Sustainable Development. As expressed in the Bangkok Declaration on Regional Economic Cooperation and Integration in Asia and the Pacific, the member States resolved to enhance regional cooperation in the region by developing seamless connectivity in transport, energy and ICT.¹

3. The regional road map for implementing the 2030 Agenda for Sustainable Development in Asia and the Pacific was endorsed by ESCAP member States in 2017.² In the road map, member States recognized that while access to broadband Internet in the region had improved, the digital divide among member States had continued to widen. Some ESCAP member States are at risk of being left behind while other member States benefit from the socioeconomic opportunities created by broadband connectivity. Consequentially, the opportunity for regional cooperation in ICT through the implementation of the Asia-Pacific information superhighway initiative was recognized in the road map.³

4. Enhancing broadband connectivity at the national, regional and global levels contributes to the social, economic and environmental dimensions of sustainable development, which is reflected in the Sustainable Development Goals. Under Goal 9 (Infrastructure, industrialization and innovation), enhancing broadband connectivity is supported by targets 9.1 (Develop quality reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all) and 9.c (Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020). For education, target 4.b requires member States to expand education opportunities in ICT. For gender equality, target 5.b requires enhancing the use of enabling technology, in particular ICT, to promote the empowerment of women. Finally, target 17.8 further specifies the role of ICT as a means of implementation.

¹ See Commission resolution 70/1, annex.

² See Commission resolution 73/9.

³ See E/ESCAP/73/31.

5. In the light of the regional road map and the Sustainable Development Goals related to ICT connectivity, the secretariat's support included conducting research and analyses for evidence-based policymaking, encouraging information sharing and convening regional dialogues towards building consensus on regional broadband connectivity for inclusive sustainable development.

6. The present document contains a summary of the main findings of selected analytical studies of the secretariat and of challenges and opportunities in implementing broadband connectivity in Asia and the Pacific.⁴

II. The digital divide in Asia and the Pacific

A. Fixed broadband

7. The Asia-Pacific region as a whole has a strong growth trajectory in access to fixed broadband. Compared with other regions, in 2016, the majority of the world's total fixed-broadband subscriptions were found in the Asia-Pacific region (56.6 per cent),⁵ followed by Europe (20.3 per cent) and North America (13.0 per cent). Fixed-broadband subscriptions per 100 inhabitants in ESCAP member States (11.6), was still far lower than North America (32.9) and Europe (31.1). However, the average fixed-broadband penetration in ESCAP member States was slightly lower than the global average (12.5) but higher than Latin America and the Caribbean (11.2).⁶

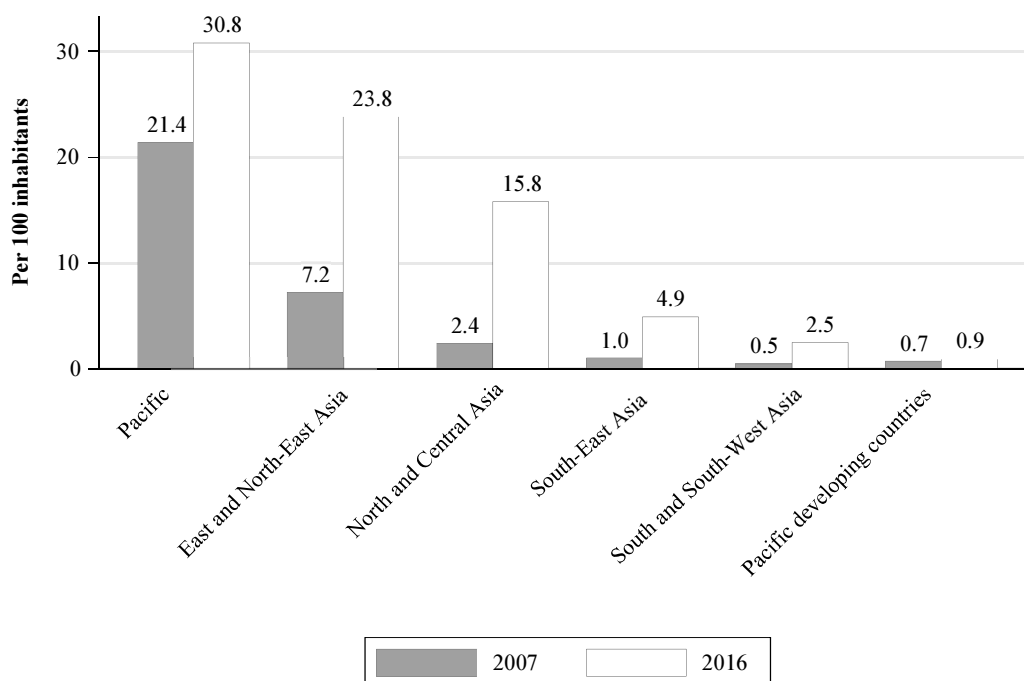
8. When analysed by subregion (as categorized by ESCAP), the average total number of fixed-broadband subscriptions in 2016 was highest in East and North-East Asia (75.74 per cent). When growth of fixed-broadband subscriptions was compared over time by subregion, North and Central Asia experienced the strongest growth (a five-fold increase between 2007 and 2016), driven by strong growth in Azerbaijan, Georgia, Kazakhstan and the Russian Federation (figure I). Other subregions that experienced strong growth include South and South-West Asia (four-fold) and South-East Asia (three-fold).

⁴ Broadband penetration is the percentage of population that has subscribed to fixed-broadband or mobile-broadband services. The use of International Telecommunication Union (ITU) indicators such as fixed-broadband subscriptions per 100 inhabitants, mobile-broadband subscriptions per 100 inhabitants and proportion of population covered by a mobile network as measures of a country's access to broadband connectivity has limitations. However, these were the indicators that have been set by the 2030 Agenda to measure the role of ICT. Moreover, these indicators have been used by ITU to collect data from national Governments, which allow for country comparison over time.

⁵ An increase of 6 percentage points from 2015.

⁶ Section II is based on ESCAP, "Artificial intelligence and broadband divide: state of ICT connectivity in Asia and the Pacific 2017" (Bangkok, 2017). Available from www.unescap.org/sites/default/files/publication_StateofICT2017.pdf.

