United Nations E/ESCAP/CICT(3)/1

Economic and Social Council

Distr.: General
17 September 2012

Original: English

Economic and Social Commission for Asia and the Pacific
Committee on Information and Communications Technology

Third session
Bangkok, 20-22 November 2012
Item 4 of the provisional agenda*
Building regional connectivity for sustainable development: the creation of a seamless regional information space

Building regional connectivity for sustainable development: the creation of a seamless regional information space

Note by the secretariat

Summary

Despite the innovative digital opportunities unleashed by the information and communications technology (ICT) revolution, the region remains hampered by a growing digital divide in fixed and mobile broadband Internet, which are the very technologies that are at the cutting edge of the transformation to a knowledge-based society. This growing divide was echoed in the outcome document of the recently concluded United Nations Conference on Sustainable Development (Rio+20), in which the transformative potential of broadband was recognized. In the document, entitled "The future we want", Heads of State and Government and high-level representatives agreed that it was essential to work towards improved access to ICT, especially broadband network and services, and bridge the digital divide to facilitate the flow of information between governments and the public. They also recognized that these technologies can promote capacity-building for sustainable development in an open and transparent manner. A key barrier to the universal uptake of broadband Internet in the Asia-Pacific region is the high Internet transit and broadband user costs due to, among other factors, the reliance on a single mode of data transmission, namely submarine cables. Not only does this barrier limit the ability of the open market to drive down the price of network services, it also increases the vulnerability of the region's ICT infrastructure to disasters and accidents that in the past have proven to be highly disruptive to many sectors that have become dependent on broadband Internet. Consequently, interest in developing transnational fibre-optic infrastructure across the region's landmass has gained momentum, as indicated, for example, in General Assembly resolution 64/186 of 21 December 2009.

The Committee may wish to provide the secretariat with guidance on the issues identified in the present document, as well as the secretariat's proposals for future work to be conducted in partnership with international agencies, regional think tanks and existing initiatives on the following: (a) development of a regional map showing the status of fibre-optic backbone infrastructure in the Asia-Pacific region and identifying the missing links for cross-border fibre-optic connectivity; (b) an in-depth study on policy barriers that impede efforts to synchronize the deployment of infrastructure across sectors, including highway construction, and options for achieving it; (c) provision of a platform to pool regional expertise on the issue of cross-sectoral infrastructure development; and (d) promotion of a regional cooperation framework on transnational connectivity.

* E/ESCAP/CICT(3)/L.1.

Contents

I. Introduction

1. As developed economies remain mired in stagnation, realizing an Asia-Pacific century will depend on the ability of the region to harness the benefits of regional economic integration. In Asia and the Pacific, as in other regions of the world, mobile telephony and broadband Internet, in particular, have brought innovative digital opportunities that are accelerating this process. Dense layers of regionally networked societies have formed and brought a more region-centric process of development. The gains, however, are not shared universally. The region remains hampered by a growing digital divide in fixed and mobile broadband Internet, which are the very technologies that are at the cutting edge of the transformation to a knowledge-based society.

2. The reasons for this are complex and are related to wider sustainable development challenges. These issues will be discussed further under other agenda items, in particular items 5, 6 and 7. Under item 4, for which this

note has been prepared, the central premise is that if broadband Internet is to replicate the mobile phone success story and function as an accelerator of sustainable development, the roll-out of seamless infrastructure networks across the region for high-speed Internet access that is universal, affordable and reliable is an essential condition.

3. For the period 2010 to 2020, it has been estimated that the Asia-Pacific region needs to spend about $8 trillion on infrastructure, with the ICT sector comprising 10 per cent of that amount.[1] As pointed out in *Growing Together: Economic Integration for an Inclusive and Sustainable Asia-Pacific Century*,[2] the theme study presented to the Commission at its sixty-eighth session, this figure, however, is based on the assumption that countries' investment patterns will not change significantly. As most developing countries in the region have been underspending on infrastructure, and rapid technological advances require substantial and constant upgrading of underlying infrastructure, the real funding requirements of closing these gaps are likely to be much larger.

4. Underspending has resulted in a lack of a seamless and efficient regional ICT infrastructure. Consequently, interregional and intraregional Internet traffic is routed through submarine cables operated by international consortia, with heavy reliance on Internet exchange points in the United States of America and other technologically advanced countries. Not surprisingly, international backhaul costs for the region can reach up to five times those in more developed regions of the global economy.

5. As regional integration accelerates, there are, however, encouraging signs that policymakers are increasingly focused on setting the right regulatory and policy environment to address connectivity gaps. Attention is now on the need for the region, with its large landmass, to shift to a cost-effective roll-out of broadband infrastructure that is comprised of a judicious mix of land- and sea-based fibre-optic cables and transnational initiatives. Satellite-based communications under special circumstances form part of the picture.

6. This reflects the importance accorded to strengthened international cooperation in expanding ICT infrastructures that bridge the digital divide as stipulated in the Declaration of Principles and the Plan of Action adopted by the World Summit on the Information Society in 2003 and 2005.[3] Importantly, this was reiterated in the United Nations Conference on Sustainable Development (Rio+20) outcome document entitled "The future we want"[4] and in General Assembly resolution 64/186 of 21 December 2009, in which the Assembly welcomed the Trans-Eurasian Information Super Highway (TASIM) initiative and encouraged interested Member States to participate in the development of regional connectivity solutions.

II. Broadband as the next frontier

7. Broadband, which is the technology that enables high-speed transfer of data, is inextricably linked to the emergence of the Internet as a knowledge tool for tackling sustainable development challenges. It is

[1] Asian Development Bank (ADB) and Asian Development Bank Institute (ADBI), *Infrastructure for a Seamless Asia* (Tokyo: Asian Development Bank, 2009).

[2] ST/ESCAP/2629.

