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Economic and Social Commission for Asia and the Pacific
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Policy issues for information and communications technology: promoting the integration and application of information and communications technology policy through the Asia-Pacific Information Superhighway initiative

Major issues and emerging trends related to digital technologies and regional broadband connectivity

Note by the secretariat

Summary

Despite rapid advancements in emerging technologies, such as artificial intelligence and associated digital technologies, the implementation of the Sustainable Development Goals in Asia and the Pacific has been constrained by the widening broadband divide. In order to understand the root causes and impacts of this divide, the secretariat has undertaken research and analyses since the first session of the Committee on Information and Communications Technology, Science, Technology and Innovation, which was held in 2016. This present note contains a summary of the key findings of these studies and identifies issues and policy recommendations for consideration by the Committee.

In particular, the attention of the Committee is drawn to the importance of addressing institutional, policy-related, social and economic factors, which influence the broadband divide, as an urgent development priority. Emerging technologies depend heavily on the availability of robust, reliable and resilient broadband infrastructure as a prerequisite.

Focused intervention is called for in Asia-Pacific countries with special needs, such as small islands developing States, the least developed countries and landlocked developing countries, which have demonstrated the slowest progress in expanding broadband connectivity. In addition, co-deployment with transport and energy infrastructure is identified as a cost-efficient way of deploying broadband infrastructure.

The Committee may wish to review the issues identified at the end of the note and provide guidance to the secretariat.

* ESCAP/CICTSTI/2018/L.1.

I. Introduction

1. Innovative digitally-led technologies have not only provided society with new capabilities, but also transformed the way in which people live, work and relate to each other. Technological advancements, such as artificial intelligence and its associated digital technologies, have opened up new avenues for sustainable development in Asia and the Pacific.

2. Intelligent applications, such as virtual personal assistants powered by artificial intelligence and machine learning, can make everyday tasks such as prioritizing emails simpler and faster. Through cloud computing, firms can reduce the cost that they would have otherwise incurred on acquiring software and hardware equipment. Broadband-enabled technologies also allow the Government to plan and develop smarter cities – including smart buildings and homes, smart grids, smart transportation, single windows and smart manufacturing – which can reduce energy wastage, identify traffic congestion, improve access to health and education, achieve production efficiency and minimize environmental degradation.

3. Affordable and resilient broadband infrastructure that is readily accessible to connect people and devices is a prerequisite for these considerable economic and social gains to be realized. In this context, studies by the Economic and Social Commission for Asia and the Pacific (ESCAP) have found the widening broadband divide between countries of Asia and the Pacific to be alarming. The reports conclude that ESCAP member countries with special needs (the least developed countries, landlocked developing countries and small island developing States) as well as poor and marginalized people, notably people living in remote and rural areas, are still unable to benefit from bandwidth-intense technological applications and services. This widening broadband divide, if not addressed urgently, will become increasingly difficult to narrow and hinder the efforts towards sustainable development of the member States.

4. Against this background, the present document contains a summary of the findings of research and analyses undertaken by ESCAP since the first session of the Committee on Information and Communications Technology, Science, Technology and Innovation, which was held in October 2016. The research and analyses were designed and undertaken in response to Commission resolutions 71/10, 72/10 and 73/6 and in support of the implementation of the Master Plan for the Asia-Pacific Information Superhighway and the Asia-Pacific Information Superhighway Regional Cooperation Framework Document. The latter two documents are also presented to the current session as information documents ESCAP/CICTSTI/2018/INF/1 and ESCAP/CICTSTI/2018/INF/2. The findings of ESCAP research and analyses have systematically contributed to activities related to the Asia-Pacific Information Superhighway initiative as a basis for evidence-based policy dialogues and regional cooperation. The outcomes of the activities and meetings are summarized in another document submitted to the Committee at its present session (ESCAP/CICTSTI/2018/2).

5. The sections below cover several pertinent themes including the broadband divide, emerging technologies, capacity and skills gaps, financing, privacy challenges and the co-deployment of fibre-optic cables along passive infrastructure.