Figure I
Fixed-broadband subscriptions per 100 inhabitants, by subregion



Source: ESCAP calculations based on data from the ITU, World Telecommunication/ICT Indicators database 2017 (21st Edition/December 2017). Available from www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx (accessed 17 February 2018).

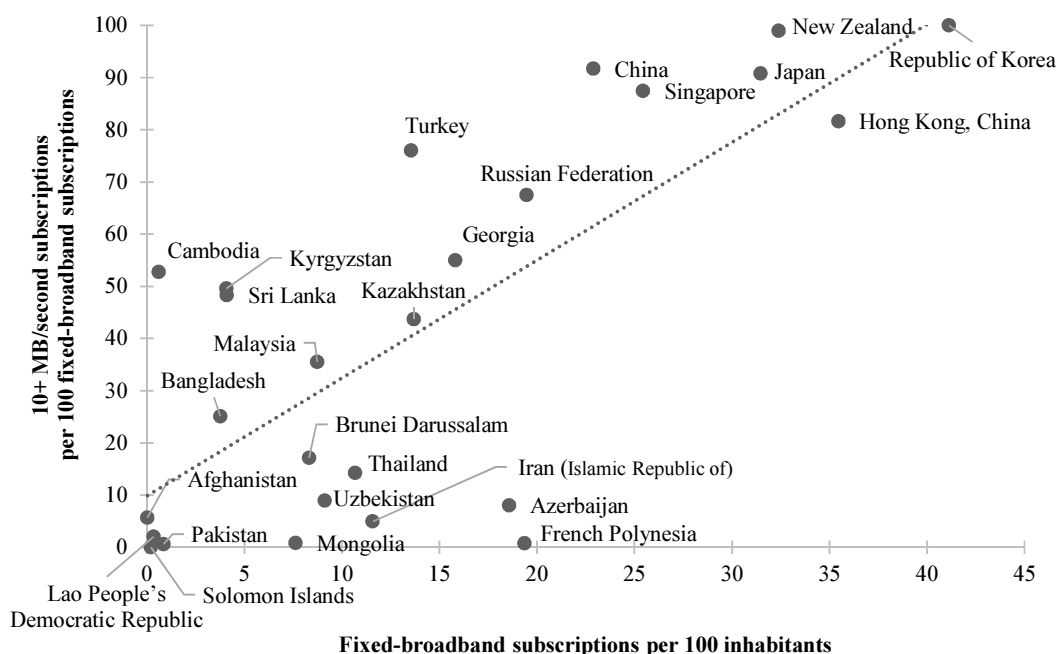
Note: Pacific developing countries exclude Australia and New Zealand.

9. However, in 18 member States,⁷ less than 2 per cent of the population on average had fixed-broadband subscriptions in 2016. This number had not changed since 2015, thus the gap between rapidly growing countries and the rest has widened. Most of the 18 countries are countries with special needs (least developed countries, landlocked developing countries and small island developing States), requiring urgent attention to increase access to fixed broadband.

10. Increased access to fixed-broadband services is associated with faster network speed (MB/second), due to increased capacity and investment in fixed-broadband network infrastructure. In Asia and the Pacific, China; Hong Kong, China; Japan; New Zealand; Republic of Korea; and Singapore are leading with more fixed-broadband subscriptions at a faster network speed (figure II). However, these members and associate members have also been found to grow at a slower pace over time, due to market maturity.

⁷ For full country listing, see ESCAP, “Artificial intelligence and broadband divide: state of ICT connectivity in Asia and the Pacific 2017” (Bangkok, 2017). Available from www.unescap.org/sites/default/files/publication_StateofICT2017.pdf.

Figure II
Network quality (speed) versus access (fixed broadband) in selected Asia-Pacific economies, 2016



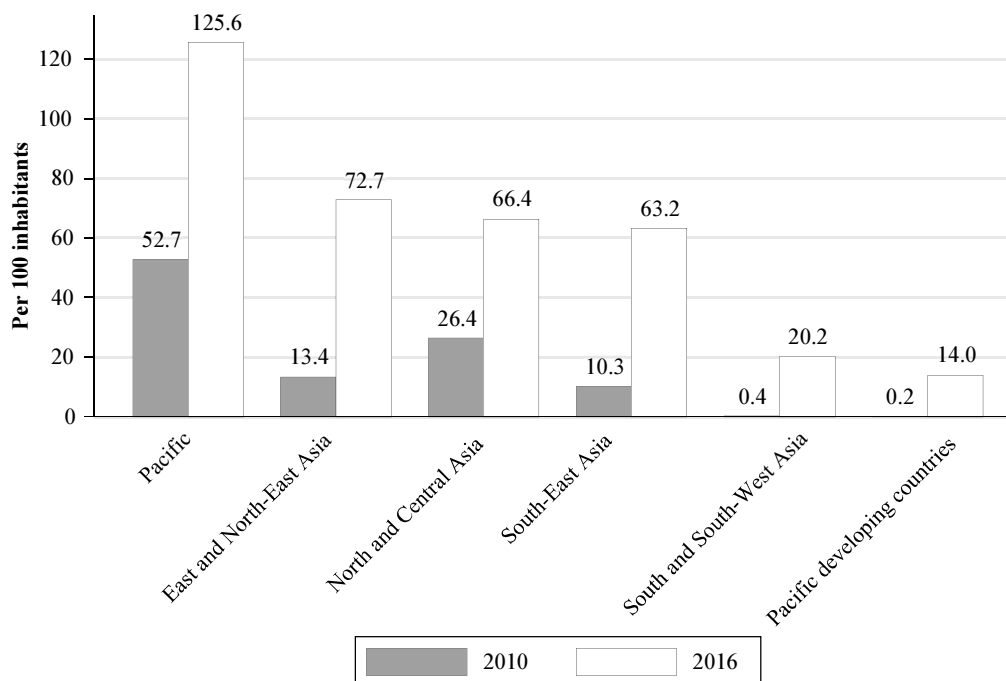
Source: World Telecommunication/ICT Indicators database (see figure I).

B. Mobile broadband

11. The 2016 data for mobile broadband in the Asia-Pacific region displayed a different pattern to fixed broadband. Almost half of the 4.4 billion people in ESCAP member States had mobile-broadband subscriptions in 2016. Compared with other regions, mobile-broadband subscriptions per 100 inhabitants in the Asia-Pacific region (49) was behind North America (115), Europe (77) and the world average (52).