[3] See A/C.2/59/3, annex, and A/60/687.

[4] See General Assembly resolution 66/288 of 27 July 2012.

instrumental for the exchange of content-rich materials and thus closely associated with the reshaping of the information economy and the transformation towards a knowledge-based society in the region. Mobile phones have proven to be very effective in conveying information on consumption and business transactions. Broadband has amplified this by enabling new ways of presenting information, ideas and services in such areas as e-health, e-education, e-banking, e-government, video streaming, musical composition, social networking and Internet telephony. Broadband therefore acts as a key link between information providers, namely individuals, communities, businesses or the government, and the inventiveness built around knowledge-networked societies.

8. The Asia-Pacific region is facing heightened instabilities and exogenous shocks that increasingly involve disasters. In this regard, broadband is helping to build e-resilient societies. Through knowledge networks, people are participating interactively in policy decisions that affect them and are better informed and more prepared, ex-ante, with wider choices that help them to recover from these shocks more expeditiously. For example, ICTs, such as early warning systems, crowdsourcing and social media, provide information that is more accessible, relevant and timely. This information is empowering a new digitally connected generation living in disaster-prone areas to better anticipate shocks. Real-time weather maps and public safety bulletins are rapidly shared through the Internet during disaster events and social groups are increasingly relying on social media in the aftermath of disasters on the view that it often provides the most up-to-date, precise and therefore the most reliable information. The enabling power of ICTs in building e-resilient societies is not limited to disasters caused by natural hazards. Numerous other examples could be cited. Information sharing through ICTs among universities and scientific institutes help insulate communities from deadly diseases. More transparent banking standards and services facilitated by ICTs can help reduce the likelihood of fraudulent transactions. During emergencies, mobile money provides the poor with remittances in a rapid, secure and cost-effective manner. The transformative potential of broadband is truly limitless, constrained only by the number of megabits that are needed to transmit and share the innovations of today's knowledge-networked societies for the region's future reorientation towards more inclusive and sustainable development that builds e-resilience to exogenous shocks.

9. The importance of broadband was recognized in the Rio+20 outcome document. Specifically, the Heads of State and Government and high-level representatives recognized that communication technologies facilitate the flow of information across societies, and promote knowledge exchange and capacity-building for sustainable development in an open and transparent manner. They agreed that it was essential to work towards improved access to ICT, especially broadband network and services, and bridging the digital divide, recognizing the contribution of international cooperation in this regard.

10. At this point, it should be noted, that increased dependence on the power of communication technologies creates its own form of e-vulnerability, as will be discussed below.

III. The Asia-Pacific situation: challenges in connectivity

11. With the world moving from narrowband to broadband Internet as the critical foundation of a knowledge-networked society, it is important to

take a closer look at the situation in the Asia-Pacific region for a better understanding of the challenges and identification of the gaps. Five challenges stand out, in particular, as discussed below.

A. The access divide

12. Although Asia and the Pacific is comprised of 60 per cent of the world's population, only 24.9 per cent of its residents had access to the Internet in 2011, the latest year for which information is available. This is much lower than in North America (78.4 per cent), Europe (68 per cent) and even Latin America and the Caribbean (32.7 per cent). Of even more concern is that only 5.1 per cent of the region's population in developing countries had access to broadband Internet. Thus, most of the region's population has been excluded from the Internet's potential transformative impacts and economic benefits.

13. This is borne out by evolving research on the contribution of broadband infrastructure to the growth of the gross domestic product (GDP). Notwithstanding the fact that studies of the socioeconomic impact of broadband have until recently focused on developed countries, and that, due to the newness of the technology, the timespan of the data and research is not sufficient to refine methodologies and results, overall findings confirm a positive impact between the two variables. These studies show that a 10 per cent increase in broadband penetration increases GDP growth by up to 1.38 per cent. More significantly from the region's development perspective, findings show that unless countries strive to dramatically increase their broadband deployment, the economic impact of the technology will remain quite limited. With low broadband access (under 20 per cent, as is the case for most Asia-Pacific developing countries) an increase of 10 per cent in broadband penetration contributes 0.08 per cent to GDP growth. For countries with medium broadband access (20-30 per cent), GDP increases by 0.14 per cent, while with broadband access higher than 30 per cent, the effect reaches 0.23 per cent.

B. Divergences in speed

14. The vast potential of the Internet can only be tapped with a high-speed connection. For example, data intensive collaboration among universities and scientific institutions can only be achieved with high-speed broadband connectivity, and even day-to-day use of widespread Internet applications, such as Skype and YouTube, and videoconferencing, or more sophisticated applications, such as sharing real time data in disaster situations, all require high-speed broadband Internet. The International Telecommunication Union (ITU) defines broadband as Internet speed that provides the user with a downstream speed of no less than 256 kilobits per second (Kbit/s). This speed, however, is no longer sufficient to take advantage of the myriad new capabilities of the Internet. Video content, for example, consumes an enormous amount of Internet bandwidth. Downloading a 20 MB video clip at a connection speed of 256 kbit/s takes more than 10 minutes as compared to two seconds at 100 megabits per second, the speed connection now available in some countries, such as Japan and the Republic of Korea.

15. Internet speed is determined by international bandwidth (akin, for example, to the width of highways in road transport) and is also known as the capacity to carry traffic internationally. This, in turn, depends on such factors as the physical infrastructure that is available within and across

countries The key concern for the Asia-Pacific region is that great intraregional inequalities exist. Urban hub areas, such as Singapore and Hong Kong, China, enjoy levels of international Internet bandwidth speeds that lead the world, while many developing economies, particularly least developed countries, landlocked developing countries and Pacific island economies, lag far behind. Japan and the Republic of Korea, for example, have more than three times the number of bits per second of international bandwidth per user when compared to countries such as Bangladesh, Indonesia and Sri Lanka (see table).

