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Abstract:

The report contains nine chapters covering the introduction, findings of the previous studies, the scope of the current study, requirements for people in rural and remote areas, solutions for the ICT connection of rural and remote areas, as well as small island states, demand and financing mechanisms for deployment of ICTs, relevant technologies, relevant services and applications, capacity building and policies necessary to connect rural and remote areas.

The contents of the chapters were based on written contributions from ITU-D members who participated in the Question's meetings, and meetings of study group 1 representing ITU member states, sector members and academia, as well as from the panel discussion hosted by the Question on 25 September 2019. Most of the contributions were of a case study nature and the case studies have been analysed mainly in chapter two while specific analysis was also made in the chapters in which each case study was more relevant. Effort was made to utilize every contribution submitted in the compilation of the report. The report makes critical findings in chapter nine and offers recommendations that can be adopted by member states, sector members and Telecommunication/ICT service providers.

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Lessons learned and suggested best-practices (if appropriate):

There is need for further studies focusing on access to broadband services and how emerging technologies can be used to transform rural and remote areas into digital economies.

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Executive summary

This document contains the results of the study of ITU-D Question 5/1 on ICTs for Rural and Remote areas for the study period 2018-2021

The report contains nine chapters covering the introduction, findings of the previous studies, the scope of the current study, requirements for people in rural and remote areas, solutions for the ICT connection of rural and remote areas, as well as small island states, demand and financing mechanisms for deployment of ICTs, relevant technologies, relevant services and applications, capacity building and policies necessary to connect rural and remote areas.

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Chapter 1 - Introduction

The Buenos Aires Action Plan which is a product of the 2017 World Telecommunication Development Conference (WTDC), discussed the need to continue achieving the objectives set by the Geneva Plan of Action of the World Summit on the Information Society (WSIS) and in particular to promote attainment of the Sustainable Development Goals (SDGs).[1] The Action Plan, in that regard, noted the need to address infrastructure development challenges, the need to install cost effective and sustainable basic telecommunication infrastructure in rural and remote areas. It also called for further studies in order to enable the vendor community to develop suitable solutions, to meet the identified challenges.

The 2014-2017 final Report for Question 5/1 highlighted the importance of the study, as including, the fact that more than 50% of the global population lives in the rural areas, that development of ICTs in rural and remote areas is slow and requires special policy initiatives and Government subsidies and that a digital divide still exists between rural and urban populations.

The Report defined rural areas as sparsely populated areas, characterised by Geographical access problem, inadequate enabling infrastructure such as regular electricity, absence of adequate telecommunication infrastructure and prohibitive access and equipment costs and low geographic density of target population (small village communities).

Case studies submitted by various ITU Regions, as well as responses to the questionnaire administered to Member States of ITU during the past studies, reflected the following in summary:

- From Sri Lanka, the main challenges were high cost for installations due to poor enabling infrastructure to support deployment, lack of skilled technical personnel, difficulty terrain and ICT illiteracy
- From Guinea, prohibitive licence costs and from Côte d'Ivoire lack of profitability for operators
- From the Democratic Republic of Congo, absence of basic infrastructure and poverty, and from the observations of Intel Corporation (United States of America), serious lack of electricity
- From the questionnaire administered to Member States by the Question 5/1 Group, in addition to the problems cited above, small market size and regulatory matters, particularly the manner in which spectrum is allocated, emerged as additional challenges.

According the 2014-2017 study, the type of technology used by the regions depended on the type of project that each country developed or intended to implement and there was no uniformity. The main technologies used included backhaul, microwave links, satellite links, mobile base stations, wireless technologies such as Wi-Fi and WiMAX, V-SAT, copper lines, copper cables and optical fibre. With regard to services, the study noted that there was need for provision of content in local languages, services and applications adapted to the needs of persons in rural and remote areas, internet broadband applications adapted to the areas, tele-centres and E-agriculture applications.

1 https://www.itu.int/en/ITU-D/Conferences/WTDC/Pages/default.aspx

With regards to business models, the study also reflected that there was need to explore public private partnerships for funding purposes for ICT projects.

1.1 Overview of findings from the previous study period (2014-17) and lessons learnt[2]

The main conclusions of the previous study were in summary as follows:

- That emerging technologies could expedite extension of ICT Services to rural and remote areas in the form of broadband.
- The urban to rural digital divide is still very wide and forward looking policy interventions and updated regulation customised to the development of telecommunications /ICTs in rural and remote areas were necessary.
- Case studies provide best practice which bridges the know how gap in rural communities
- There is need to improve the environment and life in the rural areas in order to curb rural to urban migration which limits the rural markets.

The report of the 2014-2017 study period recommended that further studies on installation of cost effective and sustainable basic telecommunication infrastructure and how to adapt network systems which are predominantly meant for urban areas, to rural and remote areas be carried out.

1.2 Gaps requiring attention during the current study (2018-2021)

While previous studies identified challenges and proposed solutions for the challenges, as well as ways of improving the development of ICTs for rural and remote areas, there was a real need to update the findings and recommendations of those studies, given that changes that have taken place in both technology and the enabling environment.

1.3 Statement of the situation: Scope of the current study Question and other issues requiring attention

The current study therefore concentrates on updating the findings of previous studies, the gaps that were left out by the previous study as identified by the Buenos Aires Action Plan, in particular, to address the challenges of deploying cost effective sustainable ICT infrastructure in rural and remote areas.

The 2018-2021 study, generally also:

- Identifies and updates details of the requisite infrastructure for deployment of ICTs for rural and remote areas and difficulties in creating or upgrading telecommunication infrastructure in rural and remote areas, as well as the best way of connecting villages with telecommunication/ICTs and capacitating rural and remote communities in ICT usage.
- Identifies difficulties faced by fixed and mobile networks for rural deployment in developing countries and the requisite requirements to be satisfied by such networks, taking into account demand and the need to generate increased usage of ICT services and devices.
- Takes stock of the needs of rural and remote communities, the current practices and case studies regarding the deployment of ICTS for rural and

2 http://handle.itu.int/11.1002/pub/80ec6ea7-en

remote areas and relevant policies to bridge the digital divide and increase affordable access to ICTs.
- Determines methods and strategies to build human resource ICT skill sets for the deployment of Broadband and maintain and encourage the training of technical staff in order to guarantee the reliability of telecommunication infrastructure.
- Identifies best practices, formulates proposed techniques, and sustainable solutions for the challenges faced in providing access to ICTs to rural and remote communities, including deployment of broadband technologies for various e-application services for economic and social development.
- Identifies the changes in technology that could be utilised for rural and remote areas, as well as the influence of cultural, social and other factors producing creative responses to the demand for multimedia services from rural and remote areas of Least Developed Countries (LDCs), the required type of community access points and tele-centres appropriate for rural and remote areas, in line with WSIS targets.
- Tracks progress made on human resources development and opportunities and challenges to access to services in locally relevant languages.

1.4 Methodology used by the group

The methodology used by the group included collection of contributions, summarising contributions, analysing them for inclusion in appropriate chapters, collection of case studies, case study analysis and panel discussions and analysis of results.

1.5 Deployment of rural connectivity for achieving the UN Sustainable Development Goals

This Report makes it clear that the attainment of the SDGs will depend mostly on ensuring that all communities including those living in rural and remote areas are connected. Applications discussed in this report are clearly linked to the achievement SDGs on ending poverty, and hunger, the SDG on healthy lives and promotion of well-being, promotion of sustainable economic growth, building resilient infrastructure and, reduction of inequality within and among countries. By finding and recommending solutions for the connection of rural and remote areas, the results of the study track and recommend ways of achieving most of the WSIS action lines that are linked to these SDGs, as a way of achieving the goals. Such connectivity depends on the technologies that are deployed and the services that are available to rural and remote communities, as well as the small developing island states (SIDS) and landlocked countries(LLC).

Chapter 2: ICT requirements of people living in rural and remote communities

Many developing countries have taken a notch higher the development of ICT infrastructure and services by promoting special policies and related regulation for the “informatisation/ICTisation” of rural and remote areas. The growth of telecommunication infrastructure has become closely linked with the economic development of a country, especially the development of rural and remote areas. The challenge is to ensure that telecommunication services and their benefits, related to economic, social and cultural development, can be extended effectively and efficiently. Most contributions to the current study of ICTs for rural and remote areas indicate that the following have become critical requirements for rural and remote areas:

- Infrastructure that fosters digital transformation, promotes and attracts investment, and allows emerging services, such as the Internet of Things (IoT), digital financial services, and e-commerce to blossom.
- Technologies that promote youth employment with the establishment of dynamic enterprises in economic sectors.
- Policies and Regulatory initiatives on Deployment of ICT infrastructure to rural and remote areas and policies that help narrow the digital divide through affordable broadband service and access to ICT infrastructure.
- Solutions to challenges relating to building human resources or ICT skills for broadband deployment, maintenance and operation, as well as training of technical staff in order to guarantee the reliability of telecommunications infrastructure.
- Availability of electricity and access road transport, which are the prerequisite for construction of telecommunications/ICTs infrastructure for rural and remote areas.

A further look at the contributions submitted to the question 5/1 meetings, reflects that the requirement for cost effective installation of infrastructure, ran like a thread through at least six of the contributions.

2.1. Changing social trends and specific needs related to vendor development of suitable services

The social needs for rural communities, have changed and continue to change from just basic telephony and short messaging service connectivity, to broadband services. The needs are now more in line with broadband services. They now include, E- Banking, on line selling, mobile banking, e-health services, e-news so that they get real time information, e- agriculture and eLearning and these needs are at the core of the Sustainable Development Goals as they help achieve financial inclusion, good health, eradication of hunger and education.

2.2. Changing economic environment and economic needs

Empowerment of rural and remote areas is urgent in order to prevent the migration of populations from rural to urban areas, in many developing and developed countries where there is increased migration of citizens between the age of 15 and 55 years old from rural areas to urban areas, or foreign countries. Some people in the rural areas run small businesses and require

connectivity for purposes of sourcing materials for their businesses and markets to sell their products. Women are no longer content with staying in the kitchen and also require a conducive environment for their projects to thrive.

2.3. e-Services requirements for rural and remote areas

Collected cases received for the study, highlighted the need to introduce major e-applications to support e-education, e-agriculture, e-health, e-government, e-banking, and e-commerce. These are services that are critical to the day to day lives of rural and remote communities, including rural businesses.

E-government services are critical because once communities have access to connectivity and broadband services, government services that continue to operate manually and require the physical attendance of people to access them, literally derail gains made by connecting such people.

The service requirements for rural and remote areas are covered in greater detail in chapter 6, which discusses services and applications for rural and remote areas.

2.4. Demand for multimedia services

Once broadband connectivity is extended to rural and remote areas, demand by rural people for multimedia services is likely to increase, so that relevant information is received in various forms, including pictures photography, text, voice and other digital forms. The need to exchange information in the community or between the communities and their relatives, or friends in foreign countries, also makes the need for multimedia access very real. Entrepreneurs also need to exchange information efficiently with the outer world. Multimedia services such as basic service, data service, video service and IoT sensors, provide enhanced access to ICTs by people in rural and remote areas.

2.5. Opportunities and challenges related to access to ICTs in locally relevant languages

There are thousands of languages and dialects spoken by world population. The challenge that exists is to create sufficient relevant content in local languages. Those that speak the languages often do not have the skills to do so. Opportunities therefore abound under these circumstances. These include coming up with pictographs and illustrations. For blind people, producing braille keyboards, short message service or on a community bulletin board service. Special measures are taken for the people with difficulties of vision. Text translation and text reading are available online where the community is connected via internet.

2.6. Analysis of case studies, with emphasis on cases related to indigenous communities, isolated and poorly served areas, LDCs, small island developing states (SIDS) and landlocked developing countries (LLDCs)

An analysis of 72 case studies collected during 2018-2020 reflect the following:

- A high number of case studies as received from Africa and the Asia Pacific Region, followed by the Europe and the CIS region and then the small Island developing states
- There were no case studies received from the Middle East and it is recommended that in future studies, strategies be put in place to motivate contribution from this region in order to make sure that the results of study are based on information from all regions.
- These case studies can help ITU members, not only with information on what is happening in other countries, but with ideas on how members can further develop their ICTs for rural and remote areas in order to overcome challenges present in the areas
- The case studies cover many areas of the study aspects, which include challenges faced by many administrations as they develop ICTs for rural and remote areas, technologies suitable for connection of the rural areas, funding models being used to connect rural and remote areas, including small Island developing states, access points commonly used by developing countries to achieve universal access, Universal access policies, Universal Service fund management, capacity building and applications currently under development for Rural and Remote areas.

Annex 1. shows the case studies submitted by ITU regions and **Annex 2** presents a summary of the content of the case studies and links to the full case study contents.

The following were the main findings from the case study analysis:

- The cost of constructing, installing and upgrading ICT infrastructure is dependent on the availability of power and access road networks, and it is a pre-requisite to develop these two, for it to be possible to create robust and reliable ICT infrastructure;
- There are no one size fits all in financing models for infrastructure development and ICT access programmes. Countries need to explore various options, which include financial institution funding, Universal Service Fund support, Government subsidies and Private Public Partnerships;
- Cooperation among neighbouring countries is key to enable landlocked countries and small Islands to access submarine cables for the development of their ICT networks and create robust communication systems;
- ICT access points such as village networks and ICT community information centres provide a good facility sharing mechanism for universal access and bridging the rural-urban digital divide; Universal access programmes such as community information centres are a cost effective public tool which offer a good opportunity for stimulating economic growth and poverty alleviation in developing countries;
- The utilisation of Universal Service Funds has evolved to include funding of internet connectivity projects as well as ICT assisted educational and agricultural programmes;
- Community networks can provide connectivity relief to remote communities.
- Developing countries can start working on Internet of Things (IoT) bit by bit with their limited resources.

In a nutshell, the cases indicate that there are no one size fits all with regards to the financing of ICT infrastructure projects and programmes. It is therefore, important for Member States to go through the various case studies presented in this report and find a mix of financing models that work for them.

Chapter 3: Available, affordable, accessible and sustainable solutions to connect rural and remote areas

From the contributions received from various Members States and entities on this question, it was clear that issues to do with the requisite support infrastructure for deployment of ICTS, the environment and social challenges, challenges relating to upgrading, maintenance and operating infrastructure were of concern. These issues are examined in this Chapter, under relevant sub-headings.

3.1 Requisite infrastructure for the deployment of ICTs for rural and remote areas

The major requisite infrastructure that featured in many contributions is power or energy infrastructure. Contributions highlighted the existence of unreliable power or no conventional power, in most rural and remote areas. They also highlighted the need for reliable road transport networks for ease of deployment. In many cases, access roads have to be constructed by the telecommunication operators to reach mountain tops and other unreachable areas. According to Zimbabwe, the distance between optimum site location and the nearest power line, is usually long, thus translating to a higher power line construction cost. The contribution therefore recommended collaboration between Telecommunication Regulators and Energy Regulators in order to resolve the issue of power.[3]

A contribution from Senegal also cited power as a problem and recommended that Universal Services Funds need to fund other struggling sectors like the power sector.[4] Another contribution from Burundi, specifically highlighted lack of electricity among the constraints of deployment of telecommunication ICTs to Rural and Remote areas.[5]

With regards to islands off the Coast of India, transport costs and unavailability of electricity were highlighted as major constraints to the development of ICT infrastructure and ICTs in general. The islands of Andaman, Nicobar Islands and Lakshadweep, were said to be using diesel generator power and diesel is not readily available on the islands.[6]

Electricity and transport problems featured in many other contributions throughout the Study period and it is clear that these two are a prerequisite for rollout of ICTs, including Broadband infrastructure, for Rural and Remote Areas. Once access roads are in place and electricity is available, it is necessary to have a national backbone comprising both fibre optic and tower infrastructure, in addition to the traditional copper line networks for telecommunication ICTs including broadband services to be rolled out. Roll out will also require last mile connectivity infrastructure.