12. When analysed by subregion, average mobile-broadband subscriptions per 100 inhabitants in 2016 was highest in the Pacific (driven by Australia and New Zealand), followed by East and North-East Asia (driven by Japan and the Republic of Korea). South and South-West Asia and developing countries in the Pacific (excluding Australia and New Zealand) had the lowest average mobile-broadband subscriptions per 100 inhabitants, although there have been significant increases in both subregions since 2010 (figure III).

Figure III
Mobile-broadband subscriptions per 100 inhabitants, by subregion



Source: World Telecommunication/ICT Indicators database (see figure I).

Note: Pacific developing countries exclude Australia and New Zealand.

III. Evaluating the universal access and service fund for information and communications technology infrastructure development

13. Extending ICT connectivity to remote and rural areas has been a persistent challenge in Asia and the Pacific. While the socioeconomic benefits created by ICT have been widely recognized over the past decades, ICT connectivity has not reached the people that would benefit most from it. Remote and rural areas are often not connected because private operators do not consider them to be commercially viable. Private sector investments in ICT infrastructure tend to target urban areas which are more densely populated, and hence more profitable. Although public-private partnerships and other approaches have been used to encourage telecommunication operators to provide services in remote and rural areas, the lack of financial resources has remained a major barrier.⁸

14. The universal access and service fund is one of the traditional financing mechanisms used to connect sparsely populated rural areas, where there was neither the population density nor the capital for telecommunication operators to justify private sector infrastructure investments. Universal access and

⁸ For detailed information for section III, see ESCAP, “The impact of universal service funds on fixed-broadband deployment and internet adoption in Asia and the Pacific”, Asia-Pacific Information Superhighway Working Paper Series (Bangkok, 2017). Available from www.unescap.org/sites/default/files/Universal%20Access%20and%20Service%20Funds.pdf.

service funds have been implemented and managed in a variety of ways, and each member State has specific mechanisms for contribution to the fund, disbursement of the fund and identification of priority areas to fund.

15. Most countries tax telecommunication operators a percentage of their gross or net annual revenue. Some countries charge an overall annual regulatory fee. For instance, Afghanistan charges telecommunication operators a 2.5 per cent tax on net revenue. Bangladesh charges telecommunication operators a fixed percentage of gross revenue, and Indonesia charges them a fixed percentage of annual gross profits. Nine countries in the Asia-Pacific region had universal access and service funds that financed fixed-broadband projects.^{9, 10} Other funding sources for universal access and service funds include contributions from international finance institutions such as the World Bank, as well as licensing fees. In some cases, contributions were made directly from the Government's budget.

16. An ITU study found that the lack of transparency of spending was one of the main constraints for the successful implementation of universal access and service funds.¹¹ As of 2013, only four of the nine Asia-Pacific countries mentioned above had conducted financial reporting: Australia, India, Malaysia and New Zealand. In the Asia-Pacific region, very few countries with universal access and service funds have published ICT adoption statistics that were disaggregated by rural and urban locations.

17. Where data are available, it can be seen that the digital divide between rural and urban areas has generally widened despite the implementation of universal access and service funds projects, possibly due to faster Internet and broadband adoption in urban areas and different focus areas of the universal access and service funds. In Turkey, the percentage point difference between the shares of rural and urban households using the Internet increased from 17.9 to 29.4 between 2008 and 2013.¹² Likewise, in Indonesia, the difference

⁹ The nine countries are India, Indonesia, Malaysia, Mongolia, New Zealand, Pakistan, the Russian Federation, Thailand and Turkey. Countries that have only implemented pilot projects or recognize broadband as an objective but do not have an active universal access and service fund were not counted.

¹⁰ India, Mongolia and Pakistan were early implementers of broadband projects through the universal access and service funds since 2006. India amended its universal service obligation policy in 2006 to support broadband projects. In the same year, universal access and service funds in Mongolia and Pakistan were created to support broadband projects. The universal service provision fund in Malaysia included broadband in 2008, followed by Turkey in 2009 and Indonesia in 2010. More recently, countries with relatively higher fixed-broadband penetration rates have started incorporating broadband financing through universal access and service funds, including New Zealand in 2011, Thailand in 2012 and the Russian Federation in 2013. Countries that have legislation on universal access service funds, but that have not yet implemented the fund, include Tonga and Samoa. Vanuatu has a universal access and service fund but with very limited projects in rural areas.

¹¹ ITU, "Universal service fund and digital inclusion for all study" (June 2013). Available from www.itu.int/en/ITU-D/Conferences/GSR/Documents/ITU%20USF%20Final%20Report.pdf.

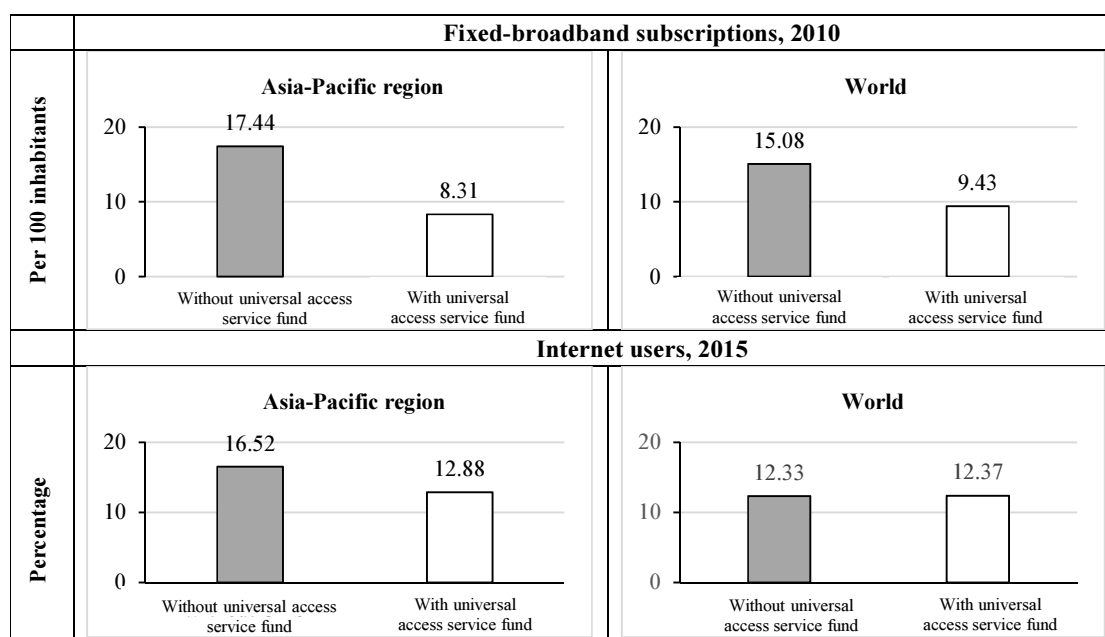
¹² ESCAP calculations based on data from U. Baris Urhan and Irem Kizilca, "How does Internet usage change in Turkey? An assessment on Internet users", *Türkiye Ekonomi Politikaları Araştırma Vakfı* evaluation note (February 2011), available from www.tepav.org.tr/upload/files/1297779538-1.How_does_Internet_Usage_Change_in_Turkey.pdf; and Turkish Statistical Institute, "Information and communication technology usage survey on households and individuals, 2013", 22 August 2013. Available from www.turkstat.gov.tr/PreHaberBultenleri.do?id=13569.