II. Broadband divide in Asia and the Pacific

A. Fixed broadband

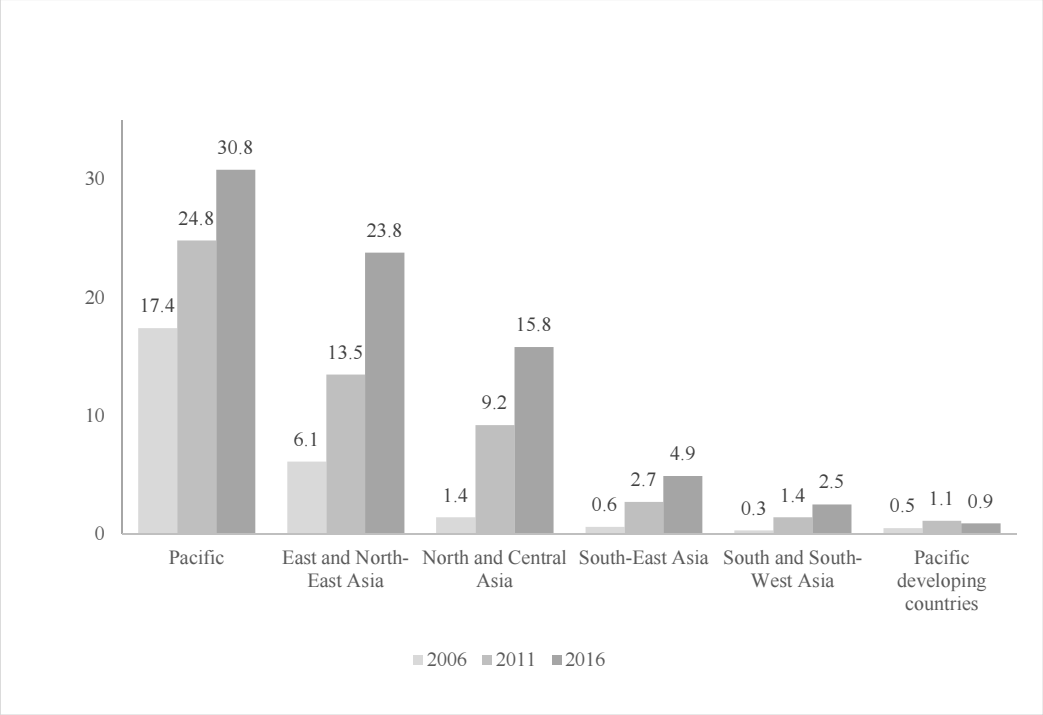
6. In the ESCAP report entitled *Artificial Intelligence and Broadband Divide: State of ICT Connectivity in Asia and the Pacific 2017* (Bangkok, 2017), characteristics of the region's broadband divide are presented and the way in which it may affect the development and roll-out of emerging technologies, such as artificial intelligence, is described. Overall, the Asia-Pacific region has demonstrated steady growth in access to fixed broadband compared to the past decade. Judging from the 2016 data, a large share of the world's total fixed-broadband subscriptions was found in the Asia-Pacific region (56.6 per cent), followed by Europe (20.3 per cent) and North America (13 per cent). However, when the number of fixed-broadband subscriptions per 100 inhabitants is examined, it becomes apparent that the ESCAP average (11.6) was still far behind North America (32.9) and Europe (31.1). The ESCAP average was also below the world average of 12.5 fixed-broadband subscriptions per 100 inhabitants, though it was marginally higher than the figure in Latin America and the Caribbean (11.2).

7. With regard to the subregional broadband divide in Asia and the Pacific, the total number of fixed-broadband subscriptions in 2016 derived predominantly from East and North-East Asia (75.74 per cent), followed by South and South-West Asia (9.32 per cent), North and Central Asia (7 per cent), South-East Asia (6.17 per cent) and the Pacific (1.76 per cent). The concentration of fixed-broadband subscriptions in East and North-East Asia has been intensifying over recent years.

8. Looking at the number of subscriptions per 100 habitants, as demonstrated by figure I, the expansion of fixed broadband over the past decade is uneven across ESCAP subregions. While the Pacific, East and North-East Asia, and North and Central Asia have performed relatively well in terms of growth in fixed-broadband subscriptions, the other subregions (South-East Asia and South and South-West Asia) have registered slower progress. When disaggregated by the level of economic development, developing countries in the Pacific have the lowest number of subscriptions and, over the past decade, recorded almost no improvement. This is despite the fact that the Pacific subregion as a whole has the highest subscription rate, owing to the growth in and number of subscriptions in Australia and New Zealand. While French Polynesia, Fiji, New Caledonia and Tonga have experienced high growth in broadband connectivity, eight Pacific island countries are lagging behind, with less than 2 per cent of average fixed-broadband penetration.[1] Similarly, in East and North-East Asia, rapid expansion is mainly being driven by China, Japan and the Republic of Korea. In North and Central Asia, noticeable progress was observed mainly in Azerbaijan, Georgia, Kazakhstan, the Russian Federation and, recently, Uzbekistan.

[1] ESCAP, *Broadband Connectivity in Pacific Island Countries* (Bangkok, 2018).

Figure I
Average fixed-broadband subscriptions per 100 habitants, by ESCAP subregion, 2006, 2011 and 2016



Source: ESCAP calculations based on data from International Telecommunication Union (ITU), World Telecommunication/ICT Indicators database 2017 (21st Edition/December 2017); available at www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx (accessed 25 April 2018).