3 Document 1/REP/13(Rev.2)
4 Document 1/REP/13(Rev.2)
5 Document 1/REP/5(Rev.2)
6 Document 1/REP/5(Rev.2)

3.2 Environmental and social challenges impacting Infrastructure deployment for fixed and mobile network

A number of environmental and social challenges emerged from the contributions to the Study. These were highlighted by the Republic of Korea, Zimbabwe, Bhutan, China, Burundi, Kyrgyz Republic and the Russian federation, as one or more of the following:

- Low levels of literacy in rural and remote areas which stifle demand and therefore impact on costs.
- Members of rural communities are not always aware of what is happening in their own environment. In many instances, they just see things develop without being informed or even asked for their input. The aspirations of the rural communities, their strengths and weaknesses, need to be leveraged to ensure rural community buy-in and participate in the successful execution of ICT projects.
- Government Policy inadequacies that delay approvals for infrastructure roll out
- Restrictive legal frameworks
- The physical environment in most rural and remote settings is characterized by some combination of heat, dust and humidity, each of which, is a challenge for standard telecommunications hardware
- Low density of populations, which make it uneconomic to invest in rural and remote areas
- Operator business model challenges, as cost of deploying and maintaining cell sites in rural areas is significantly more expensive
- High operational installation and maintenance costs due to un-coordinated development activities, such as road expansion and laying of electrical cables, results in frequent cuts in cable
- Non-availability of Power supply in rural and remote areas is also a hindrance to deployment of ICT Infrastructure.
- Delays in land use approvals are also a serious hindrance
- Difficult geographic access (distance, terrain, poor roads etc.)
- Non-availability of Government Land & Buildings for installation of Mobile Towers, as procedure for the same are not included in existing policies
- Seasonal bridges which sometimes get flooded
- Low consumer purchasing power[7]

3.3 Challenges in Creating and Upgrading Infrastructure

Difficult geographic terrain and inadequate power supply also featured as hindrances to the creation and upgrading of infrastructure. High costs arising from some of the challenges highlighted earlier in this Report, coupled with low demand which makes it difficult to recoup investments, were cited in most contributions submitted to the Group meetings on Question 5/1. The cost of constructing access roads, vehicle maintenance and road maintenance were also cited.[8]

7 Document SG1RGQ/REP/12
Document SG1RGQ/REP/5
Document 1/REP/21
8 Document 1/REP/5(Rev.2)

3.4Challenges in maintaining and operating infrastructure

A number of contributions referred to one or more of the following as challenges affecting both operation and maintenance of infrastructure to provide ICT services:

- High costs due to long travelling distances which increases response time and general maintenance costs of vehicles using the bad roads.
- Due to lack of commercial power in most rural areas, operators have to use other sources of expensive power like solar and diesel generators. These sources come with consequential challenges of fuel and battery thefts. Operators are left with no option but to install expensive security systems, which further increases deployment and maintenance costs.
- The appetite for ICT services is also reduced in the communities where there is no power, since customers find it difficult to power their equipment and gadgets. Where available, such power is usually extremely unreliable or so unstable, that it poses a threat to unprotected electronic equipment. This reduces attraction of infrastructure investment in the rural and remote areas
- Grass and brush clearance along rural routes annually in areas served by overhead fibre to prevent damage by veld fires can be very costly. For example in Zimbabwe, Operators like Liquid Telecom have to clear these areas at least three times a year where those carrying out maintenance sometimes face danger from wild animals[9].
- Generally, telecommunication Operators have to pay high taxes and levies increase operational costs.
- Most rural areas are in remote areas with difficult terrain which renders accessibility very difficult. Road infrastructure is poor, consisting of dusty eroded roads, with mostly seasonal bridges. To be able to attract investment, rural areas have to be serviced with asphalted roads at least to the major rural centres and serviced dust roads to the villages. Regular site visits are not possible due to bad roads.
- Long downtime because of the times it takes maintenance personnel to reach the remote areas. This is compounded by the fact that there is lack of ICT knowledgeable personnel in the rural areas to assist with troubleshooting. Sometimes a service provider is called to remote areas to attend to a simple power switch having been switched off.
- There is need to empower the local people, particularly traditional leaders so that villagers attend to general non-technical maintenance of sites. This gives villagers a sense of network ownership and security from theft
- Special security provisions have to be made for remote Base stations/BTSs to ensure that no one tampers with the batteries or drains the diesel from the generators. This can be in the form of surveillance systems, motion and heat sensors or permanent security guards and these are expensive.

Given these problems, there is need to design simple, high error margin techniques with low maintenance regimes, so as to reduce the operational expenses.

9 Document SG1RGQ/73

3.5Sustainable Solutions

One of the solutions that have been adopted in many countries has been the assumption by Governments of measures that reduce costs of measures or subsidise costs of creating deploying and maintaining infrastructure. Adoption of Universal Service Policies and Licensing conditions, that place universal obligations on telecommunication operators have also been utilised as solutions to the problem, as deduced from the many case studies received by the Rapporteur Group during the current study period. In many cases, Governments through the universal Service Funds have used subsidies and at times implemented projects that provide solutions that are sustainable. Examples are, Zimbabwe's community Information centre and connect a school projects, the United States' Federal Communication Commission's reduction of investment barriers, Cote d'Ivoire's community cyber centre, Japan's Shiojiri biomass power plant, the Central African Republic's fibre optic connection project, India's submarine cable project to connect islands off the coast of India and Kyrgyz's optical fibre project. China's Sichuan infrastructure programme and Bhutan's village network of community centres, cannot be left out in this narrative.[10] Details of these interventions can be found in the case studies contained in this Report.

3.6Available and accessible solutions and systems that address connectivity challenges in rural and remote areas

In order to address connectivity challenges in rural and remote areas, focus should be on costs and sustainability of the solution applied. The solution should be low cost, and easily deployable. Mobile network operators in Benin and Ghana are already using low-cost rural coverage solutions. Others in Nigeria, South Africa, Congo, Tanzania, Rwanda, Liberia, Cameroon, Afghanistan, and elsewhere, are exploring such solutions. Some of the solutions include using renewable energy to reduce costs, upgrading existing 2G network sites to 3G/4G, extending or densifying networks and deployment of fixed wireless access. Long range Wi-Fi, virtual network operations and Community networks which feed from the nearest point of presence of the national backbone and or large networks. Fixed Wireless Access through key hotspots in the villages, schools or hospitals can be connected to the network to serve locations 20–50 km away from the point of presence networks[11].

Use of these solutions require enabling policies which will be discussed later in this Report.

It is clear that there are many solutions that are sustainable for use in rural and remote areas. However, the technical details of these solutions are provided in detail in chapter 5 which covers technologies and Chapter 7 and 8.

10 Document 1/REP/5(Rev.2)

11 Question 5/1 Workshop report for 25 September 2019 : Document 1/308

Chapter 4: Demand, cost and financing mechanism to connect rural and remote areas

4.1 Demand for services and in relation to capital expenditure for infrastructure

Demand for Telecommunication services is low in rural and remote areas due to a number of reasons. One or more of the reasons w, featured in a number of contributions submitted to the Rapporteur Group meetings for Question 5/1, as outlined :

- Non availability of power to run devices, which hampers adoption and use of ICTS by rural people
- Lack of awareness of the benefits of ICTs
- Culture which hampers access to ICTs by women and girls
- Lack of affordability of both devices and internet subscriptions
- Low incomes for most rural people, as they rely on either subsistence farming or other very basic industry or trade.

Some of these challenges which were already in existence during the 2014 to 2017 study period, continue to exist during the current period although the effects may have changed. From one of the contributions, information was provided to the effect that, according to Alliance' for affordable internet, non-affordability was one of the biggest obstacles to internet access around the world. The Report stressed that access policies, national broadband strategy, infrastructure sharing and reasonable tax regimes, have been used to try and alleviate the problem of slow or low adoption.[12]

The report further highlighted that, of the 3.2 billion people that live in areas covered by mobile broadband networks, a large number are not using mobile internet services.

A large- scale consumer survey conducted by the GSMA also revealed that affordability was the greatest barrier to using mobile internet services, for people who were aware of the existence of mobile internet. In almost all the sample countries, the greatest barriers to mobile internet use are access to, and the cost of internet-enabled handsets and cost of data.[13]

All this indicates that, coverage alone, cannot address the problem of digital inclusion. One of the Broadband Commission's 2025 Targets is on affordability and the target is stated simply as that "By *2025, entry-level broadband services should be made affordable in developing countries at less than 2% of monthly Gross".*[14]

This development is likely to stimulate debate on the issue and generate efforts to address demand for ICTs.

12 Document 1/201(Rev.1)

13 Document 1/389
The analysis is based on findings from quantitative face-to-face surveys with women and men in 23 low- and middle-income countries across Asia, Africa and Latin America. Source: Gender Gap Report 2018. GSMA (2019). Available here: https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2018/04/GSMA_The_Mobile_Gender_Gap_Report_2018_32pp_WEBv7.pdf

14 Document ..... see also A4ai.org, Affordability Report (Accessed 6 September 2019)

While demand for internet services for education, networking, sports, economic and marketing related applications, health and related applications, exists in rural and remote areas, the demand remains too low for good return on investment. It is therefore, important to come up with a mix of strategies to lower the cost of internet access, for rural and remote areas, which goes beyond what has already been tried, so as to stimulate demand and encourage investment. Some of the methods that can be used include the following:

- **Demand creation** through awareness training or consumer education, that educate people on what ICTs can do for them, their projects and businesses, as well as social life.
- **Demand programmes** that identify traditionally offline or non-electronic services and then bring them online, as such services can then stimulate demand. Demand programs can be utilised through many domains such as banking, health, education, entertainment and employment. Promotion of social media applications which connect users to a network or a community and facilitate social interaction also helps to drive demand. Other mechanisms to increase demand, include the exchange of user-generated content and compelling local content, as well as programs with a focus on education, through virtual classrooms or other e-learning methods.
  Examples of demand programmes are Costa Rica's Connected Homes Program, which benefits Vulnerable Socioeconomic Groups, Colombia's Subsidy Program to Increase Internet Access for Low-Income Households, Senegal's subsidised personal computers (PCs) and broadband connections for students to enable virtual learning, Korea's Information Network Village (INVIL) Project, India's Relevant Online Content, Kenya's Digital Learning Program to Drive Primary Education and Zimbabwe's connect a school programme.[15]
- **Bridging the gender digital divide through Policies** and activities that can overcome cultural exclusion of women and children from access to ICTs and business activity, can also help stimulate demand.

The United States' "Women's Global Development and Prosperity (W-GDP)", "Connected Women" (supported by USAID) initiatives, are two good examples to empower women in rural areas to bridge the digital gender divide and improve women's participation in everyday life, by meaningfully changing the ways women access and use technology. The W-GDP aims to reach 50 million women in the developing world by 2025 through the U.S. government activities, private-public partnerships, and an innovation fund.

The connected Women and USAID's partnership with AusAID, GSM Association (GSMA) and Visa—known as the GSMA Connected Women Program, enabled 15 million underserved women to own and effectively use mobile phones, in order to increase their access to vital information, networks and services, in order to improve their families' quality of life. The GSMA Connected Women Program awarded 11 Innovation Grants to mobile network operators (MNOs) and non-governmental organizations (NGOs). The grants provided seed funding for the design and launch of economically sustainable products and services, which

15 Broadband Commission Report (Enabling the Use of ICTs and Broadband)

increase women's access to and use of mobile phones and value-added services.[16]

Other tools which help address low demand include policies that encourage competition and ensure technological neutrality.

It is clear from many contributions to the study on ICTs for Rural and Remote areas, that considerable attention has been devoted to supply-side issues, but case studies suggest that demand stimulation is a vital driver, of increased Internet access in many countries.

4.2 Investment and Cost Priorities based on Economic and Social indicators

ICT operators usually have return on investment as a priority, while governments are focused on universal access and improvement of the quality of life of rural and remote populations of their countries. From many of the contributions that were submitted to Question 5/1, these two priorities are not necessarily competing. While operators focus more on urban areas, once the urban demand is substantially satisfied, revenues can only be grown by extending services to rural and remote areas. For continents like Africa, where the urban people also have a rural home, to effectively serve the urban population, the rural population must also be served, as there is a lot of inter-connectedness between the two sets of communities. Focus on investment should therefore be given to investment in the following order of priority:

- Backbone infrastructure
- Last mile connectivity
- Basic data and voice services
- Internet access
- Applications and content that are relevant to the communities in rural and remote areas to enable financial inclusion and use of ICTs in various economic projects that the communities are involved in.

4.3 Financing Mechanisms (Subsidies, etc.) for connecting rural and remote areas

Financing mechanisms for ICT development have evolved over time. Whereas prior to 2002, the funding outlays required, were much lower in terms of investment in infrastructure and voice technology was still largely the main focus, the situation is now much more complex. While the focus was delivery of services in public facilities, the focus now is on last mile connectivity to the home. Whereas services were provided by large monopolistic corporations in the past, now even small entrepreneurs and medium sized businesses play a significant role. The age old problems of low incomes and computer illiteracy, still limit the number of people who have internet access in homes. Limited supply of electricity and unreliable road infrastructure in some developing country rural areas, still cause bottlenecks in the development of ICTS. In order to fund projects designed to achieve increased rural access to ICTs, different financing models have to be used.

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There is no single financing structure or model that can be applied to all projects. Generally, Telecommunication and ICT Broadband Financing Mechanisms include utilisation of Public-utility finance, Public-Private partnerships, Central Government funding through grants, low interest rate loans from a development banking source, or a Universal Service Fund, Operator funding from the capital budget, sometimes complemented by borrowing from lender and Policy interventions. Reverse auctions also constitutes a funding method and have been effectively used in the United States broadband infrastructure projects.

4.3.1 Public Utility financing model

This is more common for urban and suburban rollouts, where the municipality or Government department, acts as an investor for an open access network, securing initial funding at low rates for construction. An example is Japan's Shiojiri municipality project for implementing Internet of Things through environmental information sensor networks in order to improve the lives of local people. The Municipality introduced an optical fibre network to connect public facilities in the city, as well as an eco-friendly biomass power plant to supply its ICT Networks and 20,000 households'.

4.3.2 Operator funding

This is where an operator uses its own budget or borrowed funds to fund infrastructure projects and run the network. This is the most common form of funding. However, with this kind of capital, investment tends to be concentrated in the urban areas.

4.3.3 The universal service fund financing model

In rural settings, cost-sharing models including infrastructure sharing between competitors, are probably the best option for investment. However, competitors are usually reluctant to apply such models and this is where public funding comes in.

- **The United States Universal Service Fund (USF)** provides support through four programs established and directed by the U.S. Federal Communications Commission (FCC): The High-Cost Program (also known as the Connect America Fund or CAF); the Lifeline Program; the Schools and Libraries (or E rate) program; and the Rural Health Care fund. The USF receives revenue from contributions by telecommunication service providers, based on an assessment on their inter-state and international end-user revenues. The program has helped 128,147 schools and libraries, 9050 rural health care facilities, 8.1 million lifeline-eligible households and 1.2 million high-cost area households. The administration of the fund is done by an FCC designated competition neutral independent, not-for-profit entity, USAC, which collects and disburses almost $10 billion available annually, to the companies and institutions that make universal service possible in the United States. A rigorous process ensures that carriers remain accountable to consumers, taxpayers, and the FCC for USF funds, and are delivering the network performance they have committed to provide.[17]

17 Document 1/327(Rev.1)

- **In India, the Universal Service Obligation Fund,** formed through an Act of parliament, is responsible for collecting revenue and using it to support infrastructure and other ICT projects. The fund collects around one Billion USD annually and over 7 billion dollars have been allocated and disbursed to support various projects. With funding from USOF, the public service provider and private telecommunication service providers, create in villages.[18]

  "BharatNet" is the largest rural connectivity project of its kind in the world and is the first pillar of Digital India Programme. 'BharatNet' is being implemented to provide to a number of rural areas in the country has been laid to connect these areas. Under the project, network infrastructure is being established for Broadband Highways accessible on a non- discriminatory basis, to provide affordable broadband services to citizens and institutions in rural areas, in partnership with States and the private sector.

- **In China,** a universal service pilot project adopts the general idea of "central fund guidance, local coordination and support, and enterprise-oriented promotion", forming a pattern of central, local and enterprise joint efforts to support the development of rural broadband construction. According to the 2020 target of the "Broadband China" strategy, the pilot project is expected to achieve the target broadband network coverage of committees, school, clinics and other major public institutions.[19]

Other examples of Universal service funding of ICT projects include the following:

- The funding of connectivity projects and Multipurpose Community Tele-centre in rural and low income areas to bring access to information and communication technologies (ICTs) to rural communities, by **the Burundi Universal Service Fund.**
- The deployment of broadband Internet connectivity to rural schools in **Rwanda.**[20]
- **Cote d'Ivoire**'s 5000 cyber-centres project.[21]
- **India's Sanchar Shakti Universal Service Obligation Fund's Scheme**, for Mobile Value Added Services for Rural Women.
- **Tanzania's** connectivity project connecting 3000 villages, five hundred public schools and telemedicine projects.
- **The Russian federation's** deployment of more than 50 thousand kilometers of Fibre Optic Cable, in sparsely populated localities and submarine communication cables, in some regions, to provide universal services to the territory of the Magadan Region and the Kamchatka Territory.
- **Zimbabwe's** Telecommunication tower and community information centre projects.[22]
- **Cameroon's telecentre project**, designed to bridge the digital divide between rural and urban areas.

18 http://usof.gov.in
19 Document SG1RGQ/217
20 Document SG1RGQ/REP/5
21 Document SG1RGQ/REP/5
22 Document SG1RGQ/REP/5

- **Sudan's** deployment of ICT infrastructure.[23]

It is clear that Universal Service Funds play a big role in funding telecommunication /ICT infrastructure and operational projects.

4.3.4 Government funding

This type of funding has been utilised in **Bhutan** where Government has funded a project to use Wi-Fi hotspots for public service delivery in Government offices [24]. Optical fibre project is another good example where the **Government of Burundi** was funded by the World Bank to launch a project to deploy a national optical fibre network connecting Burundi to the submarine telecommunication cables of neighbouring countries. The resultant national backbone, which currently extends over 1,400 km, was aimed at reducing the costs of carrying international and national telecommunications and at facilitating universal access. At present, the optical fibre network is operational in all the country's 18 provinces and connected with the international submarine cables on the coasts of Dar-es-Salaam (United Republic of Tanzania) and Mombasa (Kenya)[25]. **The Bhutan Royal Government** established Village Network of Community Centers Information Highway Project with funding by the Asian Development Bank (ADB).

4.4Partnerships to enable connectivity for rural and remote areas

In order to fund projects designed to achieve increased rural access to ICTs, partnerships become very useful. The need for partnerships has been explored and referred to often in many contributions submitted to Question 5/1 and other questions, as a solution to the rural connectivity problem during the current study period. The value of such partnerships in various aspects of ICTs for Rural and remote areas cannot be ignored. It is important to note that such partnerships are not only financial in nature, but take many forms that result in lightening the burden of effecting rural connectivity on Government and even the private sector. The different types of partnership include Public-Public partnerships, Public-Private partnerships, intergovernmental partnerships and partnerships between international organizations and specific countries. The operational models of the partnerships include public contracts where the private partner provides management and technical skills so that the public facilities are operated by a private partner's staff. In some cases, the Private Partner's skills and finance, are used to exploit the commercial potential of the public entity or Government's assets. Some involve build-and-operate schemes.