between shares of weekly Internet users in rural and urban areas increased between 2010 and 2012.¹³ The divide between Internet users in rural and urban areas also increased in India.

18. An ESCAP analysis of the average annual growth of fixed-broadband subscriptions per 100 inhabitants in the period 2010-2015 shows a significant gap between six middle-income countries with universal access and service funds that included expanding access to broadband as an objective, and other middle-income countries in the region. The six countries, taken together, experienced lower average growth rates in fixed-broadband adoption than their middle-income counterparts (see figure IV). This was not unique to the Asia-Pacific region: a similar observation was made for the global level. The lower average growth in countries with universal access and service funds may reflect the timing and modality of investment, the need for accompanying broadband policies, or the complementarity or substitution effects between fixed-broadband and mobile-broadband services.

Figure IV

Competition policy on international gateways and broadband access in selected Asia-Pacific countries and the world



Source: World Telecommunication/ICT Indicators database (see figure I).

19. In summary, while policymakers may view universal access and service funds as a necessary financing mechanism for equitable expansion of ICT benefits to poor, rural and remote areas, the data indicate practical challenges. Increased transparency and accountability may enhance stakeholders' commitment to universal access and service funds.¹⁴ In addition, private operators may

¹³ Broadcasting Board of Governors and Gallup, "Media use in Indonesia 2012", Broadcasting Board of Governors Research Series (October, 2012). Available from www.bbg.gov/wp-content/media/2012/10/gallup-indonesia-brief.pdf.

¹⁴ ITU, "Universal service fund and digital inclusion for all study" (June 2013). Available from www.itu.int/en/ITU-D/Conferences/GSR/Documents/ITU%20USF%20Final%20Report.pdf.

encounter fewer constraints and find greater incentives to expand service into rural and remote areas if fund disbursements are set against targets.

20. An immediate problem for infrastructure investment worldwide is also the widely discussed gap between present levels of investment and future demand for infrastructure services, as well as the capacity of Governments to meet the shortfall. The gap was estimated at \$49 trillion in the period 2016–2030, with most of the investment requirement in emerging economies, particularly in the power, road and telecommunication sectors.¹⁵ The following sections of the present document contain a review of the findings of analytical studies on subregional challenges and opportunities in promoting the availability, affordability and resilience of broadband networks in Central Asia, the Pacific and South-East Asia.

IV. Promoting resilient broadband connectivity in Central Asia

21. The Central Asia subregion has many landlocked developing countries. As a result of that geographical feature and other factors, Central Asia as a whole is highly dependent on connections to neighbouring countries for Internet transit. The region has insufficient international bandwidth, high transit costs to access international links and small populations scattered over large distances. Countries in Central Asia are dealing with challenges to develop ICT infrastructure in remote and rural areas.^{16,17}

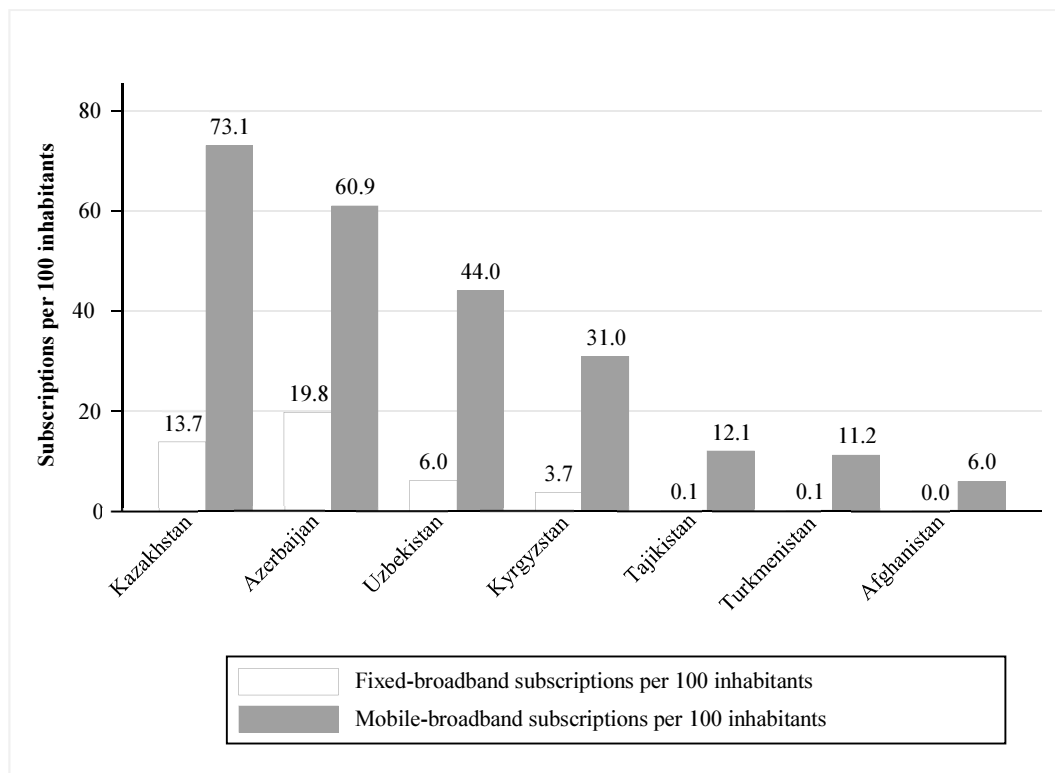
22. The two most developed economies in the subregion, Azerbaijan and Kazakhstan, have the highest shares of mobile-broadband and fixed-broadband subscriptions per 100 inhabitants (figure V). In comparison, Afghanistan, Tajikistan and Turkmenistan have the lowest shares of mobile-broadband and fixed-broadband subscriptions per 100 inhabitants.