Table
Broadband indicators, selected economies

Economy	International Internet bandwidth: bit/s per Internet user (2011)[a]	Broadband fixed Internet (percentage of monthly GNI)[b]
Australia	50 396	1.61
Bangladesh	2 924	12.08
China	2 692	4.52
EU-15 (weighted average 2011)	48 111	0.75
Fiji	8 019	6.51
Hong Kong, China	964 616	0.72
Indonesia	7 196	9.08
Japan	23 111	0.71
Kiribati	4 451	243.57
Lao People's Democratic Republic	2 048	147.87
Malaysia	10 651	3.07
Nepal	1 531	50.89
Papua New Guinea	5 703	14.91
Philippines	12 360	12.52
Republic of Korea	17 170	1.56
Singapore	547 064	0.78
Sri Lanka	5 224	2.58
Tajikistan	526	478.72
Thailand	10 622	5.71
United States	47 174	0.49
Uzbekistan	579	9.65
Vanuatu	2 764	70.49
Viet Nam	9 998	10.23

Source: ITU World Telecommunication/ICT indicators database.

Notes:

[a] If 2011 data are not available, then latest data obtainable is used.

[b] Latest data available from http://data.worldbank.org/indicator/NY.GNP.PCAP.CD.

GNI: gross national income.

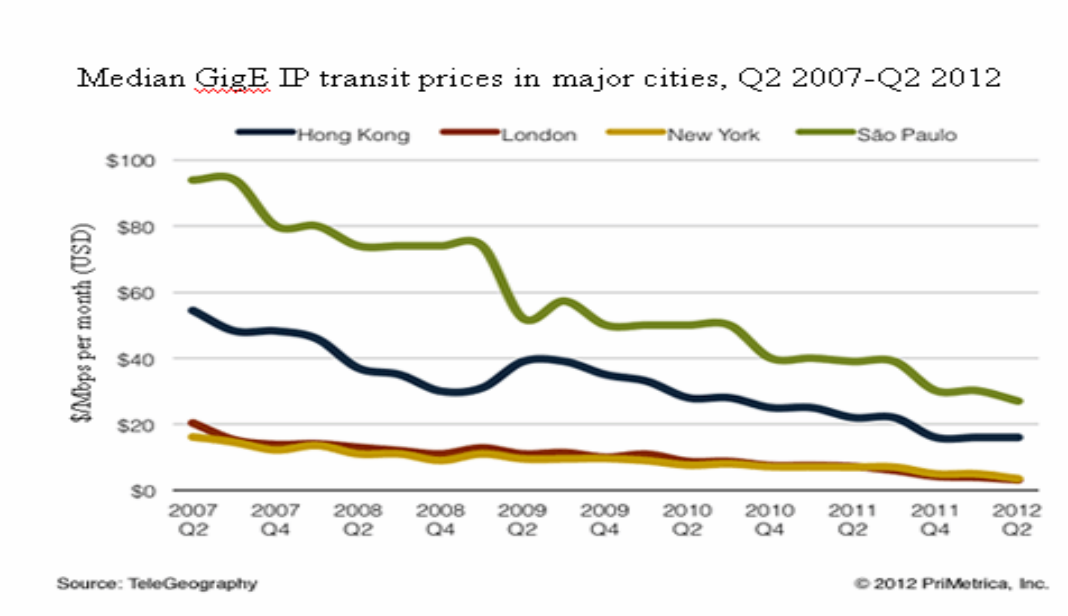
C. High user costs

16. A major barrier in the universal uptake of broadband Internet is the high user costs prevailing in the Asia-Pacific region. In countries where users are least able to afford the Internet and where Internet speeds are the lowest, user costs are sharply higher (see table). In Europe, the United States and the developed economies of Asia and the Pacific, including advanced developing countries, such as the Republic of Korea and Singapore, the cost to purchase a monthly subscription for an entry-level broadband plan is less than 1 per cent of monthly gross national income (GNI) per capita. In developing economies of the region, the costs rise to 9.36 per cent, while for least developed countries, the equivalent figure rises to 47.14 per cent. These averages mask even higher rates in some countries, such as Vanuatu (70.5 per cent), the Lao People's Democratic Republic (147.9 per cent), Kiribati (243.57 per cent) and Tajikistan (478.72 per cent). Broadband prices (as a percentage of monthly GNI per user) have been decreasing substantially in some countries in Asia and Pacific (for example in Bangladesh from $53.6 in 2008 to $7.7 in 2011). Nevertheless, it must be noted that, as average GNI per capita remains below $1,000 for many developing countries in the region, broadband remains too expensive for the majority of the population. Moreover, broadband prices are actually increasing in some of the countries with special needs, notably landlocked and island developing economies, such as Kiribati (from $380.7 in 2008 to $428.3 in 2011) and Kyrgyzstan (from $28.4 in 2008 to $54.2 in 2011).

17. The widespread adoption of mobile telephony in the Asia-Pacific region over the past decade was made possible because hardware and subscription service costs declined considerably as a result of technological innovation and competition. Similarly, broadband diffusion in the region will not progress on the same scale unless costs are significantly reduced.

18. Furthermore, viewed from an international perspective, Internet transit prices in major Asian Internet exchange points, such as Singapore, Hong Kong, China and Tokyo, are on average more than five times as expensive as those in the European Union for example. Even though such factors as deregulation, competition and new roll-out of infrastructure have lowered the costs, the wide gap that exists between Asia and the Western Hemisphere has remained evident. More specifically, although Hong Kong, China, is regarded as the most competitive Internet transit market in Asia and the Pacific, Internet prices in the territory are still approximately 2.5 to 3.5 times higher than in London (see figure 1). These costs are even higher in cities far from major Internet exchanges, such as Bangkok and Manila, due to the cost of transport back to the primary exchange.