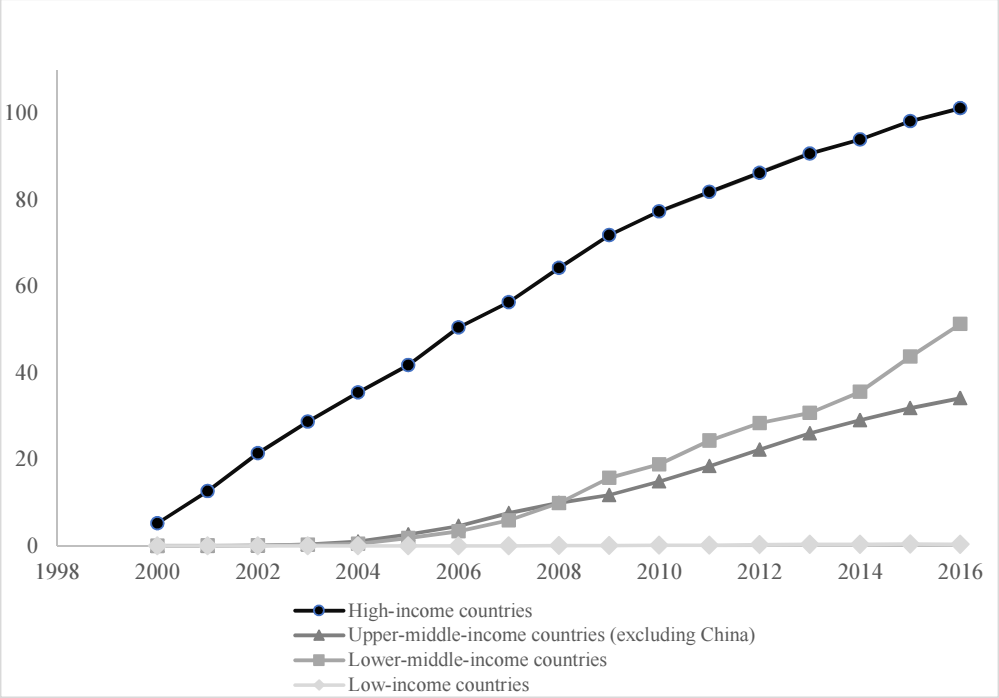
Note: The category entitled "Pacific developing countries" excludes Australia and New Zealand.

9. Using the standard deviation approach (a measure of sample distribution) to examine fixed-broadband connectivity, it is clear that there is similar evidence of a widening broadband divide in Asia and the Pacific.[2] Specifically, an estimate relating to Pacific island countries shows that in terms of fixed-broadband subscriptions, the standard deviation values increased between 2010 and 2016, meaning that the differences among countries, especially between countries with high and low broadband access, increased over time. The estimate also indicates that some countries have experienced no growth in broadband connectivity.

10. Countries of different income levels have experienced different growth patterns in fixed-broadband subscriptions, as shown in figure II. High-income economies have demonstrated stable but slow growth over the years, while upper- and lower-middle-income economies have demonstrated accelerated growth since 2007. The most worrisome trend is the lack of progress in the total number of fixed-broadband subscriptions among low-income economies, which is further worsening the broadband divide among countries.

[2] ESCAP, *Artificial Intelligence and Broadband Divide*.

Figure II
Fixed-broadband subscriptions per 100 inhabitants, by income group, 2007–2016



Source: ITU, World Telecommunication/ICT Indicators database 2017 (see figure I).

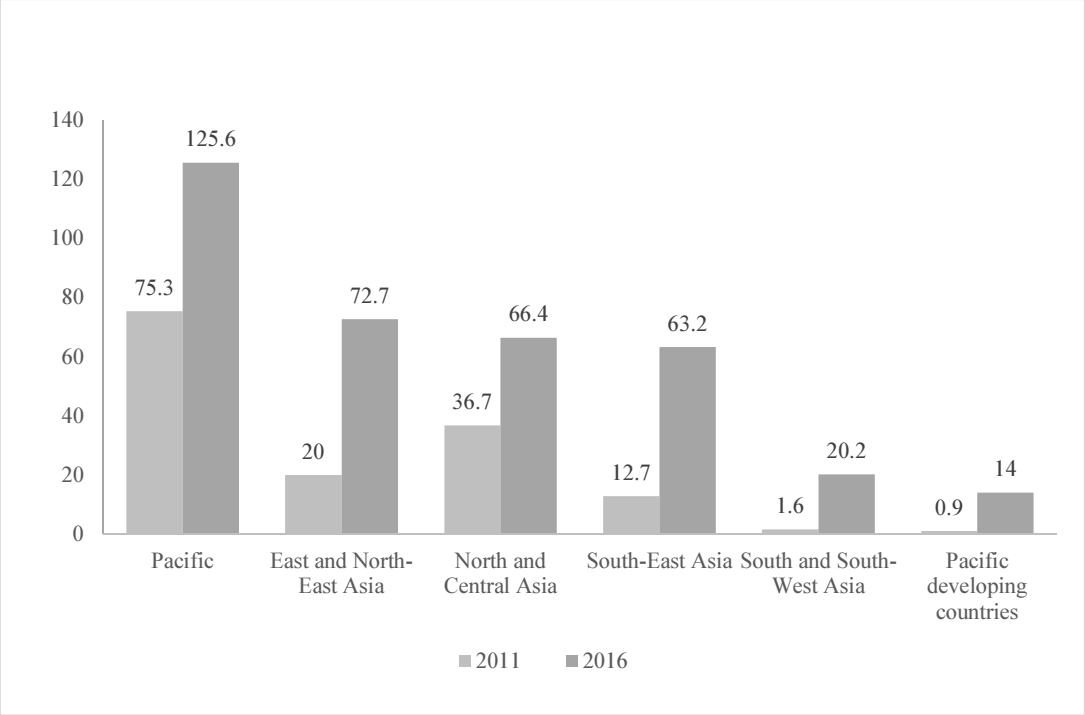
B. Mobile broadband

11. Asia and the Pacific performed much better in terms of mobile-broadband uptake.[3] The region is leading in mobile-broadband growth, with the majority of global mobile-broadband subscriptions registered in the region.