¹⁵ McKinsey and Company, *Bridging Global Infrastructure Gaps* (2016).

¹⁶ Section IV summarizes ESCAP, “A study of ICT connectivity for the Belt and Road Initiative: enhancing the collaboration in China-Central Asia corridor”, Working Paper by the Information and Communications Technology and Disaster Risk Reduction Division (Bangkok, 2017), available from www.unescap.org/sites/default/files/BRI.pdf; and ESCAP, “Building a resilient digital economy: fostering SMEs in Central Asia”, Asia-Pacific Information Superhighway Working Papers (Bangkok, 2017), available from www.unescap.org/resources/building-resilient-digital-economy-fostering-smes-central-asia.

¹⁷ More ICT issues and challenges in Central Asia are described in Rajnesh Singh, “Improving broadband access in Southeast and Central Asia”, presentation at the ITU for Development meeting, Bangkok, June 2016. Available from www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/Documents/Events/2016/May-RDF2016/Presentation/SINGH%20ITU-RDF%20Connectivity%20in%20ASEAN%20and%20Central%20Asia%20Jun16.pdf.

Figure V
Broadband connectivity in United Nations Special Programme for the Economies of Central Asia countries, 2015

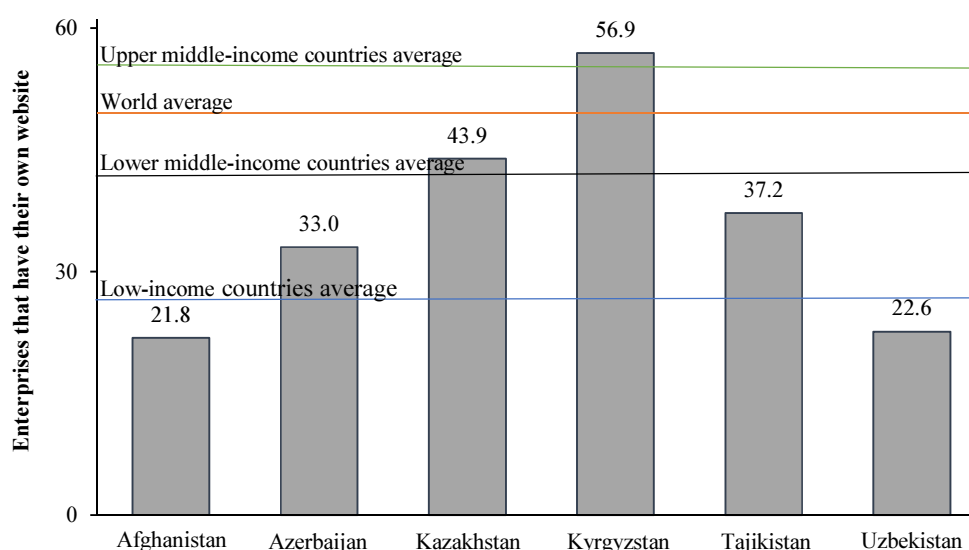


Source: World Telecommunication/ICT Indicators database (see figure I).

23. One of the benefits of developing broadband infrastructure is enhanced commercial and business activities online. Engaging in electronic commerce (e-commerce) tends to generate benefits for small and medium-sized enterprise in particular. E-commerce encourages entrepreneurship, business opportunities, employment and export diversification. Studies showed that firms engaged in e-commerce were more likely to export. Small and medium-sized enterprises that make extensive use of the web have access to a larger market. Extensive web users are significantly more likely to source and sell products and services to partners beyond their immediate region.¹⁸ Aggregated data for the subregion showed extensive use of the Internet by small and medium-sized enterprises in Kazakhstan, Kyrgyzstan and Tajikistan in particular (figure VI).

¹⁸ Kati Suominen, "Aid for e-Trade: accelerating the e-commerce revolution", International Centre for Trade and Sustainable Development, 12 March 2015. Available from www.ictsd.org/opinion/aid-for-etrade-accelerating-the-e-commerce-revolution.

Figure VI
Web presence among small and medium-sized enterprises in United Nations Special Programme for the Economies of Central Asia countries, 2013–2014
 (Percentage)



Source: ESCAP calculations based on data from World Bank Group, Enterprise surveys database. Available from www.enterprisesurveys.org/ (accessed 21 July 2016).

24. The potential for small and medium-sized enterprises to use e-commerce for trade can be limited by low broadband connectivity. Using the 2016 business-to-consumer electronic commerce index developed by the United Nations Conference on Trade and Development with data for 137 countries, fixed-broadband connectivity was found strongly correlated (0.90) with business-to-consumer electronic commerce.¹⁹ Thus, enhanced broadband connectivity in the United Nations Special Programme for the Economies of Central Asia subregion can encourage the development and adoption of e-commerce by companies.

25. Disaster risk is one of the main challenges in expanding broadband connectivity in the subregion. Some areas of Central Asia are prone to multiple natural hazards. During the period 2000–2015, 210 disasters caused 10,639 deaths and affected more than 16 million people in the Special Programme for the Economies of Central Asia subregion. Floods were the most frequent disaster, followed by earthquakes and landslides, which may impact ICT networks and facilities. Building resilience into ICT infrastructure is a development imperative.

26. As a first step in building resilient infrastructure and businesses, risk assessment and risk identification should be carried out for the ICT sector, particularly in disaster-prone areas. Based on the risk assessment,

¹⁹ Kati Suominen, “Accelerating SME trade in Asia-Pacific: de minimis plurilateral”, presentation made at the Workshop on using technology in support of trade for micro, small and medium-sized enterprises, Bangkok, December 2016. Available from www.unescap.org/sites/default/files/19.%20Session%205-De%20Minimis%20-%20Suominen%20120116.pdf.