- **Public partnerships**

A public-public partnership (PPP), that is a partnership between a government body or public authority and another Government Body and or authority, to promote the provision of, or provide services and/or facilities, is a concept which is now being used in ICT development, just as the concept is used in other fields. Sometimes the goal is to share or transfer technical skills and expertise. Sometimes it is to share the financial burden for costly projects in

23 Document 1/REP/21
Document 1/REP/13(Rev.2)
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25 Document SG1RGQ/166

uneconomic areas. Partners can include other local, regional, state provincial bodies, school boards, parks boards, non-governmental organizations, unions, pension funds, professional organizations, and community groups in developing countries. This concept was historically used by governments to contract corporations to design, build, finance, maintain and operate public projects like schools, hospitals and bridges. **An example is Zimbabwe's connect a school project** where the Universal Service Fund, has partnered with the Ministry of Education, and another public entity, Zimbabwe Academic and Research Network (ZARNet), to provide connectivity to schools and tertiary institutions in Zimbabwe. The bulk of the schools and institutions are situated in rural areas[26].

- **Public-private partnerships**

These are the most common type of partnerships that have been referred to in most contributions to Question 5/1. While such partnerships have been used in various sectors of economy, Germany, Austria and a host of developing countries have used public private partnerships in most of their economic sectors and, the ICT sector has had its share. **ICT content providers such as Microsoft, Amazon and Google,** are increasingly investing in undersea cables and other ICT projects, either on their own, or in partnership with public corporations and private ICT operators in various countries. Annex 3 reflects the extent of the submarine cable network worldwide. This type of Partnership is ideal for huge infrastructure and national and international projects. Microsoft's Unlimited Potential (UP) program now funds more than 500 technology training and other projects in 95 countries, to aid the progress and development of the global work force. Microsoft's Partners in learning program now work with educators from 101 countries, serving more than 10.2 million students. Currently, PPPs have also been used in ICTs for education in India's Infrastructure, leasing and financial service project, Samoa's School Net program, Pakistan's virtual University, the Philippines' Gearing up Internet Literacy and Access for Students programme and the Intel-Teach Programme in Indonesia.[27]

- **Private partnerships**

Private partnerships that are initiated without funding from public coffers by for profit partners, have been used extensively in the ICT sector, usually between ICT operators and financial institutions and insurance service providers. These are however not generally aimed at providing universal access to broadband, although Financial Inclusion has grown significantly due to the partnership between banks and ICT service providers.

- **Intergovernmental partnerships**

Partnerships among governments, businesses and international organizations is key. Usually these partnerships are integrated in regional organizations and deal more with policy formulation and guidelines on implementation. **The southern African Development Community (SADC)** has utilized this kind of arrangement resulting in customization of ICT model laws to the region. Cybercrime laws. Other regional groupings in North and east Africa have also

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utilized these.[28] **The South Asia Sub-Regional Economic Cooperation (SASEC)** established Village Network of Community Centers Information Highway Project funded by the Asian Development Bank (ADB) and the Royal Government of Bhutan. **Korea Telecom (Rep. of Korea)** worked in partnership with the Ministry of Post & Telecommunications Cambodia (MPTC) and Telecom Cambodia (TC) to provide public Wi-Fi and distance learning for schools in rural and remote areas of Cambodia.[29]

- **Partnerships with international and non-governmental organizations**

At the global level**, ITU has through its Development Bureau,** provided both funding and technical expertise for projects in telemedicine and installation of emergency response teams, as well as internet exchange points, in various countries.

Other cases include:

KT Corporation of the Republic of Korea's capacity building program which has seen 3.3 million Koreans and 16 thousand institutions benefit. The programme is carried out in conjunction with various government agencies, regional governments and Non-Governmental Organizations.[30] Another good example are the Submarine Cable projects in the Federated **States of Micronesia (FSM).** These comprise the HANTRU Cable System funded by United States Rural Utility Service (RUS) Loan. Yap Spur Cable System funded by World Bank Grant to FSM. Chuuk to Pohnpei Cable System funded by World Bank Grant to FSM. East Micronesia Cable System Funded by a combination of World Bank Grants (FSM and Kiribati) and Asia Development Bank Loans (Nauru). FSM is made up of Small Island states located in the Western Pacific namely Yap, Chuuk, Pohnpei and Kosrae and have a population of 118.000 People. Prior to 2010, the only international connectivity to FSM was via Satellite. planned for 2021). Cable System Capacities greatly exceed the requirements of small island communities, even future requirements.[31]

Conclusion and Recommendations

There is no doubt that there is need to increase access to ICTs through reducing the financing burden of governments in providing infrastructure, providing access and developing content & applications, through capacity building.

When implementing partnerships, one needs to compare various features of these financing mechanisms and analyze their implications, based on macroeconomic indicators of the concerned economy. Consideration should be paid to the suitability of the financing mechanism and macroeconomic indicators. Public private Partnership are more suitable and useful for projects that require huge capital outlays. In country public-public partnership assist greatly with small ICT projects.

28 Document 1/REP/21
29 Document 1/REP/13(Rev.2)
30 Document 1/REP/21
31 Document SG1RGQ/239

Chapter 5: Technologies to connect rural and remote areas

5.1 Availability of telecommunications/ICTs that provide enhanced connectivity

Network is normally configured in two parts: backhaul and access parts. Sometimes it is divided into three parts: core, backhaul and access, where the backhaul is routing traffic from cells sites (or points of presence) into the core network. For simplicity the core or backhaul section is called simply "backhaul" in this study. Backhaul has higher speed to transfer large information sent from various terminal equipment. Backhaul parts as well as access parts can be made via wired or wireless solutions. The following sections include and overview of fibre cable, terrestrial wireless, and satellite solutions.

Both wireless and wired technologies are used in backhaul and access parts. These two technologies have been competitive and sometimes complementary to each other for long-time. After the invention of optical cable, its use for backhaul has become the standard design pattern for national network. On the other hand, dispersed area of access network makes wireless equally effective as wired. This is specifically the case for rural and remote areas, where pulling the cable is a difficult task.[32]

5.1.1 Network configurations patterns

Table1 shows the technologies used for the access part and the backhaul part of the network. Classification and corresponding technical description below are for those transmission methods suitable for wide band connection. Some historical technologies are mentioned for comparison purpose.

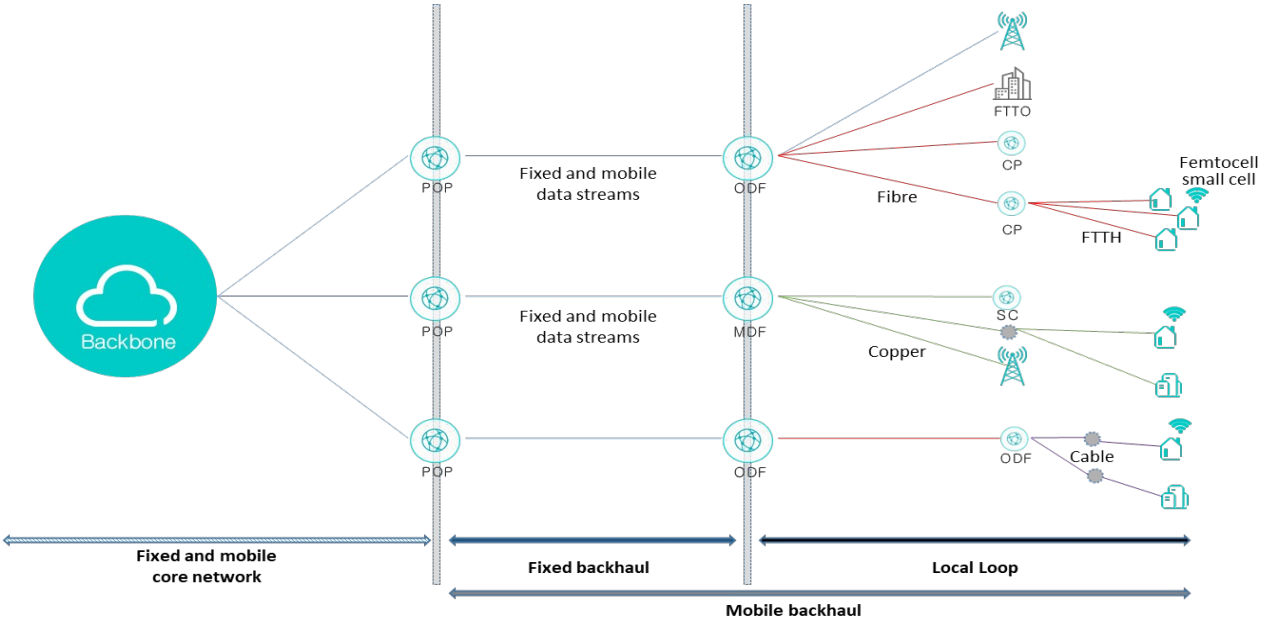
Table 1: Technologies used for broadband connections

Technologies		**Terminal Mobility**	**Access**	**Backhaul**
Wired	Optical cable	—	Fiber to the home	Optical fibre including OPGW
	Copper cable	—	Copper cable, pair cable to home	Coaxial cables, including submarine cable
Wireless	Terrestrial	Mobile	Mobile network such as Wi-Fi, WiMax, 2G, 3G, 4G,5G	—
		fixed	Fixed wireless access	Terrestrial microwave
	Via satellite	Mobile	Satellite network	—
		fixed	Satellite link/ V–SAT	Satellite/link V–SAT

32 Document SG1RGQ/107, BDT Focal Point Question 5/1 and "Broadband Situations in Rural and Remote Areas"

In the case of **People's Republic of China**, the government uses the characteristics of wireless network structure as seen in the benefit of shared constructions and cost savings to answer the need for rural ICT development in the country. It leverages on the legacy network to put forward the idea of a hierarchical structure of wireless broadband network in rural areas. The network structure diagram is shown in **Figure 2** below.

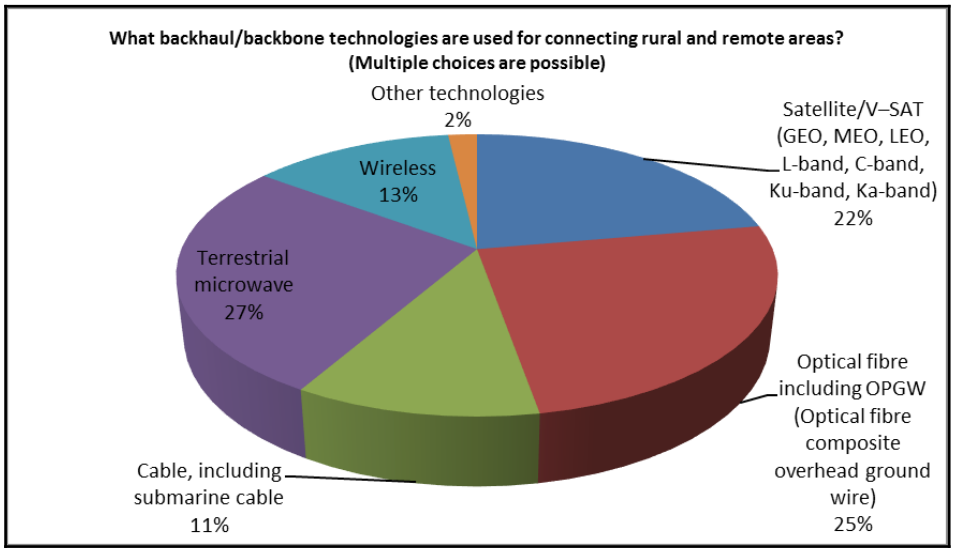
Figure 1: Mobile and Fixed network architecture



5.2 Backhaul technologies

Based on contributions submitted to Question 5/1 for the consideration by the Rapporteur Group, the main backhaul technologies used for connecting rural and remote areas are as follows:

Figure 2: Backhaul technologies used for connecting rural and remote areas



5.2.1 Optical fibre networks

Optical fibre in most cases remain the ideal medium for backhauling between the periphery and the network core. Owing to the marked growth in volumes of data exchanges between users, backhaul has to cope with an ever–growing demand for higher data speeds and volume for services such as triple play, video on demand, HDTV, IPTV, videoconferencing, interactive video and video games, cloud computing and data transfer.

To connect islands to the continent or to the main island, submarine cables are used. They have also been used mainly as international telecommunication links. Optical submarine cable is a cable with special armored cable covers. Some island countries have laid non-repeater optical fibre submarine cables to connect outer islands with distances of several hundred Kilo meters.

Examples contained in various contributions to the study include the **Central African Backbone fibre optic project** (1/29), **India**'s submarine cable connectivity to the small island regions (Andaman, Nicobar and Lakshadweep islands) (1/57), the **Republic of Guinea**'s national fibre optic cable (RGQ/40), the **Russian Federation**'s plan to deploy fibre optic including submarine cables to its 34 small and remote areas that are difficult to connect (RGQ/82), **Burundi**'s Backbone System which uses fibre optic cables (SG1RGQ/166) and its connection to multipurpose community telecentres (SG1RGQ/177), **Kyrgyz Republic**'s optical-fibre communication lines (SG1RGQ/176), **Burkina Faso**'s extension plan for national fibre-optic backbone in Zone 3 (rural zone) (SG1RGQ/178), **Brazil**'s national program for broadband which uses fibre-optics to cover more municipalities (SG1RGQ/195) and, **the Federated States of Micronesia (FSM)**'s connectivity using submarine cables to connect Yap, Chuuk, Pohnpei island regions (SG1RGQ/239). **Waseda University**, used a light weight optic fibre cable covered by stainless sheath and polyethylene and which is standardized by ITU-T Recommendation L.1700 (2016) together with Recommendations L.110 (2017) and L.163 (2018). The cable is considered affordable and reliable for backhaul solutions when deploying infrastructure in rural and remote areas.[33]

5.2.2 Terrestrial Microwave link

A number of network topologies can be used to connect the point of presence to the core network and these include **Point to point (PtP)** topology which has been used traditionally with narrow pencil like beams connecting two end points, **Point to multi-point (PtMP)**, at one end a broader beam is used to cover a relatively wide area within which there could be several other endpoints and, **Multi-point to multi-point or mesh, where** multiple end points communicate to potentially other multi points with traffic routed between them.

Wireless backhaul can operate in frequency division duplex (FDD) mode with a pair of frequencies, one for each direction, or time division duplex (TDD) mode, sharing capacity between uplink / downlink directions. **Korea Telecom's KT's digital island project** in Moheshkhali island in Bangladesh (1/66) used terrestrial microwave link to connect island to mainland.

5.2.3 Satellite link

33 Document 1/REP/13(Rev.2). For both Intel and Waseda university and BDT focal point.

Terrestrial infrastructure is often concentrated in urban centers, with limited coverage for rural and remote areas, thereby preventing segments of the population from benefiting from the information society. Advancements in satellite networks, ground equipment and applications have made satellite technologies cost effective solution and a critical component of telecommunications and broadband access strategies to ensure coverage in remote and rural areas.

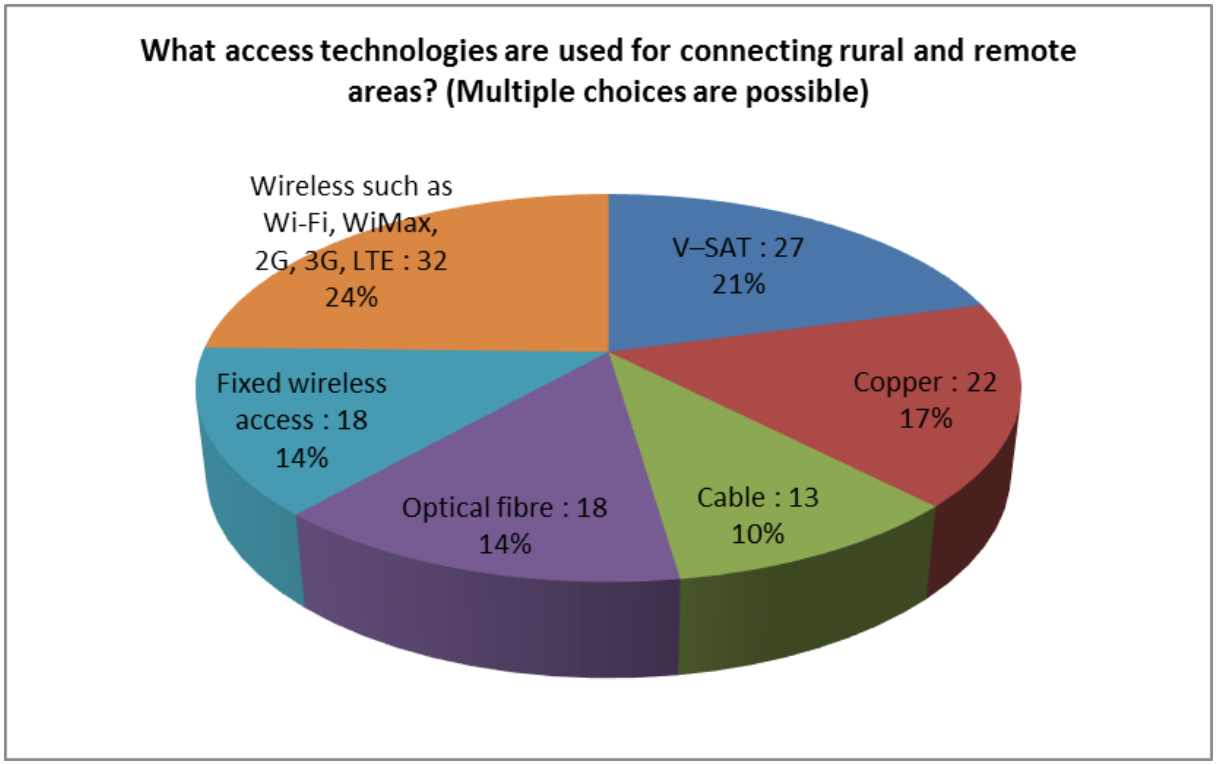
5.2.4 Mobile backhaul network

Increasing data volumes by mobile terminal usage has brought transformation to mobile backhaul networks where the cell radius, cost, physical size and associated backhaul equipment, have been reduced. This technology has become a viable alternative to deploying fibre optics especially in rural and remote areas and equally in high density urban areas where it would not be physically or economically feasible to deploy fibre optics[34].