12. Figure III shows that the average number of mobile-broadband subscriptions per 100 inhabitants 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). There has been rapid expansion in many countries in North and Central Asia and South-East Asia. Among all the subregions, South and South-West Asia and developing countries in the Pacific had the lowest average mobile-broadband subscriptions per 100 inhabitants, although there have been significant increases in both subregions since 2011.

[3] Mobile broadband has many advantages: (a) it enables Internet access wherever and whenever required, with no fees to connect to fixed networks; (b) it does not require physical infrastructure to reach each home and does not require the purchase and rental of a landline; and (c) there are no set-up fees involved, making it a cost-efficient option compared to fixed (wired) broadband.

Figure III
Average mobile-broadband subscriptions per 100 habitants, by subregion, 2011 and 2016

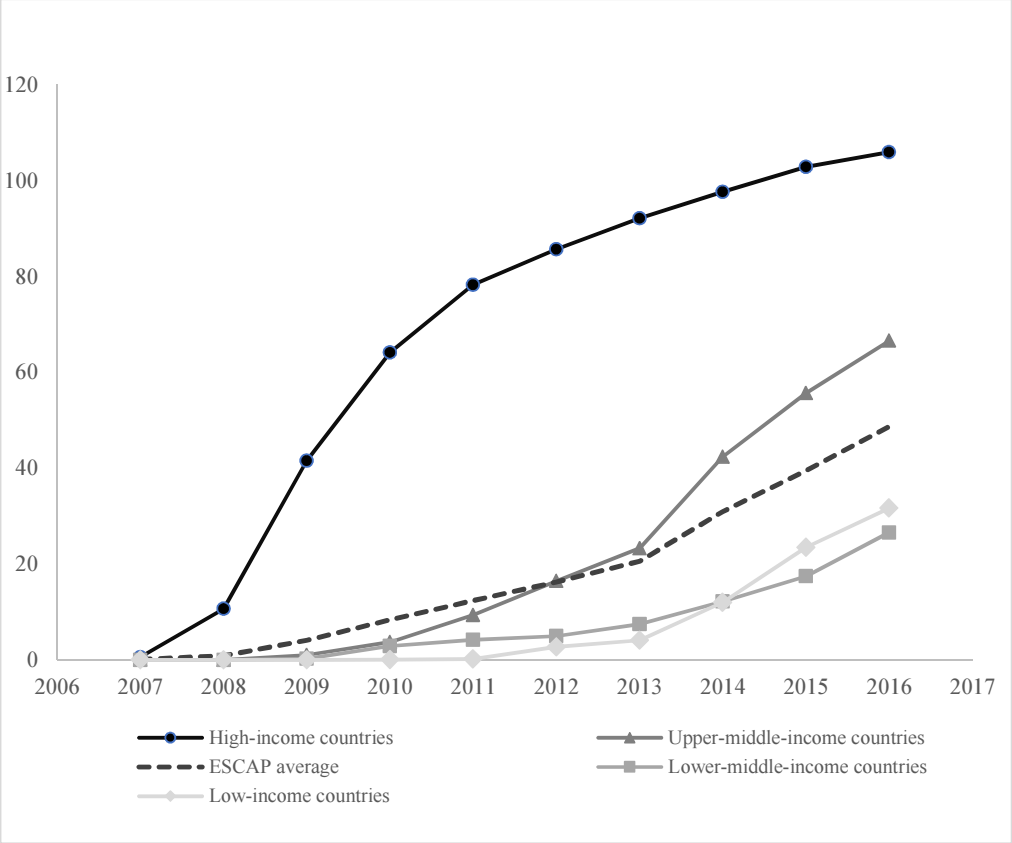


Source: ITU, World Telecommunication/ICT Indicators database 2017 (see figure I).

Note: The category entitled "Pacific developing countries" excludes Australia and New Zealand.

13. From figure IV, significant expansion can also be observed in mobile-broadband subscriptions across income groups. Low-income countries are quickly catching up, and even surpassing lower-middle-income countries. High-income countries show the highest subscription rate, but slower growth, likely owing to market maturity.

Figure IV
Mobile-broadband subscriptions per 100 inhabitants, by income group, 2007–2016



Source: ITU, World Telecommunication/ICT Indicators database 2017 (see figure I).

Note: The category entitled "Pacific developing countries" excludes Australia and New Zealand.