Figure1
Internet protocol transit prices in major Internet exchange points



19. Consequently, the above challenges result in Internet users in the region paying high prices (in some countries, disproportionately high) for slow Internet connections, inferior quality of communications and slower content delivery.

D. Increase in demand and infrastructure network congestion

20. Looking forward, broadband Internet usage is expected to increase exponentially as narrowband usage and hardware prices continue to decline. Demand for international bandwidth grew 45 per cent globally in 2011. Moreover, from a global perspective, the surge in usage is expected to be highest in Asia and the Pacific due to the region's well-known dynamic growth processes, which are driving more region-centric trade, transportation, financial and energy flows. This may result in important qualitative shifts in the direction of Internet traffic as routes diversify away from their current United States centricity to Asia and the Pacific and the nature of the traffic as it moves from voice to data. Since data traffic (as compared to voice) relies much more on international bandwidth that is provided primarily by fibre-optic cables (see section E below), increased regional traffic may put additional pressure on the existing regional fibre-optic infrastructure (submarine), especially with regard to the interconnection of the region with China.

E. Overreliance on submarine fibre-optic cable

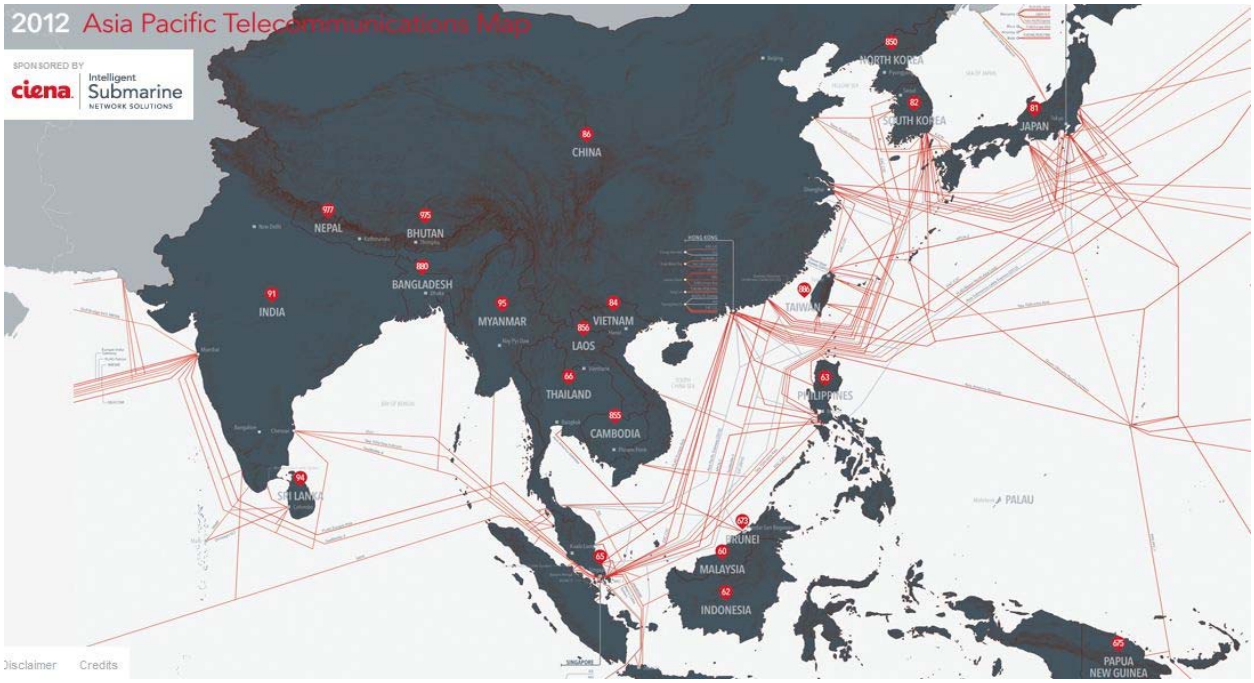
21. Connectivity infrastructure can be divided broadly into three types: wired (terrestrial and submarine fibre-optic cables); terrestrial wireless; and satellite-based connectivity. Each type provides services that include broadcasting, telephony, Internet and conferencing at different qualities, speeds and costs, and each country, depending on its particular circumstances, relies on different combinations of these technologies to meet overall connectivity needs.

22. During the late 1980s, as advances in space techonlogy occurred in tandem with other ICT innovations, satellite technologies put to use for civilian purposes held great promise for tackling emerging societal challenges related, among other things, to communications, environmental degradation, navigation systems, weather monitoring and disasters. Clear benefits emerged in many of these areas, but the role of communication satellites as the potential technology of the future has been overtaken by optical fibre. As compared to satellite technologies, optical fibre offers the higher bandwidths that are crucial for high-speed data transmission over long intercontinental distances and lower costs without long transmission delays and electromagnetic and weather interference. It also limits the broadcast of potentially sensitive information, an issue that plagues satellite communications. Economic factors have also helped push the use of optical fibre. Silicon, which is a raw material used to make optical fibre, is abundant and relatively cheap. Consequently, by the mid 1990s, developed countries had installed tens of thousands of kilometres of fibre-optic cables along the right of way of gas, railroad and electric utilities. Large investments were also made in laying down undersea cables and, by the new millennium, nearly all intercontinental voice, data and video transmissions were routed through fibre-optic undersea cables. As demand for bandwidth continues to increase, operators around the world are upgrading their existing network infrastructure and making substantial investments in new cable construction to keep pace. TeleGeography, a telecommunications market research and consulting firm, projects that $5.5 billion worth of new submarine cables will enter service during 2012 and 2013.

23. In Asia and the Pacific, about 80 per cent of the region's high capacity data fibre-optic transmitting routes are along the trans-Pacific routes, with Hong Kong, China, Tokyo, Singapore and Seoul having emerged as the core global hubs where international carriers have established points of presence (see figure 2). The Indian Ocean/ Mediterranean routes have also attracted interest, with Mumbai, in particular, expected to emerge as an important international hub.