Governments and businesses in the subregion can decide how to limit their exposure to hazards²⁰ and develop resilient broadband networks.

V. Drivers of broadband connectivity in the Pacific

27. Within the vastness of the Pacific Ocean, small island developing States and areas have gained a stronger sense of themselves as a subregional community to act on mutual development concerns with the advent of broadband Internet. However, broadband access remains unequal in the Pacific. Of the 18 ESCAP member States with 2 per cent or less fixed-broadband penetration in 2016, eight are in the Pacific.²¹ Meanwhile, New Caledonia and French Polynesia had more than 19 per cent fixed-broadband penetration, while Fiji, Nauru and Tonga had mobile-broadband penetration of more than 30 per cent.²²

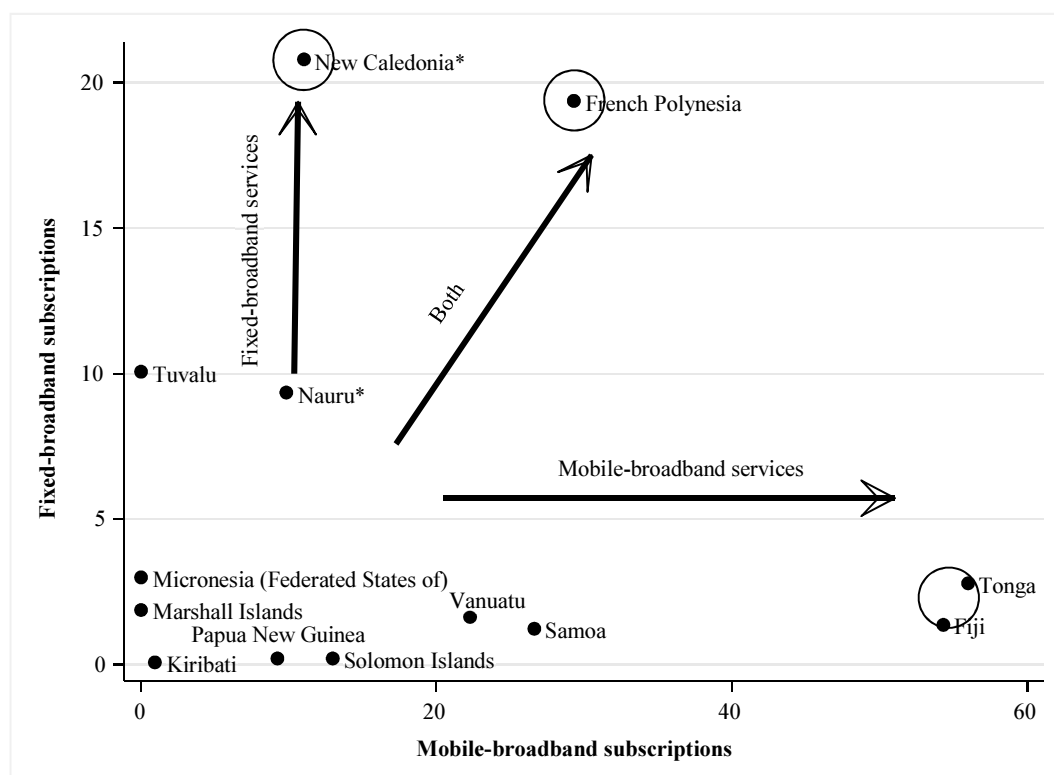
28. While both fixed-broadband and mobile-broadband subscriptions per 100 inhabitants have increased over time in the Pacific, the pace has been uneven (figure VII). One group (Marshall Islands; Micronesia (Federated States of); New Caledonia; and Tuvalu) improved access to fixed-broadband connectivity. The second group (Fiji and Tonga) improved access to mobile-broadband connectivity but with limited improvement in access to fixed broadband. The third group (French Polynesia and to a lesser extent Nauru) improved access to both fixed and mobile broadband.

²⁰ ESCAP, *Resilient Business for Resilient Nations and Communities* (Bangkok, 2015). Available from www.unescap.org/sites/default/files/Resilient%20Business%20Book-Final-lowres.pdf.

²¹ ESCAP, “Artificial intelligence and broadband divide: state of ICT connectivity in Asia and the Pacific - 2017” (Bangkok, 2017). Available from www.unescap.org/resources/artificial-intelligence-and-broadband-divide-state-ict-connectivity-asia-and-pacific-2017.

²² Section V is based on ESCAP, “Broadband connectivity in Pacific island countries”, Asia-Pacific Information Superhighway Working Paper Series (Bangkok, 2018). Available from: www.unescap.org/sites/default/files/PACIFIC_PAPER_Final_Publication_0.pdf.

Figure VII
Snapshot of mobile- and fixed-broadband subscriptions in the Pacific, 2016
 (Per 100 inhabitants)



Source: World Telecommunication/ICT Indicators database (see figure I).

Note: * refers to countries or areas with the latest data available.

29. One important factor found to influence broadband adoption in the Pacific was the level of economic development of each country or area, measured in gross domestic product (GDP) per capita. Compared to other small islands developing States in the Caribbean region, GDP per capita in most Pacific island countries or areas was quite low.²³ Kiribati and Solomon Islands had GDP per capita of less than \$1,700 in 2015. As a result, the opportunity cost of opting for broadband connectivity adoption compared to meeting basic needs may be significantly higher in less developed Pacific island countries or areas.