C. Broadband in countries with special needs

14. In *Artificial Intelligence and Broadband Divide*, another worrisome trend in the region is underlined: countries with special needs, such as small island developing States, the least developed countries and landlocked developing countries, registered slower progress than the rest.[4] Indeed, several of these countries had fewer than two fixed-broadband subscriptions per 100 inhabitants, with virtually no progress. Considering that 60 per cent of mobile data traffic was offloaded to fixed broadband through Wi-Fi and femtocells in 2016 – a proportion that, according to the above-mentioned report, is expected to increase to 63 per cent in 2021 – the importance of fixed-broadband infrastructure is accentuated not only at the backbone or backhaul level but also at the retail level. Furthermore, as stated in the report, the debate on the substitution effects of mobile broadband on fixed-broadband access is not conclusive, as some reports indicate that they are in fact complementary. Considering affordability, capacity, latency and reliability, mobile-broadband growth would require fixed-broadband infrastructure expansion.

[4] For the full list of countries, see ESCAP, *Artificial Intelligence and Broadband Divide*.

15. In the absence of robust fixed- and mobile-broadband networks and access, most people in countries with special needs do not benefit fully from the rapid advancements of digital technologies and the opportunities they offer. In order to combat disparities, it is necessary to investigate the main factors that are holding back broadband development in countries with special needs.

16. Countries with special needs appear to have mixed regulatory policies in place.[5] According to ITU data, while 13 countries reported that a regulatory authority for the telecommunications sector had been established, only nine countries indicated that the regulatory authority enjoyed autonomous decision-making. Only nine countries indicated that full competition was allowed for local fixed-line services and mobile services. Competition in international gateways was allowed in only seven countries, while seven countries indicated that a universal service fund was operational.

17. Special challenges faced by the countries with special needs are also related to geography and demography. Lack of access to the sea increases prices for international connectivity for landlocked developing countries. For small island developing States, market size and the size of the islands create a problem with the roll-out of terrestrial fibre-optic cables. These issues are exacerbated since some landlocked developing countries have large mountainous, sparsely populated and rural areas, resulting in higher capital investment and operation costs.[6] The least developed countries tend to lag behind developed countries in terms of fixed-broadband penetration, household access to information and communications technology (ICT), and Internet uptake.[7]

18. Additionally, the cost of electricity is considered as a major obstacle for the least developed countries and small island developing countries, as it adds to the cost of powering networks and raises the cost of broadband and Internet access. In the least developed countries, 79 per cent of the population lack access to electricity while 91 per cent have no access to modern fuels. The countries with the highest prices of electricity are in many cases small island developing States.[8]

III. Emerging technologies and the broadband divide in the region

19. The technological context surrounding ESCAP member countries has also been changing, with the introduction and roll-out of emerging technologies such as artificial intelligence. The accelerating adoption and proliferation of these technologies, some of which are bandwidth-intensive, will have a significant impact on the broadband networks and ecosystems, while the existing broadband divide is expected to constrain the roll-out of such applications and solutions. In this context, ESCAP undertook an analysis to identify the challenges and opportunities presented by artificial intelligence and its associated digital technologies, and how they could help support the

[5] Affordability and capacity also tend to vary among these countries.

[6] For a sample analysis of capital expenditure and operating expenditure, see ESCAP, *A Study of ICT Connectivity for the Belt and Road Initiative (BRI): Enhancing the Collaboration in China-Central Asia Corridor* (Bangkok, 2017).

[7] ITU, *ICTs, LDCs and the SDGs: Achieving Universal and Affordable Internet in the Least Developed Countries* (Geneva, 2018).

[8] Ibid.

achievement of the Sustainable Development Goals once all the factors are put in place.[9]

20. Cases of use of artificial intelligence in the agricultural sector include image recognition, data collection and analysis, and space technology applications, which help identify crop diseases onsite. The technologies may also help deliver accurate weather forecasts to guide farmers in making informed decisions on planting, harvesting, irrigation and use of fertilization. In health care, solutions powered by artificial intelligence have improved the accuracy and efficiency of diagnosis for a wide range of diseases, including cancers, and a number of applications that analyse medical images are being used to substitute and complement high-level but scarce medical expertise. In addition, artificial intelligence solutions have been increasingly used to enhance the region's resilience to disasters, particularly through real-time monitoring of hazards, assessment of risk, early warning and information support using the Internet of things, sensors and big data. These solutions and applications, enabled by artificial intelligence and digital technology, are expected to accelerate the implementation of the Sustainable Development Goals and bring qualitative transformations to both society and economy.

21. However, according to the ESCAP analysis report, not all countries in the region are equipped to develop and introduce such solutions. To reap the above-mentioned benefits, a number of conditions need to be put in place. The findings of the report suggest that the size of an economy matters in the uptake of artificial intelligence, meaning that countries with a bigger market size and thus larger workforce tend to produce more research and applications related to artificial intelligence. It is also pointed out in the analysis that a reliable and vibrant telecommunications sector correlates with artificial intelligence uptake. Furthermore, there is a strong positive correlation between artificial intelligence research and reliable and resilient broadband networks, which may demonstrate the necessity of the underlying broadband infrastructure for the development and uptake of artificial intelligence. In this context, developed economies with artificial intelligence capabilities and robust broadband infrastructure are expected to benefit more and grow wealthier than the rest, while the less developed economies of the least developed countries, landlocked developing countries and small island developing States are at risk of being further marginalized and left behind.