5.3 Access Technologies

Observations from the contributions submitted during the study for consideration by the Rapporteur Group, the main access technologies used for connecting rural and remote areas are as follows:

Figure 3: Access technologies used for connecting rural and remote areas



5.3.1 Fibre to premises

Optical fibre is capable of delivering high bandwidth, which carries integrated voice, data and video signal in the access network. It can cover distances of more than 20 km without repeaters.

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Fibre optic wireline network can have several configurations, depending on the terminating point of the fibre: Fibre-to-the-Home (FTTH), Fibre-to-the-Building (FTTB), Fibre-to-the-Curb (FTTC) and Fibre-to-the-Node (FTTN). In each case the optical network is terminated at an Optical Network Unit (ONU). The versions of FTTx are differentiated by the location of the ONU. For FTTH, the ONU is located on the subscriber's premises and serves as the demarcation between the operator's and customer's facilities. Examples are **Rwanda**'s connection from the national fibre optic backbone to rural and remote schools located less than 200 meters (SG1RGQ/11), **KT Corporation**'s digital island project in Moheshkhali island in Bangladesh (1/66), **China**'s use of fibre-optic to connect administrative villages as means of telecommunication universal service pilots (SG1RGQ/217).

5.3.2 xDSL (twisted pair cable to premises)

xDSL refers to the different range of digital subscriber line (DSL) technologies. Line-length limitations on DSL signal transmissions from the telephone exchanges have resulted in the many types of DSLs.

- ADSL (Asymmetric Digital Subscriber Line), a technology that enables access to interactive broadband services and video on demand through copper wire used in existing local telephone loop that have evolved to ADSL2 and ADSL2+ where it supports one-way transmission at bit rates up to 24 Mbps within maximum of 0.3 km efficiency range).
- VDSL (Very high bit-rate Digital Subscriber Line) provides data transmission faster than ADSL with downstream/upstream rates up to 52Mbps/16Mbps. VDSL2 provides data rates of 200Mbps/100Mbps (down/up) with maximum range within 0.3km to provide high-definition television, voice over ip, and general internet access. Mali used ADSL to connect CMSC (Centres Multimedia Scolaires Connectes) (RGQ/42).

5.3.3 CATV (Cable to Premises)

In some countries CATV network is common to satisfy the demand for video services. The Data over Cable Service Interface Specification (DOCSIS) was published in 1997. It defines the addition of high-speed data communications to an existing CATV system. Using DOCSIS, CATV operators offer competing data communications on their video network, with the development of Voice over Internet Protocol (VoIP) offered POTS-like service. The latest version of the standard, DOCSIS 3.0, bonds up to 8 channels from the network to the terminal, to deliver up to 343 Mbit/s to the optical node. CATV operators offer subscriber access speeds as high as 100 Mbit/s using this technology.

5.3.4 Mobile network (3G/4G/5G)

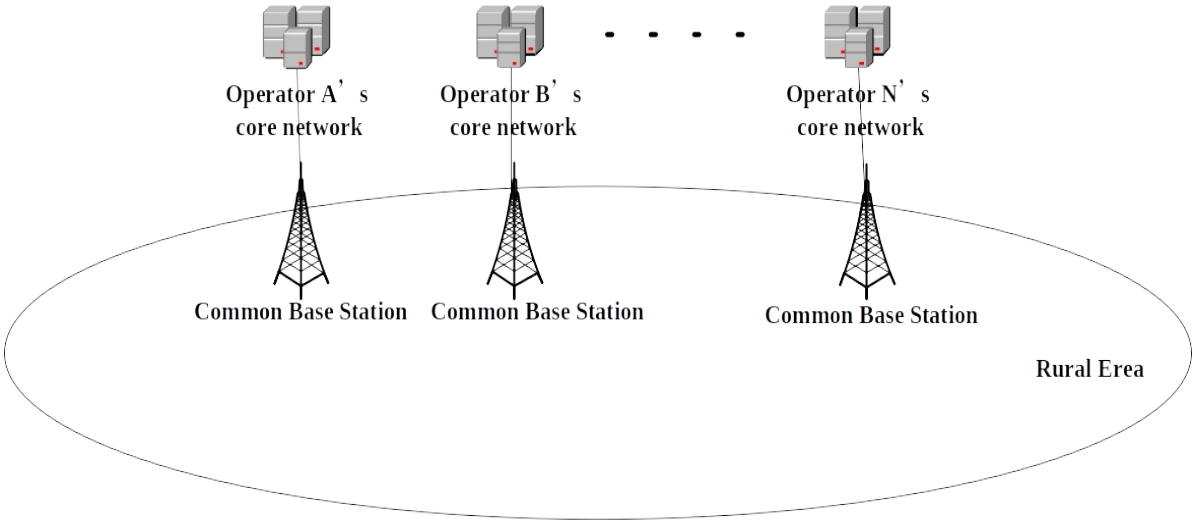
The usage area covered by wireless communications is wide. Distinction is made from many perspectives, that is fixed vs. nomadic/mobile, licensed vs. unlicensed, as well as point-to-point vs. point-to-multi-point.

Responding to these requirements of user usage pattern, spectrum regulation and technical network pattern, the ITU has come up with Recommendation ITU-R M.1801, which contains "Radio interface standards for broadband wireless access systems, including mobile and nomadic applications, in the mobile service operating below 6 GHz".

- These standards support a wide range of applications in urban, suburban and rural areas for both generic broadband internet data and real-time data, including applications such as voice and videoconferencing. There is also Recommendation ITUR M.2012 which contains detailed specifications of the terrestrial radio interfaces of IMT-Advanced (International Mobile Telecommunications Advanced). It includes the LTE-Advanced radio interface technology and the Wireless MAN-Advanced radio interface technology. These ITU-R recommendations and the 3GPP family of standards provide wide choices of modern wireless mobile networks.

In China, mobile communication technology has entered the 5G era, and the rural areas are also in full swing for the construction of 5G/4G network. Due to the issue of cost and benefit, the majority of communication operators in rural areas adopt a “thin coverage” strategy, meaning only areas with population and major rural roads are covered. **Figure 4** illustrates the typical wireless network structure at present in rural areas. Each operator has deployed a network of their own, using the typical 5G/4G network structure.

Figure 4 Sketch map of existing wireless network structure in rural areas



The current wireless network in rural areas imposes a number of problems which restrict the development of rural ICT. First, the rural wireless network is more concentrated on areas with population regardless of where the farmers work. Secondly, as rural areas are vast in territory and sparse in population, the rural wireless network generally has low speed, unable to meet the demands of hotspot data transmission. Thirdly, amongst the multiple operators, each has deployed its own wireless network, increasing the cost of rural ICT development.

Examples of note are **Rwanda**’s connection from the national fibre optic backbone to rural and remote schools far away are connected via 4G LTE network (SG1RGQ/11), **Cameroon**’s use of 3G mobile communications to connect rural areas (1/125), **Brazil**’s use of mobile broadband to expand coverage of villages and rural areas (SG1RGQ/195), **Korea Republic**’s use of 5G for rural and remote areas during 2018 winter Olympics (SG1RGQ/212), **China**’s use of 4G to connect administrative villages as means of telecommunication universal service pilots (SG1RGQ/217), **Kenya**’s mobile

connectivity to sub-regions (SG1RGQ/256). The updated report on the global status of 5G, based on information from the Global Mobile Suppliers Association, identifies 769 operators running LTE networks and providing mobile and/or fixed wireless broadband services in 225 countries worldwide.[35]

5.3.5 Wi-Fi Network

Broadband RLANs, commonly called Wi-Fi such as those based on the IEEE 802.11 standard, allow for high-speed access to the Internet over short distances. RLANs, coupled with mesh network architecture provide the extended coverage from hot spots. This Wi-Fi plus mesh is a convenient way to provide local access network without licenses.

Typical applications are public and private wireless access offered in homes, SOHOs, schools, hospitals, hotels, conference centres, airports, shopping centres, etc. Today, broadband RLANs are widely used for semi-fixed (transportable) and portable computer equipment such as laptops and smartphones that can be used for a variety of broadband applications. The key feature is portability. Wi-Fi provides high data rates and system throughput but the geographic coverage is limited to about 100 m.

Mali used Wi-Fi to connect CMSC (Centres Multimedia Scolaires Connectes) (RGQ/42), **Zimbabwe** recommended use of Wi-Fi to connect infrastructure challenges faced in rural and remote areas (RGQ/73), as well as use of internet Wi-Fi garden (RGQ/85), **Sudan**'s effort to use Wi-Fi hotspots in uncovered rural and remote areas (1/157), **Korea Republic**'s connectivity to rural areas in Cambodia using Wi-Fi technology (1/169), **Intel**'s detailed Wi-Fi 6 technology for consideration in rural areas (1/230), **Bhutan**'s Wi-Fi technology for public service delivery pilot project (1/251)

5.3.6 High Altitude Platform Systems (HAPS) and Unmanned Aerial Vehicle (UAVs)

Unmanned Aerial Vehicles, such as drones, can serve as mobile base stations to provide connectivity. **Airbus** Zephyr[36], for example, uses a series of lightweight solar-powered UAVs. Another example is **Google** Loon[37] that has been tried in different countries, such as New Zealand and Peru, which uses a network of balloons flying on the edge of space. **KT Corporation**'s Skyship[38] can be used to provide communications, surveillance and monitoring in case of disaster situations.

5.3.7 Satellite Broadband Access

Frequency bands used in satellite communications define the size of the dish required and their capabilities:

Satellite Frequency Band

35 Document SG1RGQ/236
36 Jaheung Koo Question 5/1 Workshop Presentation 25 September 2019; https://www.itu.int/oth/D0718000002
37 Jaheung Koo Question 5/1 Workshop Presentation 25 September 2019; https://www.itu.int/oth/D0718000002
38 Jaheung Koo Question 5/1 Workshop Presentation 25 September 2019; https://www.itu.int/oth/D0718000002

- L-band (1.5/1.6 GHz) is used by non-geostationary earth orbits (NGEO) and geostationary earth orbit (GEO) systems. For GEO systems large antennas (e.g. 10-20 m diameter) are used on the satellite platform to provide large number of small spot beams on the Earth surface. Due to the limited spectrum available in this range, data rates are limited (currently around 500 kbit/s). L-band frequencies are virtually unaffected by propagation impairments.
- C-band (4/6 GHz) transmissions require larger dishes compared with Ku-band and Ka-band described below. Transmissions in the C-band are less affected by rain fade and other weather conditions compared with higher frequencies.
- Ku-band (11-12/14 GHz) has a shorter wavelength allowing for smaller dishes than C-band. However, the higher frequencies make Ku-band more susceptible to atmospheric conditions like rain fade. Applications include VSAT, rural telephony and broadband, satellite news gathering, backhaul links, videoconferencing and multi-media.
- Ka-band (20/30 GHz) has even shorter wavelengths than Ku-band, allowing for even smaller dish size; however, transmissions are also even more susceptible to poor weather conditions. High-bandwidth interactive services are possible including high-speed Internet, videoconferencing, and multi-media applications.

Satellite Types per orbit

- GEO Satellite: Satellites in Geostationary orbit are situated 35,800km and above that can cover earth with less number of satellites used for broadcasting and communication purposes.
- MEO Satellite: Satellites in medium earth orbit are positioned between LEO and GEO orbits circling the planet at altitudes of 5,000 to 12,000km handling high-speed telephone signals.
- LEO Satellite: Satellites in low earth orbit (LEO) are the closest devices to Earth only 500 to 1,500km above the Earth’s surface making them ideal for satellite phone and GPS communication. It takes many LEO satellites to cover the planet, as illustrated in figure 5.

Figure 5 Satellite types per orbit (GEO/MEO/LEO)

Given their unique regional and global coverage capabilities, satellites are able to deliver immediate internet and broadband connectivity even to remote areas using existing satellite resources.

5.3.8 Internet of Things (IoTs)

Internet of Things (IoT) is a system that can transfer data over a network without requiring human-to-human or human-to-computer interaction for example used often to connect home devices and appliances for “Smart home”. It can be used as a shared infrastructure for remote and less connected areas seen in **BDT** contribution for Smart Green Villages (1/150). Case contribution from IoT sensors in **Japan**’s Shiojiri city for sustainable smart society (SG1RGQ/36) and by **Daiwa computer co., Ltd** for e-agriculture (RGQ/39),

Chapter 6: Services and applications for rural and remote areas

6.1Applications for Rural and Remote Areas

The report for the 2014-2018 study period highlighted the need for applications that help development in social, agriculture, health, financial inclusion, and government services as applications required in rural and remote areas. It also recommended that content and services that address the needs of rural and Remote areas be developed. This chapter draws attention to current developments that in some way fulfil these recommendations and also updates the information on the applications relevant to rural and remote area communities and what is happening on the ground in relation to applications that are of relevance and practical use, in rural and remote areas. Applications and content for each application which are suited for each specific region's rural area across the world and in developing countries in particular, are key to development. These may be designed according to natural resources available in a particular region as industry often develops on the basis of such resources. It is therefore necessary to equip rural communities with ICT applications and necessary knowledge, to exploit these resources effectively. Relevant applications include:

- Applications that assist rural communities to move from subsistence exploitation of a specific resource to commercial and diversified exploitation.
- E-health applications for both disease control and prevention. This is particularly important in relation to pandemics such as the COVD-19 pandemic, which has made the need for health related information.
- Social networking applications at the individual level, which enable sharing of information between friends and social groups. In the COVID-19 era, religious services are now being held virtually and without access to broadband infrastructure and services, the rural communities would not be able to take advantage of these developments.
- E-banking and mobile banking applications that enable unbanked rural communities to have ease of access and inexpensive banking facilities.
- Teleworking related applications for what has been popularised as working from home. This has also become critical since the advent of COVID, as even small businesses and projects have had to be managed from home.
- Virtual meeting applications for both business and social meetings which can cut travel and conference room costs.
- E-marketing applications to enable rural people to market their produce and trade wares and gain access to wider markets.
- Various sector specific applications for different rural areas together with relevant content so that information relating to health, tourism, training, food, mining and small scale manufacturing and the attendant services, are made available.
- E-Government applications that enable government to disseminate information and offer services electronically rural areas. This should assist for access to various trade licences, issuance of Identity documents and other government issued documents that citizens require.

Examples of some these applications are outlined below:

- **China**- China implemented and promoted the establishment of comprehensive rural information service platforms namely, 'agricultural faith and communication', 'information field' and other rural information service platforms that have seen the growth rate of rural e-commerce becoming higher than that of urban areas, for three consecutive years. In 2017, the total rural retail sales of goods reached I trillion, 244 billion, 880 million Yuan, up 39.1 percent compared to 2016[39]. These platforms have enabled farmers to enjoy the use of convenient high speed agricultural and market technology.
- **Bangladesh**: With the help of KT Corporation of the Republic of Korea, e-learning solutions were deployed in Moheshkali Island to provide distant learning and resolve a teaching staff shortage. The e-learning application solution saw urban teachers being linked to teach rural students on the Island, with the Ministry of education running a Teachers' portal for the purpose. E-mobile health solutions together with scanners, basic x-ray and ultrasound systems, were provided to local clinics an Moheshkali health complex[40]
- **Rwanda** – Implemented ICT enabled agriculture through the use of A digital green projector, which aims to increase agricultural productivity through dissemination of agricultural knowledge and technical information.[41]
- **Japan: Shiojiri environmental information data collection platform and its IoT sensor network**
  The Shiojiri environmental data collection platform and IoT sensor Network is designed to protect children and the elderly when they walk alone, predict landslides, predict floods, track public transport arrival and departure times, protect farmers from wild life, protect citizens from radioactive pollution, predict natural disasters, detect deterioration of buildings and monitor[42]. The data collected by all these sensors, is regularly analyzed so that appropriate action is taken to remedy any impending danger disaster or undesirable state of affairs.
- **Daiwa Computer Co. Ltd,** developed an ICT applied farming application for producing muskmelons in green houses which contributed to the income generation for the company and collaborating farmers. This ICT applied farming method for the production of muskmelon in green houses, proved to be cost effective, increased productivity and reduced the labour costs for farmers. This e-agricultural method was going to be replicated to other agricultural products.[43]
- **Japan** also shared a study on e-education and agricultural consultation through ordinary use of portable emergency telecommunication systems in the rural areas of Nepal.[44]

39 Document 1/REP/5(Rev.2) or Document 1/69: expanding the new space for rural communication in China
40 Document 1/REP/5(Rev.2)
See also Document 1/66 (KT Corporation, Republic of Korea)
41 Document SG1RGQ/REP/5
42 Document SG1RGQ/REP/5
43 Document SG1RGQ/39 (Daiwa Computer, Japan)
44 Document 1/268 (Japan)

- **The BDT** shared information on work related to Smart Green Villages and Internet of Things (SGVs & IoTs). The contribution summarises two initiatives planned by the BDT on Smart Green Villages and Internet of Things (SGVs & IoTs) that may be useful for developing countries, particularly rural and remote villages.
- **The People's Republic of China** provides information on the construction and deployment of telecom infrastructure and also provides management-based big data platforms to promote universal telecommunication services.