24. In terms of connectivity, perhaps the most significant challenge for the Asia-Pacific region is that submarine cable networks carry not only interregional traffic (to North America and Europe), but also intraregional traffic. Unlike the United States, which relies on terrestrial cables for much of its national broadband traffic and submarine cables for international traffic, or Europe, which is dependent on a combination of terrestrial and submarine cables for intraregional as well as international traffic, the Asia-Pacific region relies on submarine cables. This raises a number of problems, which are discussed below. At the same time, it also provides opportunities for new forms of regional integration and a possible role for ESCAP in promoting intergovernmental cooperation, which will be discussed in subsequent sections.

Figure 2
Submarine telecommunications cables landing in Asia and the Pacific



Source: http://asia-pacific-map-2012.telegeography.com.

25. Heavy reliance on a single mode of data transmission raises at least two problems. One is that it compromises competition and limits the ability of the open market to drive down broadband prices to levels that are affordable to the majority of people. This is further exacerbated by the fact that the few terrestrial fibre-optic cables in operation are owned by private companies, which tend to be disinclined to provide meaningful concessions to new potential operators.

26. Second, the region's reliance on submarine cables increases its vulnerability to natural disasters, marine vessel accidents and even sabotage. For example, the Hengchun earthquake, which struck near Taiwan Province of China in December 2006, devastated the region's voice and data Internet services. It took 11 cable repair ships 49 days to fix the damage. Many countries and territories in the region, including China, India, Japan, the Philippines and Thailand as well as Hong Kong, China, experienced severe delays and outright stoppages in day-to-day banking services, airline bookings and e-mail communications that could not be satisfactorily resolved by rerouting traffic through undamaged cables. After this experience, carriers began to give high priority to the Indian Ocean and Mediterranean routes, but, in early 2008, within a period of 12 days, six submarine cables were snapped in a synchronized way, the cause of which remains unexplained. In 2009, Typhoon Morakot and the subsequent undersea earthquake damaged 10 submarine cables and adversely affected voice and data traffic across South-East Asia and in China, India and Japan. Most of the affected cables were those used for short- and medium-haul regional traffic. The great east Japan earthquake of March 2011 damaged seven segments of cable, which took more than a month to repair. In this case, disruptions in intraregional and interregional connectivity were not as severe as would have been expected given the dense network of fibre that Japan had built up. It goes without saying that terrestrial cables, whether

aerial or buried, are also vulnerable to damage inflicted by floods, earthquakes, excavatory accidents, vandalism or other forms of willful damage, but the case of Japan shows that the redundancy provided in multimodal routes strengthened e-resilience, a condition that has become fundamental to achieving well-being in this hyperconnected world.

IV. Responses

27. Not surprisingly, these developments have led to surging interest in the deployment of terrestrial cable networks as governments seek to expand coverage to underserved areas, build a competitive enabling environment that lowers costs for all and builds e-resiliency. Due to the region's expansive landmass, the synergies that can be gained from cross-border connectivity are a key aspect of that interest. Consequently, a number of interregional and subregional initiatives have emerged. These initiatives are examined in detail below.

28. It is important to underline that the intention of these initiatives is not to have terrestrial cables replace submarine cables. Instead, terrestrial networks are seen as one piece of the global ICT infrastructure network that, in concert with submarine cables and satellites, and when mixed judiciously, can bring more affordable and reliable high-speed broadband to developing countries, particularly, least developed countries, landlocked developing countries and Pacific island developing countries. What constitutes a judicious mix will depend on the costs involved and the expected socioeconomic development benefits, which, in turn, are determined by circumstances. Innovations in satellite systems that have seen the emergence of non-geostationary, low-earth-orbiting satellites have proven able to provide higher quality voice coverage, as compared to earlier geostationary satellites. Such communications have been particularly useful for personal communications in difficult terrains where the costs of laying cable would be higher than the expected economic and social benefits. Satellite communications have also proven, time and again, that they provide a critical lifeline during disasters when Earth-based infrastructure has been destroyed.

29. Overall, advances in satellite systems have thus further enhanced e-resilience in special circumstances with payoffs for terrestrial connectivity. For example, Nokia Siemens Networks has partnered with satellite router manufacturer iDirect to develop a system linking remotely located mobile base stations to the core network via satellite. According to the company, this solution delivers downlink speeds of 10 Mbps per user by eliminating intermediate nodes used in regular mobile networks. Maxis Communications Berhad, a Malaysian mobile network operator, is implementing a similar solution to extend mobile coverage across rural areas through an agreement with satellite firm MEASAT Broadband. NBN Co, the company set up to operate the National Broadband Network, an infrastructure project supported by the Government of Australia, plans to use a combination of wireless and satellite technologies to cover the 7 per cent of Australians (or about 3 per cent of premises), that will not be linked up through fibre to the home (FTTH).[5] The use of satellites may have lost its dominance in transporting international voice and data traffic due to the emergence of submarine cables during the last decade. The role of the former has been decisively diversified in various layers of

[5] The installation and use of optical fibre from a central point to individual buildings to provide high-speed Internet access.

telecommunication services, coexisting with the terrestrial and submarine networks.