IV. Main challenges

22. ESCAP research and analyses also identified financial, institutional, policy-related, social and economic factors that may influence the expansion of broadband connectivity within and among ESCAP member countries. A summary of the key findings of these reports, categorized around the main factors, is given below.

Affordability

23. The affordability of broadband access is one of the key factors driving the broadband connectivity growth in the region. In an ESCAP study, the cost of fixed broadband in two of the nine countries surveyed – Kiribati and Solomon Islands – represented over half of the gross national income per capita, which was reflected in the slow broadband growth.[10] An ESCAP study on broadband networks in the Association of Southeast Asian Nations

[9] ESCAP, *Artificial Intelligence and Broadband Divide*.

[10] ESCAP, *Broadband Connectivity in Pacific Island Countries*.

(ASEAN) subregion also found a similar result: the costs of subscriptions in the Lao People's Democratic Republic and Myanmar were more than 15 per cent of the gross national income per capita, and much more than 10 per cent in Cambodia and Indonesia, correlating with the level of broadband access and growth rates respectively.[11] A report on the ASEAN subregion also found that lack of diversity in ICT network routes, limited competition and cost of access to global networks, including via submarine cables, may influence the cost passed on to end users.[12]

E-resilience

24. Broadband networks can often be disrupted by natural disasters. As such, the challenge is to enhance the resilience of ICT infrastructure and its ability to support disaster-response efforts efficiently and effectively. When applied specifically to ICT, resilience relates to two dimensions: (a) ICT for disaster response and recovery, including the rapid restoration of ICT infrastructure and services; and (b) ICT for disaster risk prevention, risk reduction and preparedness.

25. The Asia-Pacific region is the most disaster-prone region in the world, with frequently occurring natural disasters including earthquakes, tsunamis, tropical storms, flooding, landslides and volcanic eruptions. Data from 2016 show that there was a lower impact of disasters in the region by historical standards, and yet 4,987 people were killed, 34.5 million people were affected and physical damage was estimated to have cost approximately $77 billion.[13] Among the effects, the economic impact is greatest in the least developed countries and small island developing countries. Post-disaster needs assessment reports for some disaster events underlined the destructive effects of natural disasters on ICT infrastructure and facilities, which in turn negatively affected emergency response efforts. Frequent disasters in the region not only disrupt broadband networks but also derail broadband-expansion efforts and infrastructure investment in the region, which could further exacerbate the broadband divide in the region.

Quality of regulation

26. Poor quality of regulations is strongly correlated with low ICT connectivity and vice versa in ESCAP countries and globally.[14] Historically, the telecommunications industry has been operated and controlled by monopolies owing to high start-up capital requirements, which often led to inefficient and costly services. Targeted policy interventions and regulatory reforms have been effective in stimulating the growth of the telecommunications sector. For example, a strong and independent judiciary system, an independent telecommunications regulator and high-quality regulatory bureaucracy seem to correlate positively with the level of competition and private investment in ICT infrastructure, which overall leads

[11] ITU, *Measuring the Information Society Report 2017*, vol. 2, *ICT Country Profiles* (Geneva, 2017).

[12] ESCAP and National Information Society Agency, *Technical Report: 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* (Bangkok, 2016).

[13] *Leave No One Behind: Disaster Resilience for Sustainable Development – Asia-Pacific Disaster Report 2017* (United Nations publication, Sales No. E.17.II.F.16).

[14] ESCAP, *State of ICT in Asia and the Pacific 2016: Uncovering the Widening Broadband Divide* (Bangkok, 2016).

to better performance in the telecommunications industry. An ESCAP study on Pacific island countries provides concrete evidence in this regard: the regulatory reforms in the telecommunications sector allowed private operators to enter the market, which has driven competition and led to a significant expansion of mobile-broadband access and service.[15]

27. Lack of competitive markets may be a problem in some countries. The liberalization of international gateways correlates with broadband expansion.[16] However, owing partly to rising security concerns, the number of countries liberalizing the international gateways appears to be reducing in the region.

Gaps in capacities and skills

28. While broadband diffusion and technological innovations may create vast opportunities for society, they also come with potential negative consequences when the pace of the diffusion is not matched with sufficient capacity and skills. This issue is of particular relevance to the Asia-Pacific region, where approximately 60 per cent of the world's youth population resides.[17] Microsoft conducted a survey among youth in 14 markets in the Asia-Pacific region and found that young people in the region expected technology applications such as artificial intelligence to have the largest impact on their future lives.[18] However, 6 out of 10 young people felt that their countries were not ready to adapt to digital disruptions, highlighting the need for access to technology as a key priority. In many developing countries, Governments tend to channel relatively few resources and insufficient effort into supporting capacity development initiatives in public and private institutions. Thus, the benefits of ICT – which could be a great source of technological leverage, innovation and capacity development – go unrealized.