The examples shared above, are an indication of how far development of applications that can help Rural and remote areas achieve the Sustainable Development Goals many fronts and better their lives have gone. Replicating these in all rural areas would ensure that no rural or remote community is left behind unconnected.

6.2 Community Networks and village connectivity

Existing network systems are primarily designed for urban areas; where the necessary supporting infrastructures such as adequate power, building and road transport, as well as skilled manpower are available.

It is clear that connectivity models for urban environments cannot simply be transplanted to rural areas. There is therefore need for many and new approaches to address rural connectivity gaps.

According to the ITU Report on Digital inclusion, 80% of the people in Developing Countries across the world at the end of 2018, compared to 45.3% in developed countries, lacked access to the internet or had insufficient or slow connectivity.[45] To address this issue, contributions providing details of community networks and other small networks that can used to provide connectivity in rural and remote villages, were received during the study period. These were also covered in detail during the workshop hosted by the Rapporteur Group for Question 5/1 on 25 September 2019. Examples of these types of networks are given below

- **Small operators, such as Internet service providers (ISP) and virtual network operators**

These operate under authorisation (less stringent than a license and most times operate for free or pay low fees (unlicensed e with free spectrum regime). In some countries, they provide data and voice services, but in many countries, they provide only data and are not allowed to provide voice over IP using a number, to "protect" the large operators who pay fees. The main challenge with these is that they cover small geographical areas and may not cover rural areas but may cover underserved communities within urban areas.

Their limitations lie in the fact that they can only make services available in the same geographical area covered by the large operator on whose network they ride.

- **Community networks**

45 Digital inclusion for all, https://www.itu.int/en (Accessed 29 August 2019)

While the international Telecommunication plenipotentiary conference and the World Telecommunication Development conference have not come up with a commonly accepted definition of community networks, these are often very small networks managed by the community itself, that is, small do it yourself networks. The involved parties can be families, individuals, social groups, organisations and institutions that manage and utilise networked computers and gadgets as a means of electronic communication and sharing knowledge and information within the community. The aim is to improve business efficiency and increase access to information, as well as improve on traditional communication channels. They have been utilised mainly in remote areas in the amazon rain forest, the Himalaya Mountains and some fly in communities in Northern Canada. They have also been used in many countries, particularly Brazil, Mexico, Columbia and other Latin America Countries. Community networks can provide a good solution for connecting rural, remote, and under-served communities. One such network was introduced in Zimbabwe at Mpandawana Growth point.[46]

One example is of the cooperation with Georgia's ISP Association, the local community in Tusheti, and the Georgian Government to develop small community networks in Tusheti. Tusheti is in northeast Georgia on the northern slopes of the Greater Caucasus Mountains and is bordered by the Russian republics of Chechnya and Dagestan. Internet connectivity has helped support the economic sustainability of this remote region and create opportunities for communities to sell their local products, as well as access education, healthcare and government services. Horses were used to move equipment up the mountain.[47]

- **Commercial arrangements between small local operators and large operators**

  Arrangements where large operators allow small local networks to connect to the large network with the Small operators providing the local solution or last mile connectivity and big operators providing capacity to connect to the Internet can also provide affordable connectivity for rural and remote villages.

  - In **South Africa**'s Eastern Cape Province, the rural community of Mankosi worked with researchers from the University of the Western Cape to set up a telecommunications cooperative called Zenzeleni Networks Mankosi[48], which provides solar-powered wireless mesh connectivity to its 3,500 residents. As a licensed Internet service provider, Zenzeleni works directly with incumbent regional network operators EastTel and OpenServe to purchase backhaul Internet connectivity from them, reflecting a truly complementary relationship.

6.3Types of access and exchange points

There are different types of access points that have been utilised by different countries to ensure that rural and remote communities easily access telecommunications/ICTs, as can be seen from the following:

46 Document SG1RGQ/REP/12 Question 5/1 Workshop report
47 Document SG1RGQ/REP/12 Question 5/1 Workshop report
48 Zenzeleni.net (n.d.) https://zenzeleni.net/

- **India** has been using ICT enabled kiosks as intermediaries for offering E-government services.[49]
- **Democratic Republic of Congo** highlighted tele-centres as recommended access points obviating the need for portable phone and receiver for each household.[50]
- **In Bhutan,** the village networks enable Community Centers to serve as an access point for the rural population to have access to Government and Internet services.
- **Côte d'Ivoire** launched a project comprising 5,000 community cyber centres in Côte d'Ivoire in rural areas of 500 or more inhabitants. The project was launched for purposes of providing access to ICTs for all the country's inhabitants. [51]
- **Cameroon** put in place its Polyvalent Community Telecentre comprising premises in a village with Internet connectivity and computer equipment, capable of providing services such as telemedicine, teleworking, e-agriculture, e-tourism, e-governance, e-commerce, e-learning and basic training in ICTs.
- **Zimbabwe** shared a case study of the ICT Community Information Centre programme whose main purpose is to promote access to telecommunications/ICTs for all Zimbabweans, be they in urban, rural or remote areas and to narrow the digital divide between urban and rural communities, rich and the poor, as well as between genders. The programme provides relevant infrastructure, Internet service, equipment and free ICT literacy training. Noteworthy is that the entrepreneurially minded gain access to economic information related to their Industry and other economic projects and markets. Students use community information centres as research facilities that allow them an opportunity to search for university places and possible employment opportunities.[52]
- **Burundi** established multipurpose community tele-centres, in order to connect rural areas and enable residents to connect to broadband Internet, thereby bridging the digital divide. The project was being implemented in four of the country's 18 provinces, with plans to extend it to all provinces by 2025.[53]

6.4Strategies to promote small, non-profit community operators

At WTDC17 in Argentina, there was division on the recognition of community networks, which showed that there is reluctance on the part of some countries and regions to adopt or accept that community networks can play a significant role in connecting rural and remote areas. One cannot rule out that governments may suspect that the community networks may be used to promote ant--government activities. Operators also often see such networks as pirates encroaching in their turf. Three strategies however, can help deal with these issues and promote establishment of the community networks and these are:

49 Document 1/REP/13(Rev.2) 1/137 (India)
50 Document 1/REP/21
51 Document SG1RGQ/30
52 SG1RGQ/85
53 SG1RGQ/166

- Engaging government on the benefits of community networks and demonstrating that the objective is to connect rural communities, which is a common objective for both the communities and government. In a short, getting government buy in is critical
- Convincing operators that community networks are not pirate networks but can complement major operators as they serve the areas that are away from the point of presence of major operators. That the relationship is between the community network operators and the Mobile network operator or fixed network operator is like the relationship between relay runners on the same team in the race to connect rural, remote and underserved communities.

6.5Strategies to localise content

One of the key strategies that can promote generation of local content for ICTs in general and applications in particular, is capacity building that is discussed in detail in Chapter 7 of this report. Once rural and remote communities are conversant with the use of ICTs, they are likely to start sharing local knowledge systems and generate content that can assist their communities.

Another key strategy is policy. Administrations can come up with policies that promote generation of local content. Innovation hubs and innovation programmes driven by policy can go a long way in generation of locally relevant content

6.6Quality of service and sustainability

Given the challenges and prohibitive cost of installing infrastructure in rural and remote areas, quality of service is usually compromised in such areas.

The **BDT Focal Point for Europe highlighted** publications elaborating outcomes of two twinning projects , one between Poland and Albania in which technical specifications for a tool to measure quality of service were developed and the other between Albania and Slovenia, which focused on broadband infrastructure mapping.[54]

In Sri Lanka, a study initiated in Sanniwedanaya Gamata, to identify unserved and underserved areas in Sri Lanka. The study used a mobile monitoring vehicle to manually check signal strength, and identify areas where there was weak signal and service provision. Through comparing the results of the investigation with coverage information provided by operators, the Telecommunications Regulatory Commission of Sri Lanka (TRCSL), found that that coverage in the region, was below satisfactory. Solutions, such as raising mobile base stations, were expected to improve broadband coverage to all identified unserved and underserved areas.[55]

54 Document SG1RGQ/46 + Annex
Document SG1RGQ/REP/12

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Chapter 7: Knowledge development, capacity building and training for increased access

Great effort has been made to link rural and remote areas to national backbone ICT infrastructure, install last mile connectivity, create application for use by rural communities and improve physical access to ICTs, in many countries. All this effort can however, go to waste unless the rural communities acquire the skills to use ICTs and to some extent maintain the equipment used. Capacity building is therefore a necessary component of the action that must be taken to ensure that rural and remote communities are not left behind as broadband services are developed. A number of contributions to the Question 5/1 Study, highlighted capacity building activities that have been.

7.1Skills Requirements

A number of contributions to the Question 5/1 Study, highlighted capacity building activities that have been undertaken by some countries and organisations in order to impart necessary skills to rural and remote communities and, these are outlined below:

- **Zimbabwe :** Following the establishment of Community Information Centres, as access points for Rural and Remote communities, a training programme that involves a basic computer skills course which incorporates an appreciation of computer applications was launched. Training is carried out by community members who would have undergone a train the trainer course run by the Postal and Telecommunications Regulatory Authority of Zimbabwe. Between 23 October and 3 September 2018, nine thousand and twelve (9012) people had been trained across the Country for free. The basic course empowers people by enabling them to access information on Government initiated developmental projects, farming inputs, weather, farming methods, solutions to disease, sanitation, and any other aspects of their lives. It also enables them to communicate with family and friends, as well as their business contacts. After the basic course, members of the community can take the advanced course, which covers presentation skills, graphic design, file management, database management, and cybersecurity, computer programming and web designing, among other skills. The advanced training programme commences once the majority of community members have received basic training. It provides a foundation for those who wish to take up careers in the ICT field.
- **In Rwanda**, Under the pilot phase of its ICT enabled agriculture programme, designed to increase agricultural productivity through the use of ICTs, an initiative was launched to accelerate the dissemination of agricultural knowledge and technical information, at national level, from the central office of the Ministry of Agriculture, to the rural farmers. This was done through what are called Farmer Field School (FFS) facilitators and agronomists, using a digital device known as “digital green projector”. One Hundred and Eight (108) villages benefited from the initiative. Farmer Field School (FFS) facilitators in each village and sector agronomists, were trained with basic skills to operate and use the digital green projectors to enable them to prepare, plan and carryout trainings in their respective villages.[56]

56 Document SG1RGQ/REP/5

- **India:** In the case of Sanchar Shakti, the Indian Universal Service Obligation Fund's Scheme for Mobile Value Added Services for Rural Women, training carried out is aimed at skill enhancement and is an integral part of the projects.[57]
- **The United States**: The United States (U.S.) used a number of initiatives to enable women and girls' to use ICTs and to grow the initiatives until a digital divide no longer exists. These are:
    - **Academy for Women Entrepreneurs (AWE)**
      The Academy for Women Entrepreneurs (AWE), equips women in 26 countries in Latin America, the Caribbean, Africa, and Papua New Guinea, with the technical skills needed to create sustainable businesses. Women participating in AWE have access to Dream Builder, a massive-open-online-course (MOOC) on women's entrepreneurship that is localized and provides country-specific data on business results and successes. As of 2018, it was available in over 65 countries, with over 100,000 learners worldwide.
    - **Women and the Web**
      Women and the Web is a public-private partnership among USAID, NetHope, Intel Corporation, World Pulse, World Vision, UN Women, and Women in Technology in Nigeria. Through digital literacy training, policy work, and online social networks this alliance seeks to address the internet gender gap by bringing more than 600,000 young women online in Nigeria and Kenya in the by 2021. So far, the programme has brought 120,000 women online.
    - **Fulbright Teacher Exchange**
      Fulbright Teacher Exchange brings approximately 200 international secondary-level teachers from the developing world to U.S. universities for educational technology and gender responsive training. As a result, thousands of their female students have access to higher education and greater employment opportunities.
    - **Gender Digital Divide Online Course**
      This course, developed through FHI 360's mSTAR project and Panoply Digital, introduces development practitioners to the barriers in women's access and adoption of digital tools, and the impact of the digital gender divide. Participants develop an understanding of key gender and ICT considerations when designing and implementing digital projects and programs.

7.2 Human Resources Development

With regards to Human Resources Development, it is important for a wide base of trained ICT experts to be available across the world. A number of initiatives whose details can be found in the contributions submitted during the current study period include the following:

- **United States**
    - **Community College Initiative (CCI) Program**

      The CCI Program provides participants from underserved regions and underrepresented groups with a one-year, non-degree academic program at a U.S. community college focusing on IT technical skills, leadership

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development, and English-language learning. In 2018, the CCI Program welcomed 146 participants from 12 countries to the United States, where they participated in 20,265 volunteer and 17,550 internship hours.

- **International Visitor Leadership Program**

The International Visitor Leadership Program (IVLP), a Professional and Cultural Exchange Program, is a two-day to three-week professional exchange program for current and emerging foreign leaders. In 2018-2019, seven projects focused on improving women's involvement in Science, Technology, Engineering, Arts, and Mathematics (STEAM) fields.

- **TechGirls**

TechGirls offers girls age 15-17 from the Middle East and North Africa the opportunity to engage in an intensive, three-week exchange program in the U.S. Exchange activities include a technology camp with American peers, site visits with technology companies, job shadowing, community service activities, and home hospitality arrangements. Since 2012, TechGirls trained and mentored 186 teenage girls.

- **TechWomen**

TechWomen, selects female participants from Africa, South and Central Asia, and the Middle East who take part in a peer mentoring experience with American women at leading science and technology companies in Silicon Valley and the San Francisco Bay Area. The program develops talent in the fields of science and technology, increases the trade capacity of the participating countries, and enables women to reach their full potential in the science and tech industry. Since 2011, 518 women from 22 countries have participated in the program.[58]

- **Mali** introduced ICT into the Mali school curriculum, especially in the basic and secondary levels of education through Multimedia School centres. Priority in diffusion of ICTs was given to schools and universities in order to improve learning and reduce the digital divide in the education system.
- **In Tanzania**, during implementation of the school's connectivity projects, the Universal Service Fund noted challenges in terms of ICT literacy among teaching staff. In order to deal with this problem, the Fund engaged the University of Dodoma and the Dar-es-Salaam Institute of Technology, to train teachers in the proper use of devices, as well as simple computers trouble shooting and maintenance. So far, the Fund has trained 800 public schools teachers on the proper use and simple maintenance of the devices.
- **Korea Telecom (KT)** has worked in close partnership with the Ministry of Post and Telecommunications in Cambodia (MPTC) and Telecom Cambodia (TC), on a public Wi-Fi and digital schools project providing free Wi-Fi in public places and distance learning to schools in remote areas, under the e-Education objective of the Cambodian ICT Masterplan 2020 and, Cambodia Vision 2023. KT Corporation conducted indoor and outdoor training on the built system. Local training was regarded as essential, in sustaining the project and therefore local practical and theory training, has been carried out.[59]

58 DocumentSG1RGQ/187
59 Document 1/REP/13(Rev.2)

- **KT Corporation of Korea**'s capacity building program which has seen 3.3 million Koreans and 16 thousand institutions benefit. Those trained people receive information technology qualification certificates. The programme is carried out in conjunction with various government agencies, regional governments and Non-Governmental Organizations[60]
- **The Lomé (Togo) workshop** organized by the West African Regulators Association from 26 to 28 June 2019, where policy makers and Telecommunication/ICT Regulatory Authorities, discussed the need to consider community networks as a viable form of connectivity.

It t is clear from the contributions received that there is still a lot that require to be done in relation to capacity building, if the roll out of ICTs to rural and remote areas is to yield the desired results of not leaving anyone behind in the broadband roll out and ICT access race. More countries need to adopt capacity building programmes and submit contributions to the rural access study question so that progress in this area can continue to be tracked.

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Chapter 8: Policies and regulations for telecommunications/ICT in rural and remote areas

There are a number policies and types of regulations that administrations can use to promote development of telecommunication/ ICTS in and for rural and remote areas. These can be policies or regulations to stimulate investment or demand, achieve universal access and bridge the rural urban, or gender digital divide. This Chapter looks at universal service policies and other policies that have been employed by a number of countries strategies that promote small non-profit community operators.

8.1 Universal Service Policies and Regulations

At least eighty percent of the contributions received from various administrations reflected that utilising the Universal Service fund for broadband infrastructure and roll out of services is a policy common to many countries. Contributions from Mali the United States, China, Zimbabwe, Burkina Faso, Cote d'Ivoire, Burundi, The Russian Federation, Tanzania, Sudan, Rwanda, India, Japan, Haiti Guinea, Senegal, Madagascar, Cameroon, India, Brazil, Kyrgyz Republic, Republic of Korea, Democratic Republic of Congo and Senegal, analysed by the Rapporteur Group for Question 5/1 reflected this.