30. The affordability of broadband connectivity is linked to economic development, and it can influence broadband adoption in the Pacific. According to a report of the Broadband Commission for Sustainable Development, broadband access is considered affordable when the share of total gross national income (GNI) per capita spent on broadband services (mobile or fixed) was less than 5 per cent.²⁴ Using that standard and ITU data for 182 countries or areas for 2015, broadband access was still considered

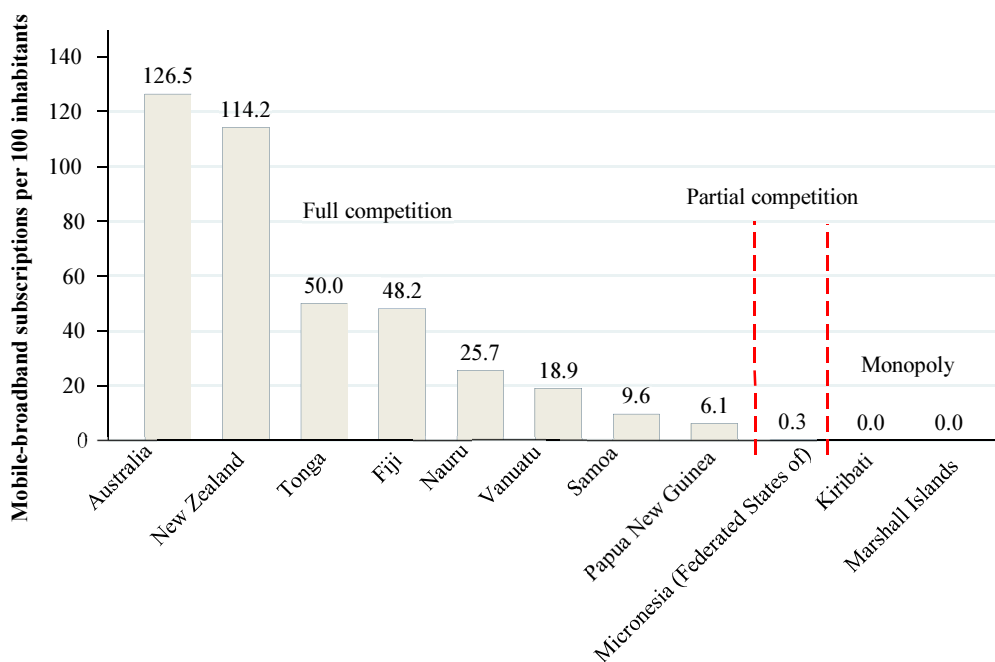
²³ The Caribbean region outperformed the Pacific region in both fixed-broadband and mobile-broadband subscriptions per 100 inhabitants between 2007 and 2015.

²⁴ Broadband Commission for Sustainable Development, “Broadband targets for 2015” (Geneva, 2015). Available from www.broadbandcommission.org/Documents/Broadband_Targets.pdf.

unaffordable in the Pacific subregion.²⁵ The cost of mobile-broadband services in Tonga (3 per cent of GNI) and Fiji (4 per cent) was considered less affordable, while the cost of mobile-broadband access in Kiribati, Marshall Islands, the Federated States of Micronesia, Papua New Guinea, Tuvalu, Samoa, Solomon Islands and Vanuatu was considered least affordable.

31. Another important factor in the adoption of broadband connectivity is a conducive regulatory policy for ICT infrastructure investment. The overall situation of the telecommunication sector development in the Pacific has revealed that introducing competition through regulatory reforms achieves positive outcomes.²⁶ Pacific island countries or areas that have introduced competition in the mobile services sector (by allowing a second private telecommunication operator to enter) have experienced significant expansion in broadband access (figure VIII).

Figure VIII
Mobile-broadband adoption and level of competition, 2016



Source: World Telecommunication/ICT Indicators database (see figure I); and the International Bank for Reconstruction and the World Bank, *The Little Data Book on Information and Communication Technology 2017* (Washington, D.C., 2017). Available from <https://data.worldbank.org/products/data-books/little-data-book-on-info-communication-tech>.

32. Access to resilient and affordable electricity also impacts broadband adoption in the Pacific. A positive and statistically significant relationship was

²⁵ ITU, World Telecommunication/ICT Indicators database 2017, 21th Edition/December 2017 (4 January 2018). Available from www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx.

²⁶ Siope Vakataki 'Ofa, *Telecommunications Regulatory Reform in Small Island Developing States: The Impact of the WTO's Telecommunications Commitment* (Newcastle upon Tyne, Cambridge Scholars Publishing, 2012). Available from www.cambridgescholars.com/download/sample/60612.

found between access to electricity (measured by electricity consumption) and fixed-broadband adoption.²⁷ The policy implication is that other supporting infrastructure, in particular the power grid, must have the power generating capacity to meet the increasing demand of an expanding broadband network.

33. Another important factor in the adoption of broadband connectivity in the Pacific was the availability of ICT goods (for example, mobile devices). Most consumer ICT goods (such as smartphones, computers and consumer electronics) were imported from overseas. Between 2000 and 2015, 4 per cent of total imports in the Pacific, on average, were ICT goods. In the same period, only 0.6 per cent of total exports were ICT goods. Higher tariffs increased domestic price of imported ICT devices, thereby discouraging access to broadband connectivity, especially for low-income households. Pacific island countries or areas had higher import tariff rates²⁸ (8 per cent) compared to the average for the region as a whole (7.1 per cent) and for the world (7.7 per cent). While this may be a prudent public fiscal measure, it could have an adverse effect on accessing affordable ICT goods.

34. Natural disasters hindered broadband adoption in the Pacific. Between 2000 and 2016, the subregion experienced 225 natural disasters²⁹ that caused 1,752 fatalities, affected 4.7 million people and resulted in nearly \$50 billion (in 2005 United States dollars) in damages.³⁰ The ICT infrastructure was continually affected by natural disasters, which disrupted the ability of providers to serve current and new customers. The total damage caused by Cyclone Winston to the communication sector in Fiji was estimated to be approximately \$24 million.³¹

VI. Quality of broadband connectivity in member States of the Association of Southeast Asian Nations

35. Despite rapid ICT development in some member States of the Association of Southeast Asian Nations (ASEAN),³² the subregion faces

²⁷ Correlation coefficient equals 0.69.

²⁸ Average tariff rate, most-favoured-nation, weighted mean, manufactured products (per cent).

²⁹ Disaster categories included were drought, earthquake, extreme temperature, flood, landslide, mass movement (dry), storm, volcanic activity and wildfire.

³⁰ Centre for Research on the Epidemiology of Disasters, EM-DAT: The OFDA/CRED International Disaster Database. Available from <http://emdat.be> (accessed 14 March 2017).

³¹ Including loss of income due to interruption of service.