29. The International Data Corporation predicted that 8.6 billion devices driven by the Internet of things would be used in Asia and the Pacific (excluding Japan) by the year 2020. However, having the required human capital to match the rapidly growing demand for new technology-related skills is a major challenge.[19] In a CompTIA report, significant skills gaps are identified in the areas of artificial intelligence, business-process automation and the Internet of things.[20] The skills gaps occurred both in new hire and the existing workforce, who lacked advanced skills in the following areas: integration of different applications, data sources, platforms and devices; cloud infrastructure and cloud application skills; digital business transformation or skills for modernizing legacy hardware or software; and cybersecurity.[21]

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[15] ESCAP, *Broadband Connectivity in Pacific Island Countries*.

[16] ESCAP, "Effect of open international gateways on the broadband connectivity market" (Bangkok, 2017).

[17] *Switched On: Youth at the Heart of Sustainable Development in Asia and the Pacific* (ST/ESCAP/2744).

[18] Microsoft, "Asia-Pacific youth expect artificial intelligence to have biggest impact on their future: Microsoft survey", 22 February 2017.

[19] ESCAP, *Internet of People* (forthcoming).

[20] CompTIA, "Assessing the IT skills gap", May 2017. Available at www.comptia.org/resources/assessing-the-it-skills-gap.

[21] David Weldon, "AI, business process automation the hardest skills to find", Information Management, 23 June 2017. Available at www.information-management.com/news/artificial-intelligence-automation-the-hardest-skills-to-find.

30. Furthermore, recent ESCAP studies on institutions of higher learning revealed that curricula and programmes at universities in Asia-Pacific countries may not be updated to take advantage of emerging technologies and develop necessary and relevant human capacities.[22] To address these skills challenges, targeted support is urgently needed to provide sufficient infrastructure, especially in primary and secondary schools, as well as universities and research institutes with science, technology, engineering and mathematics programmes. These programmes have become a foundation and prerequisite in developing relevant and sufficient skills for the application of emerging technologies.

31. Such needs for skills upgrade and capacity development are particularly acute when solutions enabled by artificial intelligence are introduced. Low-skilled and labour-intensive jobs may be vulnerable to automation and artificial-intelligence-assisted services, but systematic support in training and skills development could create new employment opportunities with value added.[23]

Widening gender gap

32. There are increased concerns as to whether emerging technologies will deepen gender bias. Broadband connectivity and its affordability are requirements for technological access and usage, and therefore the first factor influencing women's presence. Wage and income inequality between women and men is identified in ESCAP research as a factor that negatively influences the differentiated level of affordability and access to ICT tools and services between women and men. Even when women are connected to the Internet, other factors can affect their active participation, including digital literacy, the existence of relevant online content and other normative values. For example, in a study on women's perceived barriers to using the Internet, the World Wide Web Foundation found that "not knowing how" was an important reason cited by women from poor backgrounds with little or no education. Women were 1.6 times more likely than men to report a lack of skills as a barrier.[24] Given the gender disparity in education and skills in ICT, frontier technology applications like artificial intelligence may exacerbate the digital gender gap and accentuate other social biases.

Limited ICT investment and financing

33. Some Governments have established universal access and service funds as a funding mechanism to stimulate the development of ICT infrastructure, especially in unserved and underserved areas.[25] These funds, by their function,

[22] ESCAP, "Planning processes, policies and initiatives in ICTD education at institutions of higher learning (IHLs) in Asia and the Pacific", 27 January 2017. Available at www.unescap.org/resources/planning-processes-policies-and-initiatives-ictd-education-institutions-higher-learning.

[23] ESCAP, *Artificial Intelligence and Broadband Divide*.

[24] ESCAP, *Social Media and Gender* (forthcoming); and World Wide Web Foundation, *Global Report – October 2015: Women's Rights Online – Translating Access into Empowerment* (Washington, D.C., 2015).

[25] The universal access and service fund is a financing mechanism established by national Governments to connect sparsely populated rural areas, where there is neither the population density nor the capital for telecommunications operators to justify private sector infrastructure investments. Initially, the focus of the funds was on providing basic telecommunications services, such as fixed telephones, to unserved and underserved areas. However, as countries have formulated their national

could provide affordable and accessible broadband connectivity, which serves as a foundation for the creation, adoption and usage of applications and services, in turn leading to more users and more demand for ICT services.

34. However, a recent ESCAP study demonstrates that the effectiveness of universal access and service funds in delivering their core promises is debatable.[26] The results of country case studies and econometric analysis indicate that countries with universal access and service funds targeting the expansion of broadband and Internet have not experienced better outcomes in fixed-broadband and Internet growth than countries without such funds. This limit in the effectiveness of the funds is possibly because of weaknesses in the design, structure and implementation, which hamper the timely and efficient disbursement of funds.