A. Increased initiatives at the interregional, subregional and national levels

30. The TASIM project is a key regional initiative aimed at creating a transnational fibre-optic backbone spanning more than 20 countries between Central Asia and Europe. In addition to developing broadband connectivity in the landlocked countries of Central Asia, the project aims to provide redundancy for the existing submarine cables and therefore enhance e-resilience and introduce competition in order to reduce prices. In its resolution 64/186 of 21 December 2009, the General Assembly welcomed the TASIM initiative and recognized that well-developed ICT infrastructures, such as information superhighways, act as one of the main technological enablers of digital opportunities and have the potential to provide new solutions to development challenges.[6] The Assembly also encouraged interested Member States to participate in the development of regional connectivity solutions and stressed the importance of strengthened and continued cooperation among all stakeholders to build and run information infrastructures to bridge the digital divide in the region. The TASIM initiative is envisaged as a collaborative multi-stakeholder project that will rely on governments, the private sector and international organizations, such as the United Nations, to build and run information infrastructure across the region. Consequently, there are now ongoing discussions on the establishment of a connectivity alliance led by ITU, as well as a consortium made up of leading telecom operators from the participating countries which would be jointly responsible for carrying out the construction of the backbone network.

31. In the Greater Mekong Subregion (GMS), progress continues to be made in building and upgrading the national sections of the GMS Information Superhighway Network (ISN) for which the Asian Development Bank (ADB) has provided funding of $65 million. Similarly, ADB has approved about $16 million in grants and loans for the South Asia Subregional Economic Cooperation (SASEC) Information Highway initiative, which aims to establish and enhance existing data connectivity capacity among Bangladesh, Bhutan, India, and Nepal. This initiative may serve as a preliminary phase for the development of an extended South Asian Association for Regional Cooperation (SAARC) information highway. Also of note, in South-East Asia, the Association of Southeast Asian Nations (ASEAN), in its *Master Plan on ASEAN Connectivity*,[7] has designated the development of broadband corridors as a key component of its infrastructure development plan.

32. There are also a number of other initiatives related to fibre-optics aimed at creating infrastructure networks that support research. In Central Asia, the Central Asian Research and Education Network (CAREN) project, with funding of about 6 million euros ($8 million), came into

[6] Afghanistan, Australia, Azerbaijan, China, Georgia, India, the Islamic Republic of Iran, Japan, Kazakhstan, Pakistan, the Republic of Korea, the Russian Federation, Tajikistan, Turkey, the United States and Uzbekistan are ESCAP members that co-sponsored the draft resolution.

[7] Association of Southeast Asian Nations, *Master Plan on ASEAN Connectivity* (Jakarta: ASEAN Secretariat, 2010). Available from: www.aseansec.org/documents/MPAC.pdf.

operation in 2010 connecting Kyrgyzstan, Tajikistan and Turkmenistan. This network is expected to be extended to Kazakhstan and Uzbekistan.

33. Another regional framework is the third generation of the Trans-Eurasia Information Network (TEIN), which provides high-capacity connectivity among research institutions in Australia, China, India, Indonesia, Japan, the Lao People's Democratic Republic, Malaysia, Nepal, Pakistan, the Philippines, the Republic of Korea, Singapore, Sri Lanka, Thailand, Viet Nam and Taiwan Province of China. This network received support from the 8th Asia-Europe Meeting (ASEM) Summit of Heads of State and Government, which was held in Brussels on 4 and 5 October 2010, and is expanding to include research instituions in Bangladesh, Bhutan and Cambodia.

B. Private sector involvement

34. Increasingly, private sector companies have stepped up their efforts to invest in cross-border connectivity as the need for regional infrastructure gains in urgency and commercial interests increase. Of particular note is the first direct terrestrial cable link between India (Siliguri) and China (Yadong) through the Nathula Pass, in which Reliance Communications and China Telecom partnered. It went live in December 2010, whereas previously these two countries relied primarily on submarine cable routes via Hong Kong, China, or Singapore for digital connectivity. Similarly, telecom operators in China and the Russian Federation announced in 2011 a plan to expand the bandwidth of the Transit Europe-Asia (TEA) cable system, a terrestrial cable system, which provides the shortest route between Europe and Asia, running mainly over areas in China and the Russian Federation, and connects countries in Central Asia, such as Azerbaijan, Georgia, Kazakhstan and Ukraine. Earlier this year, the concerned Governments announced that investors in China and Thailand would build two terrestrial fibre-optic links connecting Cambodia, China, the Lao People's Democratic Republic, the Russian Federation, Thailand and Viet Nam to ease congestion on the main international submarine cable routes, as well as to serve growing Internet demand in the region.

35. Though these initiatives have made progress, some of them have experienced delays, sometimes spanning years, and complexities that are well known in international cooperation endeavours. The regional political sensitivities as well as difficulties involved in reconciling different policy and regulatory regimes across countries, particularly with regard to ownership, usage and revenue sharing of the networks, have all raised the stakes for regional coordination at the intergovernmental level, and multi-stakeholder partnership approaches.

V. The way forward

36. In a hyperconnected world where everything is interlinked, ICT innovations are leading the way in transforming existing structures. Viewing ICT as a meta-infrastructure — an infrastructure for all other infrastructures — opens up vast opportunities for synergistic cross-sectoral efficiencies that can be expected to become imperatives as sustainable development gains prominence in international and national policy agenda setting. What might this entail?

A. Multisectoral synergies

37. In most countries of the region, sector-specific infrastructures are developed independently of other sectors. This is partly because of wide variety in the types of infrastructure; a road, for example, is quite unlike a fibre-optic or electricity cable. In this regard, the convergence of ICT connectivity infrastructure with transport and energy infrastructure networks has great potential. It has already been successfully used in some of the most digitally advanced countries. The United States, which is implementing a major deployment of ultra-high speed broadband infrastructure, provides an example of the growing importance of this collaborative model for infrastructure development. The President signed an executive order in June 2012 to accelerate broadband deployment in the country by, among other strategies, directing federal agencies to assist telecommunication carriers in synchronizing their broadband deployment projects with the physical construction of roadways and properties. This approach is expected to reduce the cost of constructing fibre-optic terrestrial cable by up to 90 per cent. Within the Asia-Pacific region, there are also instructive cases. For example, in the Republic of Korea, for some time already, ICT fibre-optic cable infrastructure has been deployed along the highway backbone network. This approach is also being used by the Maharashtra State Road Development Corporation in India, which is installing fibre-optic cable ducts and conduits alongside national highways, state highways and rural roads during the physical construction of those roadways.