Without repeating what is contained in other chapters, the concept of universal access has expanded beyond access to basic telephony and data Services, to include broadband services and the role of Universal service funds has also changed to accommodate this, resulting in more flexible Universal access policies across the world. Administrations like the United States and Korea, have even gone cross border or international, to assist disadvantaged communities in other countries through their Universal Service policies. This relates to the USA's activities in various countries, with regards to ICTs and The Republic of Korea's work in Cambodia.

8.1.1 Regulations

A number of contributions reflected that administrations had created universal Service funds or furthered their universal service policies through an Act of parliament or some other law. The laws generally cover the structure of the Fund, source of revenue and utilisation of the revenues of such funds, as well as the objectives of such funds.[61]

- **For Rwanda** a policy of Universal Service was formulated as part of Rwanda's vision 2020 to turn the Country into a middle income economy and the Universal Service Fund was established in 2004 in order to support rollout of communication infrastructure and has expanded by virtue of law to cover literacy training rural school internet connectivity, ICT enables agriculture, subsidising the cost of internet in rural and remote areas and supporting access to ICTs by people with disabilities.[62]
- **In Senegal**, legal instruments were used to update the institution of the universal services fund the concept of which had been adopted in 2018.
- **For Tanzania**, the universal communication service access fund, was set up by law in order to help bridge the digital divide between rural and

61 Document SG1RGQ/REP/5

62 SGIR GQ/11-E

urban communities. To date, it has funded school connectivity projects, telemedicine projects and training of teachers, as well as rural communities.

- **Côte d'Ivoire** adopted a decree on 19 November 2014, setting out contribution rates for the allocation of ICT/Telecommunication sector resources to public ICT infrastructure. Each telecommunication service provider pays 5% of its previous year's turnover into the Fund. However, up to 50% of this contribution can be offset by the Operator through financing public ICT projects. This has seen financing of the digital library at Alassane Ouattara University, to facilitate student research and the hosting of the inter-school technology and telecommunication days.
- **In Senegal**, a number of decrees have been used to implement universal access and support the Country's electronic communication code. The country also established a well-structured, participative and transparent governance model for the Universal Service Access Fund and the policies that relate to it.

Six Countries whose Universal Service missions of the six (6) countries were studied by Senegal, namely Malaysia, Colombia, Morocco, Ghana, Ivory Coast and Uganda were found to have developed appropriate policies which reflected the political will to operationalise their Universal Service Funds effectively as can be seen from the following observations made by Senegal in its contribution on the matter:

- In all cases, there was political will to implement universal service with a diversified source of revenue.
- Each of the six (6) countries had a regulatory framework that clearly defined, **"**access**"** and **"**universal service**".**
- All six (6) countries had concrete projects running within the framework of universal access and service and the Funds. The type of project depended on the needs of each country.
- Financial resources of each of the Funds, were not used for other purposes, other than those for which the Universal Service Funds were set up.
- In a contribution analysing the universal service approach in the Economic Community of West Africa, **Senegal r**ecommended sharing experiences and best practices among regional members, prioritising education, health, agriculture, fishing, the financial industry and other key industries, as well as the requirements of people with disabilities, as integral to any universal access policy.[63]
- **Brazil**: Beginning with a decree establishing the objectives and guidelines of public telecommunication policies, Brazil issued a number of decrees which resulted in a number of initiatives described below:
  - The Broadband connectivity in Schools Program that sought to connect all urban schools to the internet free of charge.
  - The National Broadband Program which offered concessions to operators to expand broadband into rural and remote areas
  - The Intelligent Brazil Program which implemented incentives and financing mechanisms for industry players to expand their broadband networks and the structured Plan for telecommunication networks.

63 Document 1/152 jan 19 report

- Spectrum frequency auctions were used by Brazil to stimulate network expansion in Brazil.

- **The United States** provided useful information and what could become best practice in the management framework of a universal service fund, in order to accelerate broadband connectivity in rural areas. The universal access goals were expanded in the Telecommunication Act of 1966 to include telecommunications and high-speed internet for consumers at just, reasonable and affordable rates. Other principles were also added, hence, the US Universal Service Fund also supports schools, libraries and rural health care. This is done through the high cost program (also known as the connect America Fund), the lifeline program, the schools and libraries program and the Rural health care program. While the FCC has overall management and oversight of the USF, the USF operations are carried out by the Universal Service Administrative Company (USAC), which is the designated permanent Administrator of all four USF support mechanisms. USAC collects contributions, disburses support funds advises the FCC and provides informative data, as well as educates stakeholders on how to participate in the USF programs[64]. This set up is different from the set up in most countries where the USF is run by a government Ministry or is part of the Regulator which may in some cases compromise independent decision- making, particularly where the relevant government Ministry may be responsible for overseeing state owned telecommunication companies.

8.2 Policy Assistance to Other Countries

- **The United States** developed policies that assist other Countries, focusing on developing Countries. Through these policy tools, the USA has helped other Countries through technical assistance for network expansion and digital inclusion projects, as well as policy assistance and capacity building as outlined below:
- **Mawingu Network:** USAID worked with the Government of Kenya, Nethope, Microsoft and Mawingu Networks, a local tech start up, to use TV while space technology and solar units, to extend internet access to remote communities in Kenya.
- **Recover It:** Through a Public-Private Partnership between USAID and the Orange Group, USAID worked to improve ICT infrastructure for connectivity in order to fight Ebola in Liberia.
- **Jamaica Rural Broadband Project:** In an effort extend last mile connectivity to 31 new sites, including schools, community centres, police stations, and health clinics, USAID worked with Nethope, Microsoft, Jamaica Universal Services Fund and the Jamaica Minister of Science and Technology, to expand broadband to rural Jamaica
- **In Lebanon** USAID focused on two rural communities, Ghazza and, Sebhel, to get 80% of the population in these rural areas covered.
- The **Kenya** Dadaab Connectivity Project, brought connectivity to Somali Refugee Camps and five local communities to support education, medical programs and youth related projects. These Policy tools have also seen USAID support GSMA developing a platform that provides mobile coverage.

64 Document 1/REP/21

- **KT Corporation of Korea**, with assistance from the Bangladesh Government, constructed telecommunication infrastructure in Moheshkhali island beginning October 2016 which connected three unions, an information Technology and business education areas, and twenty-five Government related organisations that included schools and clinics.[65].
- **KT Corporation**'s work in Cambodia that installed public Wi-Fi for schools and public places which was covered in chapter 7 is another good example of cross border assistance [66]

8.3 Other key findings and conclusion from various contributions were as follows:

- The method used for financing of the universal service must promote economic efficiency and not distort the economic behaviour of operators or markets.
- The Fund must allow competition and stimulate additional investment
- the contribution plan must be fair and reasonable
- No operator, licensee or other supplier should be privileged and no technology should be favoured;
- when drawing up telecommunication/ICT development policies it is important to focus on the strong link between WSIS action lines and the Sustainable Development Goals of the 2030 Agenda for Sustainable Development;[67]
- Policy should allow diversification of sources of funding for universal service/access;
- Policy-makers are encouraged to adopt policies that support mobile operators' efforts to provide affordable mobile internet services. This includes:
- Policy makers need to consider removing sector specific taxes which have an impact on the price of mobile devices and the costs of providing mobile internet services helps;
- Adopting pro-investment supply side policies in areas such as spectrum policy and planning;
- Providing open and non-discriminatory access to state-owned public infrastructures.[68]
    - **The People's Republic of China** highlighted the Telecommunication Universal Service policy and practices in China which include measures that promote the construction of rural information infrastructure and mechanisms to achieve deep network coverage in rural and remote areas and as well as encourage residents in poor areas to use broadband.[69]
    - **China Telecom came up with an innovative policy of** ensuring universal service and access for Sichuan Province, which has a poor economy and is characterized by complicated terrain, thereby

65 Document 1/66
66 Document 1/rep/13(rev.2)
67 Document SG1RGQ/175
68 Document 1/389
69 Document SG1RGQ/217

reducing the digital divide. The approaches used are aimed at ensuring network construction and incentivizing network use in the area, by designing packages and tariffs that are cheaper and tailored for the communities. Smartphones and broadband terminals were offered for free.

- **India** shared the model of the Universal Service Obligation Fund (USOF), rules and regulations, resources for collecting Universal Service Levy, and major programs. Apart from, apart from public service providers, private telecommunication service providers were creating infrastructure in remote and rural villages, and providing telecommunication services, with subsidies from (USOF'. India's infrastructure project termed the 'BharatNet project' is the first pillar of the Digital India Programme and has been hailed as the largest rural connectivity project of its kind in the world.[70]
- According to a contribution by **Intel Corporation, United States** on the updated information on the global status of 5G and the importance for developing countries, it was proposed that, for the timely introduction of commercial 5G services, the assignment of 5G related low-mid-high frequency bands to operators was important.[71]
- In the **United States**, the Federal Communications Commission (FCC) used a reverse auction system to efficiently and effectively allocate limited government funds to broadband providers for last mile broadband deployment and connectivity in rural and remote areas. The FCC plans to use this regulatory tool in its universal service program going forward. In a reverse auction, broadband providers compete to roll out broadband to a specific number of locations in an unserved area for the smallest government subsidy..[72] The FCC's Connect America Fund Phase II Auction (CAF II Auction) successfully used a reverse auction solution to help bridge the digital divide between urban and rural communities.
- **The BDT** came up with a toolkit for regulators, governments, service providers and communities to address the inadequate communication service delivery in developing countries. It offers last mile connectivity solutions to connect the unconnected people in developing countries.[73]
- The Global symposium for Regulators came up with Best Practice Guidelines which recognized that flexible and innovative policy and regulatory approaches can support and incentivize digital transformation. These best practices allow regulators to respond to the changing landscape and address the continuing need for secure and reliable ICT infrastructure, affordable access to and delivery of digital services, as well as protect consumers and maintain trust in ICTs.[74]

The technologies and solutions discussed in this document are generally subject to regulation. It is therefore important to look at the regulatory models

70 Document SG1RGQ/229
71 Document 1/378
72 Document SG1RGQ/209
73 Document 1/REP/21
74 Document SG1RGQ/REP/5

used and make recommendations for effective last mile connectivity for rural and remote areas.

Regulators usually licence large mobile service and satellite providers, who have a large coverage and some guaranteed Quality of Service (QoS). These large operators are usually reluctant to serve rural and remote areas which they consider as uneconomic. It is therefore important to come up with licensing models that can be used for connecting rural and remote areas. These include Mobile Virtual Network Operator (MVNO) model, where operators who do not own infrastructure can offer services through riding on the infrastructure of a larger operator, the community network model, where small and medium operators are run by local entrepreneurs or cooperations or groups and the hybrid model which combines both large and small operators.

For this to happen, Regulators and existing large network operators need to keep an open mind and remove regulatory barriers encourage the investment and lower the operational cost. The United States Federal Communications has made efforts to reduce regulatory barriers to investment created by local regulatory fees, one-time application fees, annual recurring fees and discriminatory gross revenue fees in order to deal with access and affordability problems.[75]

75 Document SG1RGQ/56 + Annex

Chapter 9: Conclusions and recommendations

9.1 Conclusions

This chapter covers the main conclusions of the current study in relation to a number of aspects and appropriate sub-headings for each aspect have been used.

9.1.1 Challenges

- Challenges from difficult Geographical access and lack of adequate infrastructure in the form of power and good road infrastructure, including inadequate bridges, which were highlighted in previous study periods remained very real in the current study.
- Length distances over rough roads and dangers from wildlife affects the maintenance of infrastructure and results in long down times.
- Low demand of telecommunication /ICT s due to low incomes of consumers and sparse populations which discourages investment in ICTs in Rural and Remote areas remain a challenge to creation and installation of Telecommunication/ICT infrastructure, as well as provision of services.
- The cost of constructing, installing and upgrading ICT infrastructure is dependent on the availability of power and access road networks, and it is a pre-requisite to develop these two, for it to be possible to create robust and reliable ICT infrastructure.
- Power supply is a critical ingredient or enabler for the deployment of broadband services.
- Current policies and procedures by governments such as high licence fees and land use approvals delays affect speedy development of ICTs.
- uncoordinated development activities such as road expansion and laying of electrical cables result in frequent damage to Telecommunication cables.
- High taxes and levies continue to increase the operational costs for investors and operators.
- Competitor services providers are usually reluctant to share infrastructure construction and installation costs.

9.1.2 Needs and requirements of rural and remote areas

- The social and economic needs of rural and remote communities are high in e education, e agriculture, financial inclusion (e-banking) and e-health.
- Empowering rural and remote areas with ICT use knowledge, helps prevent unnecessary rural to urban migration of the age groups between 15 and 55 years.
- There are no one size fits all in the type of technologies that can be used to connect rural and remote areas.
- There is need for security which can be costly for Remote base stations, as they are usually tempered with and diesel for the generators and power batteries are prone to theft.

9.1.3 Demand

- Demand of multimedia services is a function of broadband roll -out and capacity building related to ICTs and the need for communication between individuals, social groups and relatives.
- Lack of relevant local content continues to affect demand for services in rural and remote areas.
- Lack of awareness of the benefits of telecommunication ICTs and non-affordability of devices results in low demand for broadband services.
- Culture also hampers uptake of ICTs, particularly by women.
- Policy interventions can help bridge the gender digital divide.
- Consideration in the development of Telecommunications/ICTs have concentrated on the supply side issues with very little focus on the demand side.
- Current focus is on last mile connectivity.
- There is no single financing structure or model, that can be applied to all projects and some tend to be more successful than others.

9.1.4 Financing mechanisms

- Competitors are reluctant to share the cost of investment in infrastructure for rural and remote areas`.
- The Universal Service Funds across the world, have been shouldering the bulk of the financing for Telecommunication/ICT projects, including construction of infrastructure, capacity building and development of applications.
- Partnerships have played an important role in reducing the burden of financing.
- The cost of constructing, installing and upgrading ICT infrastructure is dependent on the availability of power and access road networks, and it is a pre-requisite to develop these two, for it to be possible to create robust and reliable ICT infrastructure.
- There are no one size fits all in financing models for infrastructure development and ICT access programmes. Countries need to explore various options, which include financial institution funding, Universal Service Fund support, Government subsidies and Public-Public partnerships, Private- Public partnerships, Public-Non Governmental Institution Partnerships and regional cooperation.
- Partnerships between the BDT and various administrations is helping in financing ICT infrastructure and capacity building.
- Universal access programmes such as community information centres are a cost effective public tool which offer a good opportunity for stimulating economic growth and poverty alleviation in developing countries.
- The utilisation of Universal Service Funds has evolved to include funding of internet connectivity projects, as well as ICT assisted educational and agricultural programmes.

9.1.5 Access points

- Cooperation among neighbouring countries is key to enable landlocked countries and small Islands to access submarine cables for the development of their ICT networks and create robust communication systems.

- ICT access points such as village networks and ICT community information centres or telecentres provide a good facility sharing mechanism for universal access and bridging the rural-urban digital divide.

9.1.6 Technologies

- In addition to technologies highlighted in the previous studies, there are additional and updated technologies that have been noted as enhancing rural connectivity in the current study. but in a nutshell these are still either wireline or wireless and utilise optical cable, copper cable technologies, mobile terrestrial and satellite technologies.
- Construction of Submarine cables that link continents and, developed and developing countries, plays a major role in connecting rural and remote areas.
- Wi-Fi technology in the form of Wi-Fi hotspots, is increasingly being used to connect localities in rural and remote areas, homes, schools, hospitals, hotels, conference centres, airports and shopping centres.
- High Altitude Platform Systems (HAPS) and Unmanned Aerial Vehicle (UAVs) have been used as mobile base stations in some instances.
- 5G networks are in some jurisdictions being utilised for last mile connectivity.
- The ITU has come up with Recommendation ITU-R M.1801, which contains “Radio interface standards for broadband wireless access systems, including mobile and nomadic applications, in the mobile service operating below 6 GHz”, which supports a wide range of applications in urban, suburban and rural areas, for both generic broadband internet data and real-time data, including applications such as voice and videoconferencing.
- The current wireless networks in rural areas impose a number of problems which restrict the development of rural ICTs. The networks are also more concentrated in areas with large populations, regardless of where the farmers really work.
- Given their unique regional and global coverage capabilities, satellites are able to deliver immediate internet and broadband connectivity, even to remote areas using existing satellite resources. This technology has become a viable alternative to deploying fibre optics, especially in rural and remote areas and equally in high density urban areas, where it would not be physically or economically feasible to deploy fibre optics.
- As governments seek to ensure mobile connectivity for all citizens, satellite backhaul, will continue to play a role in providing connectivity to regions where terrestrial-based technologies alone, are not an economically viable solution.
- Developing countries can start working on Internet of Things (IoT) bit by bit, with their limited resources.

9.1.7 Applications

The following applications have become a necessity for rural and remote areas

- Applications that assist rural communities to move from subsistence exploitation of a specific resource to commercial and diversified exploitation.

- E health applications for both disease control and prevention are important, particularly in relation to pandemics such as the COVD-19 pandemic, which has made the need for health related information even more critical.
- Social networking applications at the individual level, which enable sharing of information between friends and social groups, especially in the COVID-19 era, where virtual meetings and communication have become the norm'.
- E banking and mobile banking applications that enable unbanked rural communities, to have ease of access and inexpensive banking facilities.
- Teleworking related applications for what has been popularised as working from home, have become critical since the advent of COVID-19, as even small businesses and projects, have had to be managed from home.
- Virtual meeting applications for both business and social meetings that cut travel and conference room costs and enable people to meet even during lock down periods.
- E marketing applications to enable rural people to market their produce and trade wares and gain access to wider markets.
- Various sector specific applications for different rural areas, together with relevant content so that information relating to health, tourism, training, food, mining and small scale manufacturing and the attendant services form a good foundation for a rural digital economy.
- E Government applications that enable government to disseminate information and offer services electronically in rural areas, have become necessary on the road to achieve the Sustainable Development Goals.