³² In 2016, Malaysia, Singapore and Thailand had the highest access to broadband (fixed and mobile) connectivity. On the other hand, Brunei, Myanmar and the Lao People's Democratic Republic recorded the least access to broadband connectivity. As in the global trend, a higher percentage of the population accessed mobile broadband compared to fixed broadband.

formidable challenges in improving the quality of broadband connectivity³³ in terms of network speed,³⁴ latency,³⁵ tromboning effect³⁶ and affordability.³⁷

36. Speed tests in ASEAN countries showed that Internet speed varied significantly (table 1). At one extreme, Indonesia had the slowest Internet speed (download and upload), while Singapore, Thailand and Viet Nam had the highest Internet speed (more than 10 times higher than Indonesia).

Table 1
Results of Internet speed test

<i>Country</i>	<i>Download (MB/second)</i>		<i>Country</i>	<i>Upload (MB/second)</i>	
	<i>Highest</i>	<i>Lowest</i>		<i>Highest</i>	<i>Lowest</i>
Singapore	59	30	Singapore	44	17
Viet Nam	14	10	Viet Nam	12	7
Thailand	13	10	Myanmar	6	1
Myanmar	9	2	Lao People's Democratic Republic	6	3
Philippines	7	2	Cambodia	6	4
Lao People's Democratic Republic	6	3	Thailand	4	2
Cambodia	5	3	Malaysia	4	3
Malaysia	5	4	Philippines	2	1
Indonesia	3	2	Indonesia	2	1

Source: ESCAP and National Information Society Agency, "A pre-feasibility study on the Asia-Pacific information superhighway in the ASEAN sub-region: conceptualization, international traffic and quality analysis, network topology design and implementation model" (2016). Available from: www.unescap.org/sites/default/files/ASEAN%20report%20%5Bdraft%5D.pdf.

37. Based on the discussion at the ASEAN telecommunications senior officials meeting in November 2016 on the findings of the Asia-Pacific information superhighway pre-feasibility study in the subregion and the way forward, it was proposed to differentiate between the southern corridor covering Brunei Darussalam, Indonesia, Malaysia, the Philippines, Singapore

³³ For further information, see ESCAP and National Information Society Agency, "A pre-feasibility study on the Asia-Pacific information superhighway in the ASEAN subregion: conceptualization, international traffic and quality analysis, network topology design and implementation model" (2016). Available from: www.unescap.org/sites/default/files/ASEAN%20report%20%5Bdraft%5D.pdf.

³⁴ Measured in MB/second.

³⁵ Latency is how long (delay) it takes data to travel between source and destination, measured in milliseconds. Shorter delay indicates faster transfer of data between two points and vice versa.

³⁶ A tromboning index is defined as Internet routing distance/straight line distance from the source to the destination of a packet. Higher tromboning indicates a longer virtual routing distance.

³⁷ Price of broadband connectivity as a percentage of GNI per capita. Higher percentage shares depict unaffordability and vice versa.

and Thailand, and the northern corridor covering Cambodia, the Lao People's Democratic Republic, Myanmar and Viet Nam.

38. An ongoing study on the northern corridor found that physical cross-border connectivity had improved thanks to a number of new submarine cable projects and terrestrial fibre networks. However, long detour routes for Internet traffic exchange, even among neighbouring countries, resulting from the lack of Internet exchange points in the region, are a serious problem and hamper aspects of Internet quality such as speed and latency.

39. The study found regional Internet transit prices in Cambodia, the Lao People's Democratic Republic, Myanmar and the Philippines, were 10 times more expensive than in Singapore. High transit prices convert to high service prices and ultimately result in the unaffordability of broadband services. The countries with high transit prices were also the countries where Internet connectivity was most unaffordable (Cambodia, the Lao People's Democratic Republic, Myanmar and the Philippines).

40. The countries of the southern corridor, characterized by submarine cable networks, more advanced international Internet transit infrastructure and faster integration, are moving into the digital economy. Given the fact that the southern corridor, particularly Indonesia and the Philippines, is a disaster-prone area, building redundancies in these networks can contribute to their e-resilience and therefore the overall resilience of the region.

41. Realizing that the demands for Internet bandwidth are increasing quickly with an average of 298.5 per cent growth during the period 2016–2020 for five countries, excluding Brunei Darussalam, the Internet traffic between ASEAN countries had been rapidly expanded, particularly on routes between Singapore and other South-East Asian nations. Smart applications and artificial intelligence are expected to generate more data which need a greater connectivity and bandwidth, and a smaller latency (table 2).

Table 2
Medium-term international bandwidth demand projections, 2016–2020, by country
(Percentage)

	<i>Projected annual growth 2016–2020</i>	<i>Projected total growth 2016–2020</i>	<i>Share of corporate data in international bandwidth demand</i>		<i>Share of Internet in international bandwidth demand</i>	
			<i>2016</i>	<i>2020</i>	<i>2016</i>	<i>2020</i>
Indonesia	+43.6	+325.6	11.1	11.2	88.1	88.5
Malaysia	+45.6	+349.2	22.9	23.0	76.3	76.7
Philippines	+42.7	+314.2	11.7	11.7	88.1	88.2
Singapore	+34.6	+227.6	9.6	9.6	90.1	90.2
Thailand	+39.2	+275.7	9.1	13.0	90.1	87.0
Southern corridor	41.1	298.5	12.9	13.7	86.5	86.1

VII. Issues for consideration

42. Based on the analysis provided by the secretariat and the policy gaps identified, the Commission may wish to provide guidance to the secretariat on the proposed future direction of work, including the following:

(a) Scale up support to the 18 ESCAP member States identified by the secretariat as having the slowest growth in fixed-broadband expansion, in particular the countries with special needs. The subregional implementation plans for the Asia-Pacific information superhighway will help prioritize their needs and requirements;

(b) Strengthen collaboration with the transport and energy sectors, to leverage synergies, notably cost minimization inherent to the co-deployment of fibre-optic cables along passive infrastructure such as the Asian Highway and Trans-Asian Railway networks and cross-border power grids and pipelines;

(c) Continue to promote broadband infrastructure that is resilient to natural disasters – e-resilience – through knowledge products and online tools made available from online platforms, such as the ICT & DRR Gateway;

(d) Strengthen research collaboration with relevant research institutions, think tanks, and other stakeholders on emerging trends, challenges and opportunities with a focus on ICT innovations and their impacts on the implementation of the Sustainable Development Goals;

(e) Share the findings of the secretariat's analytical work at sessions of the Committee on Information and Communications Technology, Science, Technology and Innovation and of the Commission and in other forums including with the United Nations country teams in the Asia-Pacific region.