38. Although it is preferable to install the fibre-optic conduit, ducts, as well as cables when roads and railways are being built in order to avoid multiple excavations, installing just the ducts and conduit at the time of transport construction would still provide significant cost benefits. This is because between 70 and 90 per cent of the costs to develop a terrestrial fibre-optic network is related to the excavation and installation of ducts and conduits through which cables are pulled. The cost of installing ducts and conduits vary based on geographic location and terrain, yet even in the most difficult terrain, the synchronized construction of roadways and cable infrastructure can be cost-effective. Therefore, although sufficient capital may not have been fully mobilized at any given time to lay extensive fibre-optic cables throughout the region, a forward-looking approach that coordinates road construction with the placement of ducts and conduits will ensure that future investments in fibre-optic cables are deployed in a manner that is more efficient, safe and cost-effective.

39. Investment in additional terrestrial fibre-optic cable routes will lead to the establishment of new transit routes for the transmission of data. Thus, new “Internet hub cities” along the routes could also be developed. This would bring a number of development gains. For one, it would open up previously unimagined revenue-earning opportunities through data-transmitting services for landlocked countries. Second, the emergence of new Internet hub cities would reduce dependency on European Union- and United States-centric connectivity. This, in turn, could lead to a more competitive environment as it would provide incumbent carriers with incentives to lower connectivity prices across all networks. Third, with regard to forging new forms of regional integration, Internet hubs. unlike other forms of infrastructure hubs, do not need to be located in physical proximity to the region’s megalopolises. The congested mega-cities of Asia with their high operation costs and increased exposure to disasters — be they man-made or natural, intentional or unintentional as discussed above

— increase the attractiveness of finding untapped physical connectivity in remote expanses of land. Similar to dry ports, such Internet hubs would offer new and cost-effective ways of decentralizing economic activities for a more inclusive and geographically balanced development process in the region. An additional benefit is that the co-location of dry ports and Internet hub cities would further enhance the commercial viability of both.

40. In a similar vein to the above discussion, ICT as a meta-infrastructure could also encompass fibre-optic cables that run alongside railway networks, allowing them to use the paths and already established wiring networks that railways use for signaling systems. Energy and ICT infrastructures also offer potential areas for synergies. For example, the provision of modern energy access and basic ICT services in one smart grid package would contribute to energy-saving efficiencies for sustainable development.

B. Multi-stakeholder partnerships

41. Governments have increasingly formed partnerships with the private sector to develop and operate infrastructure assets as a way to bridge the large funding gaps in infrastructure development mentioned above, overcome the limited delivery capacity of the public sector and benefit from the private sector's efficiency and advanced technology. Although a number of public-private partnership (PPP) projects in the telecommunication industry and ICT infrastructure sector have been implemented in recent years, numerous challenges in this regard have come to the forefront. Progress in this area has been constrained by, for example, the non-availability of sufficient long-term finance, lack of capacity in governments and legal and regulatory regimes that are not conducive to attracting private sector investors. In particular, limited institutional capacity is preventing countries from exploiting the PPP modality to develop infrastructure projects.

42. Legacy telecom operators typically have invested heavily to develop broadband infrastructure in commercially viable areas, which are mainly centred in major cities and urban centres. Often they maintain exclusive access to submarine and terrestrial cable networks. The lack of competition in this sector has led to the problems highlighted in the present document. As an alternative, governments and the private sector could combine their resources and expertise to adopt a lower-risk model whereby the initial investment cost is shared among multiple telecom operators and national governments on the condition that the network would be operated on an "open access" basis. The benefits of a vibrant open-access market can be seen in the mobile telephony market in which intense competition among service providers led to a high-volume and low-profit margin model that lowered the cost for the end user and spread mobile telephony to rural and less connected areas. An open-access model in which PPPs construct an open access network of fibre-optic cables crisscrossing the region would lead to lower bandwidth costs and accelerate broadband adoption throughout Asia and the Pacific. Universal access to broadband would be a giant leap forward towards bridging the digital divide, which is keeping large swaths of the region from reaping the significant social and economic benefits of ICT.

43. Private sector operators have traditionally dominated the broadband infrastructure industry but the landscape of this industry is changing, with more opportunities opening for the governments to play a significant role in

broadband deployment. For example, the successful broadband strategy implemented by the Republic of Korea can be credited to a combination of deregulation, competition, privatization, and government investment in the construction of a backbone network. Upon completing various broadband networks, the Government transferred ownership of the infrastructure to the private sector, cognizant that private companies would be better suited to manage the network.

44. Similarly, the Government of Australia has taken the lead in promoting broadband connectivity as part of its National Digital Economy Strategy announced in 2011. One of the aims of the national strategy is to reduce the digital divide and bring the benefits of ICT to all. In this regard, the National Broadband Network (NBN) promises to provide fibre-optic access to 93 per cent of the premises throughout Australia by using government resources to design, build and operate the network in an effort to shorten build time and reduce costs. These examples demonstrate that there are a number of ways for public and private organizations to collaborate for successful ICT infrastructure development. Countries therefore need to carefully consider the various options available with a view towards creating mutually beneficial synergies that allow public and private organizations to achieve their respective policy goals and commercial objectives.