9.1.8 Capacity building

- Rural communities often lack the skills to use ICTs and to some extent maintain the equipment used. Capacity building is therefore a necessary component of the action that must be taken to ensure that rural and remote communities, are not left behind as broadband services are developed.
- A lot of work has been done by ITU and individual countries and institutions to build the required capacity to support access and use of ICTs by rural and remote communities.

9.1.9 Policies

- Many countries have promulgated laws or legal instruments to guide the implementation of universal access programs, particularly, how the universal access levy should be collected and how the revenue should be allocated for deployment of Telecommunication/ICTs.
- The BDT came up with a toolkit for regulators, governments, service providers and communities, to address the inadequate communication service delivery in developing countries and provide last mile connectivity solutions, to connect the unconnected people in developing countries.
- The Global symposium for Regulators came up with Best Practice Guidelines which recognized that flexible and innovative policy and

regulatory approaches can support and incentivize digital transformation.
- Regulatory policies in the form of high licence fees, levies, taxes and land use approval regimes, can be a barrier to deployment of telecommunications/ ICTs for rural and remote areas.

9.2 Recommendations

In order to resolve challenges that affect creation, upgrading and maintenance of infrastructure, the following measures are recommended:

- Telecommunication/ICT regulators need to make an effort to cooperate with Energy and Transport regulators when coming up with policies.
- Use Universal Service Funds to assist the energy and transport Sectors where this is necessary for requisite power and transport infrastructure required for ICT infrastructure to be rolled out is made available.
- Use of renewable energy to power base stations and other network equipment.
- Adopt pro-investment supply side policies when it comes to spectrum management.
- Focus should be in the following order:
  - National backbone infrastructure.
  - Last mile connectivity.
  - Basic data and voice services.
  - Internet access provision.
  - Relevant applications for Rural and Remote communities.
  - Local content generation and content relevant to specific rural populations.
  - Encourage shared infrastructure investment and sharing.
- Use spectrum frequency auctions to finance rural ICT infrastructure.
- Attach obligations to connect rural and remote areas when allocating radio-frequency spectrum.
- Regulators and existing large network operators need to keep an open mind and remove barriers encourage the investment and lower the operational costs.
- It is important for an optimum mix of licensing models should be used for connecting rural and remote areas. The mix can include Mobile Virtual Network Operator (MVNO) model, where operators who do not own infrastructure can offer services riding on the infrastructure of a larger operator, the community network model, where small and medium operators are run by local entrepreneurs or cooperation or groups and the hybrid model.
- Dig once' policies should be implemented in relation to the laying of fibre, in order to make the cost of installation affordable, while at the same time keeping service fees low.
- Policy interventions which include tax breaks and duty breaks, can go a long way to increase investment.
- Flexible Universal Fund policies which allow diversification of revenue sources, independent management of financial resources and flexible disbursement of resources are recommended for the achievement of Universal access and the WSIS action lines, leading to achievement of the Sustainable Development Goals.

- Governments should consider welcoming a wider range of technological solutions including emerging technologies in order to encourage innovation and broadband deployment in rural and remote areas.
- Creation of local contents is critical in stimulating demand. Production of content services and application should therefore be a key component of policy.
- Telecommunication/ICTs need to be made part of the entire education curricula for a country and capacity building, a key component of any country’s ICT policy.
- Universal access should be taken into account when telecommunication development policies are formulated, with particular focus on the strong link between the WSIS Action Lines and the SDGs of the 2030 Agenda for Sustainable Development.
- Policy makers are encouraged to adopt policies that will support efforts by mobile operators to provide affordable mobile internet services, particularly through removal of sector specific levy and taxes.
- ICT policy making should take into account the needs of people with disabilities and incorporate obligations relating to such people when licensing operators.
- Governments should make land available for installation of mobile towers and have clear policies and precision in the role of each Government department in the document approval chain for facilitating installations
- An enabling environment where no service provider or technology is favoured, should be created.
- Operators and investors should choose efficient, cost-effective and fast deployment technologies, business and policy models, to improve accessibility.
- An enabling environment where no service provider or technology is favoured, should be created.
- Operators should be innovative and Upgrade 2G network sites to 3G or 4G

Annex 1: Case studies presented by Region, Member States/Sector members/Associates /Academia

No.	Web	Title	Country/ Region	Key word	Related Chapter
1	1/29	International Internet connectivity of the Central African Backbone (CAB) fibre-optic project, Central African Republic component	Central African Republic/AF	International Internet connectivity, CAB, fibre-optic, Central African Republic component	2, 3, 4, 5, 8
2	1/30	Empirical analysis of factors determining mobile broadband penetration in sub-Saharan Africa	Higher Multinational School of Telecommunications (Senegal)/AF	Penetration, Broadband, adoption, Africa	1, 2, 3, 8
3	1/33	Village Network in Bhutan - Building the Digital Divide	Bhutan/ ASP	ICT, rural, network, infrastructure, community, ICT services	2, 3, 4, 5, 6, 7
4	1/44	Current situation, mechanisms and constraints in ensuring widespread availability of telecommunication/ICT services in rural and isolated areas	Burundi/AF	Ensuring widespread availability of telecommunication/ICT services in rural and isolated areas	1, 2, 3, 4, 8
5	1/57	Submarine cable connectivity from mainland to other small islands with Government funding to	India/ ASP	Universal Service Obligation Fund, ASEAN, SAARC, LDCs, LLDCs, SIDS	1, 2, 3, 4, 5, 8

No.	Web	Title	Country/ Region	Key word	Related Chapter
		provide reliable telecommunication and to increase broadband penetration in rural and remote islands			
6	1/66	Study topics for Question 5/1 in the current study period	KT Corporation, Korea (Rep. of)/ASP	Broadband, ICT solution/application, public-private partnership, job	2, 3, 4, 5, 6, 7
7	1/69	Expanding the new space for rural information consumption	China (People's Republic of)/ASP	Rural, information consumption, new space	1, 2, 3, 6, 7
8	1/125(Rev.1)	Broadband connectivity model for rural areas of developing countries	Cameroon/AF	Broadband connectivity, rural areas of developing countries	2,3
9	1/133	Survey on the status of ICT access and use in the rural areas of Madagascar	Madagascar/ AF	Internet, ICTs	2,3,6
10	1/136	Uncovered villages: Method to find out number of uncovered villages and government initiatives to provide mobile coverage	India/ASP	Access, villages	1,2,3,5, 6
11	1/137	Identifying determinants of satisfaction of	India/ASP	Common service centres, e-Government,	1,2,3,6, 8

No.	Web	Title	Country/ Region	Key word	Related Chapter
		intermediaries working as social entrepreneurs in rural and remote areas of LDCs and developing countries for delivery of e-Government services		service delivery, rural, developing countries, social entrepreneur.	
12	1/140	Telecommunications/ICTs for rural and remote areas	Guinea/AF	ICTs, broadband connectivity, development of rural and remote areas	2,3,4,6,8
13	1/152	Chapter 8: Public and regulatory policies relating to telecommunications/ICTs for rural and remote areas	Senegal/AF	Public policies; legal framework; universal service/access; rural and peri-urban areas	8
14	1/157(Rev.1)	Technology and strategy deployment to modernize the ICTs in rural and remote areas - Sudan case study	Sudan/AF	Access telecommunications and information technologies, modern technical solutions, broadband	1,2,3,4,5,6,8
15	1/160	Overview of the study to update the universal service strategy in Senegal (part 2)	Senegal/AF	Update, strategy, legal framework, universal service/access, rural and peri-urban areas	1,2,3,4,68,
16	1/169	ICT improvement initiatives in public and	Korea(Rep. of)/ASP	Broadband, ICT solutions, public Wi-Fi, Public	1,2,3,4,6,7

No.	Web	Title	Country/ Region	Key word	Related Chapter
		remote areas		Private Partnership, distance learning, remote areas, Broadband Commission report, capacity building	
17	1/201	Transition to high-speed, high-quality mobile broadband networks (5G)	Zimbabwe/AF	ICT skill sets, rural and remote areas, case study	1,2,5,6, 7,8
18	1/224	Transition to high-speed, high-quality mobile broadband networks (5G)	Intel/United States/AM	5G (IMT-2020), high-speed, high-quality, mobile, broadband, transition	5
19	1/225	Affordable and reliable optical cable backhaul solution standardized at ITU-T for use on the ground's surface to air to water in a DIY manner	Waseda Univ./ Japan/ASP	Urban-rural digital divide, affordable, reliable, optical cable, backhaul, on the ground’s surface	5
20	1/230	Importance and evolution of Wi-Fi	Intel/United States/AM	Wi-Fi, high-speed, wireless, broadband access, evolution	5
21	1/245	Broadband demand programs and financing mechanisms, for rural and remote	Intel/United States/AM	Broadband, demand, finance	3,4

No.	Web	Title	Country/ Region	Key word	Related Chapter
		areas			
22	1/251	Wi-Fi hotspot for public service delivery	Bhutan/ASP	*Wi-Fi hotspots, public service*	6
23	1/254	Connecting the Unserved – Broadband Access Networks and Trial with TV White Space Technology	Bhutan/ASP	TV White Spaces (TVWS), broadband access networks	3,5,6
24	1/268	Proposal for case studies of e-education in rural areas through ordinary use of emergency telecommunication systems	Japan/ASP	Emergency telecommunication, e-education, e-agriculture, rural communication, disaster drill	2,3,5,6
25	1/279	Mobile broadband in rural areas: The case of Sudan	Sudan/AF	Rural areas, ICTs, broadband	1,2,3,4, 5,8
26	1/302 (Rev.1) + Annex	Overview of the organization and functioning of the Steering and Monitoring Committee for universal service/ access	Senegal/AF	Electronic communication code; policies and strategies; universal service/access; rural and peri-urban areas	1,2,8
27	1/316	Improving the efficiency of universal services. Experience of the Russian Federation	Russian Federation/CIS	Universal services, broadband access, tariffs for universal services, remote regions	1,2,8
28	1/326	Satellite	Algeria	Satellite, 5G,	2,3,5

No.	Web	Title	Country/ Region	Key word	Related Chapter
		components for the 5G system	Telecom SPA/ Algeria/AF	non-terrestrial networks (NTN), 3GPP, chapter 3 Q1/1 draft report	
29	1/327 (Rev.1)	Managing and distributing Universal Service Funds in the United States	United States/ AM	Broadband, universal service funds, USF, rural development	1,2,4,8
30	1/338	Telecommunications/ICTs for rural and remote areas in the developing countries	DR Congo/AF	Access, telecentre, teleservices, communities	1,2,8
31	1/354	South African Broadband Policy and Strategy	South Africa/AF	Broadband expansion, connectivity, network	1,2,8
32	1/361	Promoting the use of 5G in regional environments, including rural and remote areas	Japan/ASP	5G, field trial, local 5G	2,3,5,8
33	1/375	Innovative approaches for universal service	China Telecom (People's Republic of China)	network, low tariff, e-commerce, platform	2,4,6
34	1/378	Updated information on the global status of 5G	Intel Corporation, USA	5G (IMT-2020), high-speed, high-quality, mobile, broadband, digital economy	2,5
35	1/379	Updated information on Wi-Fi 6 (IEEE	Intel Corporation, USA	Wi-Fi, high-speed, high-quality,	2,5

No.	Web	Title	Country/ Region	Key word	Related Chapter
		802.11ax)		wireless, broadband, evolution, digital economy	
36	1/382	Useful partnerships in ICT projects and programmes that enhance access to ICTs by rural and remote communities	Zimbabwe (Republic of)	partnership	2,4
37	1/384	ICT capacity building support program “IT Supporters” to bridge the information gap in Korea’s rural and remote areas	KT Corporation/R.O.Korea/ASP	Capacity building, rural and remote areas, underprivileged population, underserved population, disabled population, digital divide	2,7
38	1/386	Affordable and reliable optical cable backhaul solution and its implementation by following newly standardized ITU-T Recommendations	Waseda Univ./ Japan/ASP	Urban-rural digital divide, affordable, reliable, optical cable, backhaul, on the ground’s surface	2,3,5
39	1/389	Addressing barriers to mobile network coverage	GSMA	mobile broadband, taxation, policy, mobile networks, rural coverage	2,4
40	RGQ/11	Universal Access	Rwanda/AF	UAF,	2, 4, 6,

No.	Web	Title	Country/ Region	Key word	Related Chapter
		and Service Fund as a pivotal for rural development		broadband, rural and remote areas	7, 8
41	RGQ/30	Community cyber centres in Côte d'Ivoire	Côte d'Ivoire (Republic of)/ AF	Cybercentre, community	2, 4, 6, 8
42	RGQ/32	The case of Sanchar Shakti, the Indian Universal Service Obligation Fund's scheme for mobile value added services for rural women, an example of flexible, bottom Up, collaborative business models	India/ ASP	Gender, women, ICTs, universal service, ICTs for rural areas	2, 4, 6, 7, 8
43	RGQ/36	Proposal for the sustainable smart society	Japan/ASP	IoT sensors, visualization of information and data, smart city and society, renewable and eco-friendly, bio-mass power generation, clean energy, Big data analysis	2, 3, 5, 6, 8
44	RGQ/37	Accès numérique aux populations des zones reculées	Haïti/AM	Accès, intégration	2, 3, 4, 6, 7, 8
45	RGQ/39	ICT-applied farming method for producing muskmelon by an IT company	Daiwa Computer Co., Ltd. (Japan)/ASP	ICT control, IoT sensors for e-agriculture, hydroponic production for	2, 4, 5, 6

No.	Web	Title	Country/ Region	Key word	Related Chapter
				muskmelon	
46	RGQ/40	Télécommunications/TIC pour les zones rurales et isolées - les initiatives de la Guinée	Guinea (Republic of)/ AF	TIC, connectivité haut débit, développement des zones rurales et isolées	2, 4, 6, 8
47	RGQ/42	La problématique de l'introduction des nouvelles technologies de l'information et de la communication (TIC) dans l'enseignement au Mali	Mali/AF	*TIC, connectivité, ordres d'enseignements (éducation de base, secondaire et supérieure), nouvelles technologies, TIC, la problématique'*	2, 4, 6, 7, 8
48	RGQ/43	Aperçu de l'étude pour l'actualisation de la stratégie de Service Universel (SU) au Sénégal	Sénégal/AF	Actualisation, service/accès universel, zones rurales et périurbaines	2, 4, 5, 8
49	RGQ/44	Aperçu de l'étude pour l'actualisation de la stratégie de Service Universel (SU) au Sénégal	Sénégal/AF	Actualisation, service/accès universel, zones rurales et périurbaines	2, 4, 8
50	RGQ/46	Information on two publications based on twinning projects in Europe in 2017 (Poland, Albania, Slovenia)	BDT Focal Point for Questions 1/1 and 5/1/BDT	Twinning projects, Poland, Albania, Slovenia, QoS measurement tool, broadband infrastructure mapping	1, 2, 3, 5, 6

No.	Web	Title	Country/ Region	Key word	Related Chapter
51	RGQ/72	The needs of consumers: A perspective from Zimbabwe's telecommunications operators and consumer watch dogs	Zimbabwe/AF	Consumer needs	1, 2, 3, 6
52	RGQ/73	Enabling infrastructure, challenges in maintaining and upgrading infrastructure, ICT infrastructure for rural and remote areas and policies: Perspective from Zimbabwe's telecommunication operators	Zimbabwe/AF	/nfrastructure challenges and solutions	1, 2, 3, 4, 5, 8
53	RGQ/77	The role of Universal Communications Service Access Fund in connecting the unserved and underserved in Tanzania	Tanzania/AF	Unserved and underserved	2, 3, 4, 5, 8
54	RGQ/82	Universal services for rural and remote areas of the Russian Federation	Russian Federation/CIS	Universal service fund, tariffs for universal services, broadband, rural and remote areas	2, 3, 4, 8
55	RGQ/85	Empowering disadvantaged communities	Zimbabwe/AF	ICT Community Information Centres	2, 3, 4, 6, 7, 8

No.	Web	Title	Country/ Region	Key word	Related Chapter
		through telecommunications /ICTs: the case of Zimbabwe's universal service fund driven information communication technology centres			
56	RGQ/ 141	Communication for rural communities project initiatives in Sri Lanka	Sri Lanka/Asia Pacific	Universal access to unserved area, social and economic development, USF	1,2,5
57	RGQ/ 165	Contribution of ICT/telecommunication providers and operators to research, standardization, training, awareness-raising and studies	Côte d'Ivoire / Africa	Access, telecommunications/ICTs, financing	1, 2, 4, 8
58	RGQ/ 166	Establishment of multipurpose community telecentres in rural areas to bridge the digital divide in Burundi	Burundi/ Africa	Connectivity in rural areas, national optical fibre backbone, broadband Internet, multipurpose community telecentres	1, 2, 3, 6
59	RGQ/ 175 + Annex	The place of universal service/ access policy in the new Electronic Communication Code: overview of the Code's	Senegal /Africa	Updating electronic Communication Code, development strategy, legal framework,	1,2, 8