Privacy

35. In the age of big data, the massive amounts of personal data generated, collected, sold and traded by third parties, along with the proliferation of mobile devices, sensors and social networking platforms, have become a challenge globally. In particular, the privacy of individuals is reduced when smart devices are constantly collecting and analysing data and information from their use without the full understanding, awareness and consent of users.[27]

Limited co-deployment

36. Co-deployment, or simultaneous deployment of ducts and/or fibre-optic cable along critical infrastructure during its construction, could lead to a significant reduction of time and costs in the development of broadband infrastructure. A forthcoming ESCAP study finds that co-deployment can save $7,379 per kilometre, or 56.83 per cent of total costs, compared to separate fibre and highway deployment, based on a case study in Cambodia and Myanmar.[28] Co-deployment has also been implemented in Bangladesh and India along critical infrastructure, while a number of other countries have included co-deployment in the design of future infrastructure deployment. Positive examples from projects already implemented in the region can serve as a guide for ESCAP member countries to improve broadband connectivity through co-deployment.

The need for national broadband ecosystems

37. China, Japan and the Republic of Korea present models with advanced broadband networks and widespread broadband access, enabled by progressive broadband policies, regulations, initiatives and investment, constituting the national broadband ecosystem. An ESCAP report contains an analysis of success factors among the three countries, which have developed different

broadband strategies, the role of the funds has shifted towards building broadband infrastructure and providing universal broadband access.

[26] ESCAP, *The Impact of Universal Service Funds on Fixed-broadband Deployment and Internet Adoption in Asia and the Pacific* (Bangkok, 2017).

[27] ESCAP is planning to produce a working paper on cyberattacks and cybersecurity.

[28] ESCAP, National Information Society Agency (Republic of Korea) and KT (Korea Telecom), *A Study on Cost-benefit Analysis of Fibre-optic Co-deployment with the Asian Highway* (forthcoming).

models and approaches to broadband expansion and enhanced e-resilience.[29]

38. In this context, a way forward for the region could include examining various elements of the national broadband ecosystem models and approaches developed by China, Japan and the Republic of Korea in creating strong regulatory bodies. They facilitate the complex process of mediating all stakeholders' requirements while expanding last-mile connectivity and enhancing e-resilience. Examples from Bangladesh, India and Myanmar have shown that co-deployment is possible and has been practised for some time. In addition, co-deployment presents an opportunity to reduce the costs of broadband development through collaboration with the authorities responsible for highways and other utilities. A next step could be to extend the model to cross-border co-deployment to ensure seamless connectivity in Asia and the Pacific.

39. All these conditions will not be possible unless multi-stakeholder cooperation and collaboration are put in place among Governments, the private sector, academia and civil society. Cooperation and collaboration should take place not only at the national level but also at the regional and global levels. In this context, regional and global cooperation platforms, such as that offered by the Asia-Pacific Information Superhighway initiative, could be particularly important in addressing challenges and identifying common solutions and approaches in Asia and the Pacific.

V. Issues for consideration by the Committee

40. The findings described in the present document are aimed at informing policymakers in ESCAP member countries and stakeholders in support of the implementation of the Master Plan for the Asia-Pacific Information Superhighway and the Asia-Pacific Information Superhighway Regional Cooperation Framework Document as applicable. At the same time, they relate to concrete policy challenges for the attention of the Committee. In this regard, the Committee may wish to review the below policy recommendations and provide guidance to the secretariat on its future programme direction:

(a) The Committee may wish to consider prioritizing investment in and support for the development of broadband connectivity and ecosystems as an urgent development priority, given the development and roll-out of emerging technologies, such as artificial intelligence and its associated digital technologies;

(b) The Committee may wish to consider providing targeted support to bridge the broadband divide among countries with special needs, in particular the ESCAP member States with special needs that have been identified as having made the slowest progress in broadband expansion;

(c) In view of the proliferation of emerging technologies, the need for enhanced e-resilience and the persistent broadband divide within and between countries, the Committee may wish to undertake a review of ICT policies and regulations, taking into account the various elements identified in national broadband ecosystem models and the institutional and financing factors mentioned in ESCAP studies;

(d) The Committee may wish to note the urgent need for strengthened capacity-building and skills development programmes to ensure

[29] ESCAP, *E-resilience: A Review of National Broadband Policies, Regulations, Strategies and Initiatives of China, Japan and the Republic of Korea* (forthcoming).

that that there is a sufficient supply of human capital to meet the rapidly growing demand for skills related to emerging technologies, and propose that such programmes be expanded through, inter alia, the Asian and Pacific Training Centre for Information and Communication Technology for Development;

(e) The Committee may wish to consider strengthening collaboration with the relevant sectors, such as the transport and energy sectors, to minimize costs through 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;

(f) The Committee may wish to further encourage expanded cooperation and partnerships at the regional, national and subnational levels to promote policy-related dialogues and the sharing of experience and good practices, which would leverage synergies and reap new opportunities to address the existing and emerging challenges stemming from the rapid advancement of technology, within the context of the Asia-Pacific Information Superhighway initiative.