C. The need for a regional cooperation framework

45. In parallel, there is a growing consensus that the region's landmass remains untapped and that more needs to be done to provide broadband transnationally for more inclusive and knowledge-networked societies across Asia and the Pacific. The region is in need of a cohesive approach that would anchor these initiatives to a regional framework. Such a framework would serve as an upfront planning tool not only for governments, but also for investors, such as development banks and the private sector. To benefit most from cross-sectoral and transnational synergies, a regional framework that provides long-term predictability would reduce risks typically associated with the high capital costs and long gestation periods involved in infrastructure development. A regional cooperation institutional framework would also help governments shape the process of infrastructure development in a way that promotes long-term sustainable development goals and mitigates the potential of getting locked in to certain technologies or conditions that may not be supportive of such goals. Through mutuality of interests and sharing of risk, countries would have an incentive to join together to strengthen regional e-resilience and build a sustainable and modern ICT-driven future.

VI. The role of the Economic and Social Commission for Asia and the Pacific in building regional connectivity

46. ESCAP, which serves as the intergovernmental platform and as the main economic and social development centre for the United Nations in the region, is ideally placed to lay the foundations that will take these initiatives forward. As a starting point, the secretariat plans to work in partnership with agencies, or initiatives, such as the proposed connectivity alliance of the TASIM project, the ASEAN Broadband Corridor, the ADB Information Superhighway, LIRNEasia and Telegeography, to conduct an in-depth study on the ICT connectivity infrastructure gaps of the region. This remains an understudied area for which more systematic information is needed to help governments in their decision-making processes. As the

theme study for the sixty-eighth session of the Commission[2] pointed out, governments of the region have underspent on infrastructure. The investment gap is expected to widen, particularly for the rapidly evolving ICT sector, which requires constant upgrading of infrastructure, according to projections based on past patterns of investment.

47. Information on the status of the regional terrestrial backbone fibre-optic infrastructure is difficult to acquire. Ideally, such information would be available in terms of maps showing routes and transnational border connectivity. However, the secretariat's preliminary consultations with member countries have revealed that such maps are available for only a handful of countries, with significant variation in the quality of information provided.

VII. Issues for consideration by the Committee

48. The Committee may wish to provide the secretariat with guidance on the following matters:

(a) With funding support from development partners, and in partnership with members and associate members, the secretariat has initiated preparatory work for drawing up a regional map on the status of fibre-optic backbone infrastructure that would include identification of missing links for cross-border fibre-optic connectivity;

(b) The secretariat will conduct an analysis of the regulatory and other policy barriers that impede the formation of a single information space across the region. This will include, as recommended by the Regional Expert Consultation on Connecting Asia-Pacific's Digital Society for Building Resilience, which was held in Colombo on 5 and 6 September 2012,[8] an in-depth study of the costs of laying fibre-optic infrastructure along highways and the possibility of leveraging the Commission's Intergovernmental Agreement on the Asian Highway Network,[9] which has been ratified and is under implementation by the 28 parties. The Asian Highway and the Trans-Asian Railway offer agreed regional connectivity that could short circuit time-consuming and costly negotiations. Furthermore, as indicated in paragraph 39 above, the emergence of Internet hub cities along new terrestrial cable routes could lead to new revenue-earning opportunities for landlocked countries and further enhance the commercial viability of dry ports. As also indicated above (see para. 16), landlocked countries have the highest broadband costs, which in some cases are even increasing;

(c) Capacity-building activities in PPPs could lead to more effective policymaking on risk sharing and the development of supportive legal and regulatory regimes, as well as on developing bankable projects and managing contracts. ESCAP could provide a platform to pool expertise, using, in particular, success stories from the region, and also open new ground on the possibilities offered by cross-sectoral infrastructure development, while the training programmes of the Asian and Pacific Training Centre for Information and Communication Technology for Development (APCICT), including its flagship capacity-building programme "Academy of ICT Essentials for Government Leaders", could also advance human skill development related to these issues.

[8] See E/ESCAP/CICT(3)/5.

[9] United Nations, *Treaty Series*, vol. 2323, No. 41607.

VIII. Conclusion

49. The economic and social impact of ICT is profound. Even though the region can rightly celebrate its achievements in the spread of mobile telephony and other ICTs that have spurred regional integration and economic growth, efforts need to be redoubled to increase the accessibility, affordability and reliability of broadband to achieve deeper regional connectivity and social inclusion. The importance of broadband was echoed at the Rio+20 Conference. It is the next frontier in the fast-moving and ever changing world of ICT and offers limitless opportunities. From relatively simple applications that bring the security and efficiency of mobile banking to rural farmers to vast cloud storage networks that store millions of gigabits of information for enhanced productivity, the amalgamation of ICTs is bringing e-resilience to the forefront as a cornerstone of sustainable development. Tapping into this vast potential will require a regional effort to develop a seamless regional information space commensurate with the region's rising global influence.

50. Domestic and intercountry infrastructure connectivity in the transport, energy and ICT sectors had improved considerably in recent years thanks to various initiatives at the national, bilateral, subregional and regional levels. In ICT, however, the potential for further enhancing infrastructure connectivity in the region is enormous, and collaboration between governments as well as between the public and private sectors has been underutilized. Developing redundant, robust terrestrial networks and, when economically viable, converging them with satellite-based networks, will reduce vulnerabilities associated with transoceanic submarine cables and will increase the affordability of international bandwidth.

51. Despite the contribution that ICT connectivity can make to a strengthened regional connectivity for sustainable development, there is currently no region-wide intergovernmental cooperation mechanism for building ICT connectivity infrastructure on the basis of mutuality of interests and sharing of risks. Coordination of subregional and national infrastructure initiatives through an Asia-Pacific information superhighway cooperation framework, and the feasibility of leveraging the agreed connectivity embodied in regional intergovernmental agreements, such as that on the Asian Highway, would be worthy of an in-depth study. With guidance from members and associate members and with generous funding support provided by its development partners, the secretariat stands ready to lay the foundations deemed necessary. With support and coordinated actions from policymakers as well as private sector investors, the transformative impact of ICTs can spread across the region and broadband Internet can become a right shared by all for sustainable development.