No.	Web	Title	Country/ Region	Key word	Related Chapter
		provisions and implementing decrees		universal service/access, rural and peri-urban areas	
60	RGQ/176	Expansion of telecommunication service coverage in remote and hard-to-reach communities of the Kyrgyz Republic	Kyrgyzstan/ CIS	Remote and rural areas, telecommunications	1,2,3,8
61	RGQ/177	Rural broadband deployment and its benefits in Burundi	Burundi/Africa	Rural connectivity, rural broadband deployment, ICTs rural services	2,8
62	RGQ/178	Adoption of the Digital Planning Roadmap in Burkina Faso	Burkina Faso/ Africa	Planning, digital divide, high-speed broadband, very high-speed broadband	8
63	RGQ/187	Women, ICTs, and Development	United States of America/Americas	Women, girls, ICTs and development	7
64	RGQ/193	Rural connectivity	United States of America/Americas	Broadband, ICTs, rural development	2,7,8
65	RGQ/195	Expansion of Brazilian broadband network (Structural Plan	Brazil/ Americas	Broadband expansion, network, PERT, community networks	2,4,8

No.	Web	Title	Country/ Region	Key word	Related Chapter
		for Telecommunication Networks) PERT			
66	RGQ/200	Access to banking services in remote, hard-to-reach and sparsely populated areas	Russian Federation/CIS	Remote areas, banking services, connectivity, identification	2,3,6
67	RGQ/209	Promoting last mile connectivity using reverse auctions	United States of America/Americas	Broadband, reverse auctions, rural development	4,8
68	RGQ/212	Using 5G in rural and remote areas: Lessons learned and implications from 5G trial service in Pyeongchang and other remote areas	Korea (Republic of)/ Asia Pacific	5G, 2018 PyeongChang Winter Olympics, 5G Fixed Wireless Access, FWA, Edge cloud center, UN Broadband Commission report, 5G Village	2,5
69	RGQ/217	Strengthening the construction of rural information infrastructure	China (People's Republic of)/Asia Pacific	Rural, information infrastructure, rural revitalization	2,3,6,7
70	RGQ/229	India's USOF model	India/Asia Pacific	Universal service, USOF	2,4,8
71	RGQ/239 + Annexes	FSM Connectivity Project - FSMTCC status report and presentation	FSM Telecommunications Corporation (Micronesia)/Asia Pacific	Implementation, submarine cable projects	2,4,5
72	RGQ/	Broadband	Zimbabwe/	Broadband	3,8

No.	Web	Title	Country/ Region	Key word	Related Chapter
	241	deployment as a means of meeting consumer needs in rural and remote areas	Africa	deployment, consumer needs	
73	RGQ/ 243	Socio-economic benefits of 5G services provided in mmWave Bands	Intel Corporation (United States of America)/Americas	5G, socio economic, benefits of mmWave	5
74	RGQ/ 256	Universal Service Fund - The Case of Kenya	Kenya/Africa	USF, access gaps	1,4,8

Annex 2: Summary of contents of case studies and input documents submitted during the study period

March 2018

Document 1/29 (Central African Republic)Case study) presents the current state of affairs with regard to the deployment of fibre-optic access in the Central African Republic. It was presented to the Q1/1 meeting in detail. The aspects related to strategies and policies for the deployment of broadband in developing countries and ICTs for rural and remote areas were highlighted. Some participants suggested that the group should collaborate with ITU-T Study Group 3.

Document 1/30 (ESMT, Senegal) Case study): The presentation of this document was postponed to the next meeting as the representative of the ESMT was absent.

Document 1/33 (Bhutan) Case study) presents a Village Network of Community Centers (CCs) established under the South Asia Sub-Regional Economic Cooperation (SASEC) Information Highway Project funded by Asian Development Bank (ADB). The village network enables Community Centers to serve as an access point for the rural population to have access to Government to Citizen (G2C) services and Internet services made available by Royal Government of Bhutan (RGoB). Lessons learnt and best-practices are also shared. Participants requested clear definitions of ‘rural area’ and ‘remote areas’. It was noted that a definition of ‘rural areas’ can be found in the Q5/1 report from the previous period.

Document 1/44 (Burundi) Case study) highlights the overall situation and possible means of ensuring the major additional investments that are needed to enable both public and private authorities to make telecommunication/ICT services widely available in rural and isolated areas in Burundi. Charges are high compared to neighbouring countries in East Africa.

Document 1/57 (India) Case study) shares information about the Indian Government initiative to connect its rural and remote islands to its mainland to provide reliable and affordable telecommunication services to these islands’ people so that they can also reap the benefits of high speed broadband and e-Governance initiatives. Due to the non-viable commercial conditions, the Indian Government is acting as a facilitator in proving the submarine link and will distribute bandwidth among TSP/ISP on non-discriminatory basis. India would like to share its experience gained through this project for proving connectivity solutions to SIDS/LDC/LLDC nations and seeks to collaborate with other member states to share expertise and build capacity.

Document 1/66 (KT Corporation, Republic of Korea) Case study) reflects the need to install cost-effective and sustainable basic telecommunication infrastructures in rural and remote areas. One of the key elements is a specific outcomes needed to be available for the vendor community to develop suitable solutions to meet the challenges in rural and remote areas. Current systems need to be more adequately adapted to specific rural requirements in order to be widely deployed. One other important aspect raised was studying public policies and regulatory measures, and business models related to

telecommunications/ICTs in rural and remote areas. The meeting was invited to consider the suggestions made in this document when discussing Q5/1 study topics.

Document 1/69 (People's Republic of China) Case study) briefly introduces the latest situation of rural information consumption groups, network infrastructure and application services in China, and noted that the upgrading of rural information consumption still faces many short boards. It puts forward some suggestions for further expansion and upgrading of rural information consumption from the aspects of use skills, network terminals and application and promotion.

Document 1/84 shares a list of extracted lessons learned from the contributions received for the ITU-D SG1 meeting.

September 2018

Document SG1RGQ/11 (**Rwanda**) Case study) highlighted different initiatives taken by Rwanda to foster optimal use of ICTs for empowering rural communities through Universal Access and Service Fund as a financing mechanism. It also highlighted Rwanda's rural schools internet connectivity project implemented through the smart Rwanda Master plan, ICT enabled agricultural development in Rwanda and the ICT support provided to people living with disabilities. The contribution was discussed at length and suggestions were made to make sure that appropriate software for people with disabilities was also included in the support.

Document SG1RGQ/30 (**Côte d'Ivoire**) Case study) described the launch of a project comprising 5 000 community cyber centres in Côte d'Ivoire for localities of 500 or more inhabitants. The project was launched for purposes of providing access to ICTs for all the country's inhabitants. The pilot phase started with 12 sites, of which 11 are in post offices and one is in a town hall.

Document SG1RGQ/32 + Annex (**India**) Case study) outlined the case of Sanchar Shakti, the Indian Universal Service Obligation Fund's Scheme for Mobile Value Added Services for Rural Women, an example of Flexible, Bottom Up, and Collaborative Business Models. The project was started as a way of recognising the special ICT needs of rural women.

Document SG1RGQ/36 + Annex (**Japan)** gave an account of the work of Shiojiri municipality which is implementing Internet of Things environmental information sensor networks in order to improve the life of local people. The city introduced an optical fiber network connecting public facilities in the city and established information and incubation plaza for the purpose of nursing the IT literate population. Shiojiri municipality has almost completed the eco-friendly and biomass power plant to supply its ICT networks and 20,000 households autonomously in preparation for emergencies. Participants commended Japan for the project and agreed that it would be included in the Q5/1 report.

Document SG1RGQ/37 (**Haiti**) Case study) highlighted the establishment of ICT access zones in Haiti's rural and remote areas.

Document SG1RGQ/39 (**Daiwa Computer, Japan** – SME pilot participant IT company, Daiwa Computer Co.Ltd, Case study) for producing muskmelons in green houses which contributed to the income generation for the company and

collaborating farmers. It was developed in collaboration with other IT companies and academia. ICT applied farming for the production of muskmelon in green house proved to be cost effective, increased productivity and reduced the labour of farmers. This e-agricultural method was going to be replicated to other agricultural products. The contribution was received well by participants. After discussion, it was agreed to include the content into the case study section of the report.

Document SG1RGQ/40 (**Guinea**) Case study) provided an overview of the deployment of a fibre optic backbone by the Government of Guinea which has assisted with access to ICTs by rural communities.

Document SG1RGQ/42 (Rev.1) (**Mali**), Case study) provided an insight into the introduction of ICT into the Mali school curriculum, especially in the basic and secondary levels of education through Multi-media School centres with proposed funding of the Connected Multimedia School Centers (CMSC) by the Regulatory Authority. Priority in diffusion of ICTs was given to schools and universities in order to improve learning and reduce the digital divide in the education system. It was noted that there was need for ICT education to be introduced at much lower levels than secondary school. Participants welcomed the contribution and recommended ICT education be introduced earlier than secondary level education.

Document SG1RGQ/43 (**Senegal**), Case study) , provided an overview into Senegal's commitment to making access to telecommunications services a priority for all populations in rural and peri-urban areas. It highlighted the maturity of Senegal's Universal Service Consortium pilot phase for the operation of a telecommunications network in the Matam region of northern Senegal, in order to cover the various localities of the region. It also highlighted current efforts to update the Universal Service (SU) strategy in Senegal, adopted in 2018. Participants noted that most African Countries were using the Universal service Funding and it was important to find out if other sources of funding could also be used.

Document SG1RGQ/44 + Annexes (**Senegal**) (Case study) shared some elements of the experience of West African Regional Economic Communities (RECs), with regards to policies and strategies for the development of the Universal Telecommunication Service, particularly the Economic Community of West African States (ECOWAS), which is comprises fifteen (15) member countries located in West Africa (Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo). These countries have both cultural and geopolitical ties, and share a common economic interest. It also shared the experience of the West African Economic and Monetary Union (UEMOA) made up of eight (8) member states (Benin, Burkina Faso, Ivory Coast, Guinea Bissau, Mali, Niger, Senegal, Togo).
Document SG1RGQ/61 (**Zimbabwe**) (Case study), proposed text for the introductory chapter of the draft report on Question 5/1. The text analysed the previous study Reports, particularly the Report from the 2014-2017 study period and highlighted the key findings, including challenges and proposed solutions to such challenges. It also highlighted the areas that the current study has to concentrate on, based on the previous Reports, the Buenos Aires Action Plan of the 2018 World Telecommunication Development Conference

and the Geneva Action Plan of the World Summit on the Information Society (WSIS), as they relate to the study Question on ICTs for rural and remote areas. Participants agreed to incorporate the text into the report, subject to any modifications that may be necessary during the course of the study.

Document SG1RGQ/72 (**Zimbabwe**) (Case study), highlighted telecommunication consumer needs from the perspective of Zimbabwe's mobile telecommunication service providers and consumer watchdogs. The contribution cited access needs, social and economic needs of telecommunication consumers in Zimbabwe. E-education, e-agriculture, mobile banking and e-health, featured repeatedly in the feedback on consumer needs obtained by the Telecommunications Regulatory Authority of Zimbabwe following a circular for feedback sent to the service providers. It was recommended that the contents be incorporated into chapter 1 of the report.

Document SG1RGQ/73 (**Zimbabwe**) (Case study) highlighted challenges that persist in Zimbabwe's remote areas and that inadequate power infrastructure and supply and transportation networks are the main challenges faced. Additional challenges include cost of gadgets, unavailability of finance, environmental challenges, and cultural resistance to ICT installations and lack of skills. These affect both installation of ICT infrastructure and maintenance of ICT infrastructure. The contribution made recommendations on the solutions for the challenges.

Document SG1RGQ/77 (**Tanzania**) (Case study) provided an overview of details of the role played by the Universal Communications Service Access Fund (The Fund) of Tanzania in bridging the digital divide/ICT access gap between urban and rural population. It also listed some of the challenges faced in implementing the same.

Document SG1RGQ/82 (**Russian Federation**) (Case study) provided an overview of the activities undertaken by the Russian Federation to provide universal services in rural and remote areas of the country in order to bridge the digital divide. The contribution highlighted the best practices of the Russian Federation in providing universal services in sparsely populated territories, the activities of the universal service operator, universal service tariff policy and the current situation regarding the universal services to be considered for inclusion in the Q5/1 report.

Document SG1RGQ/85 (**Zimbabwe**) (Case study), shared a case study of the ICT Community Information Centre programme being run by Zimbabwe's Universal Services Fund (USF). The Programme's main objective is to promote access to telecommunications/ICTs for all Zimbabweans, be they in urban, rural or remote areas. Further to that, it is expected to narrow the digital divide between urban and rural communities, rich and the poor, as well as between genders. To achieve this, the programme provides relevant infrastructure, Internet service, equipment and free ICT literacy training. Noteworthy is that the entrepreneurially minded gain access to economic information related to their agricultural and other economic projects and markets. Students use community information centres as research facilities that allow them an opportunity to search for university places and possible employment opportunities.

Document SG1RGQ/46 + Annex (**BDT Focal Point for Europe)**directed the readers to two past publications elaborated as outcomes of two twinning projects which are relevant to the ITU-D Study Group 1 Questions. These projects provide approaches that can be replicated by other Member States. In a twinning project between Poland and Albania, technical specifications for a tool to measure quality of service were developed (link). A twinning project between Albania and Slovenia focused on broadband infrastructure mapping (link).

Document SG1RGQ/56 + Annex (**BDT Focal Point for Q6/1**) shared an overview of the adopted the GSR 2018 Best Practice Guidelines which recognized that flexible and innovative policy and regulatory approaches can support and incentivize digital transformation. These best practices allow regulators to respond to the changing landscape and address the continuing need for secure and reliable ICT infrastructure, affordable access to and delivery of digital services, as well as protect consumers and maintain trust in ICTs.

Document SG1RGQ/66 + Annex (**BDT Focal Point for Europe**) further highlighted the outcomes of the workshop on “The Future of Cable TV” which was held in January 2018 in Geneva. It was jointly organised by the ITU Development Bureau and Standardization. The workshop was conducted within the context of the European Regional Initiative approved by WTDC-17 on “Broadband Infrastructure, Broadcasting and Spectrum Management”, in terms of which assistance is provided to countries in need on the assessment of dynamics, challenges and opportunities of diverse broadband technologies across Europe, including cable TV.

Liaison statements:

Document SG1RGQ/ADM/2 provides the list of incoming liaison statements and allocation for ITU-D Study Group 1 Rapporteur Group meetings.

To review the mapping of ITU-T and ITU-D work three documents were considered. Document SG1RGQ/1 contained the liaison statement from the Chairmen of ITU-D SG1 and SG2 that was sent to ITU-T study groups following the annual ITU-D SG1 and SG2 meeting which took place from 30 April to 11 May 2018.The ITU-D SG1 and SG2 Rapporteur were invited to review the mapping and make any updates as deemed necessary. Three tables related to the matching of ITU-D SG1 and SG2 Questions of interest to ITU-T study groups were shared. Document SG1RGQ/10 (**ITU-T Study Group 2**) shared ITU-T Study Group 2’s updated input for the mapping. Document SG1RGQ/22 + Annex (**ITU-T Study Group 11**) contained the response of ITU-T SG11 for the mapping.

The mapping document and related tables were considered and participants were going to take a further look into the mapping and any necessary improvements.

Initial mapping of ITU-R and ITU-D work

Document SG1RGQ/84 (**ATDI, France**) was a first attempt to provide a mapping from ITU-D SG1 and SG2 Questions to ITU-R Working Parties (WPs). The group noted the mapping and added reference from Q5/1 to ITU-R WP1A.

March 2019

Document 1/125(Rev.1)**(Cameroon)**(case study) presents a case study of Cameroon's telecentre project which Cameroon earmarked in order to bridge the digital divide between rural and urban areas. It proposes broadband connectivity models and connectivity solutions suited for rural areas in developing countries. A remote participant from **Nigeria** informed the meeting that the Internet Society (ISOC) had done a lot of work in this area and could be encouraged to provide contributions to the Question.

Document 1/132 which contains proposed draft text on capacity building for Chapter 7 of the Q5/1 final report. The document highlights the necessity of training technical staff and details strategies to promote small non-profit community operators.

Document 1/133 (**Madagascar)**(case study) provides a survey on the status of ICT access and use in the rural areas of Madagascar. The survey was carried out in 2018 in order to quantify ICT access and use by households and individuals and identify areas for improvement, particularly in rural/remote areas. In response to a question from **Côte D'Ivoire** on whether or not people with disabilities had been included in the survey, Madagascar advised that where any household included a person with disabilities, the results included data pertaining to the person. Vice-Rapporteur Mr Babou Sarr from **Senegal** highlighted the need to ensure that in any survey, the sample selection process and size are adequate for accurate results.

Document 1/136 **(India)**(case study) reflects a new method adopted by the Department of Telecommunications in India to identify the number of villages that are unconnected, based on user feedback through getting the actual covering data from these villages through the mobile network. Previously there had been gaps in data regarding the number of villages connected via mobile network as these had been based on telecommunication service providers' coverage approximation. The new method assists the government in finding out the actual number of uncovered villages. The collected data is used to plan projects to have all villages covered. In response to comments from **Brazil**, **Mauritania** and **Côte D'Ivoire**, **India** confirmed that the surveys they had carried out involved collecting data through all operators across all rural areas in the country. India also informed the meeting that the country had not faced any serious challenges in utilizing universal service funds to have the villages connected.

Document 1/137 **(India)** (Case study) contribution draws attention to research on the effective provision of e-Government services by the Indian government to rural areas. It highlights that provision of services can be greatly improved by increasing the satisfaction levels of social entrepreneurs (or Intermediary manned outlets) who are responsible for providing ICT infrastructure and support to e-Government service.

Document 1/140 **(Guinea)**(case study) provides information on initiatives undertaken in the country to build an information society that is people-oriented, inclusive, and secure, and that catalyses in a cross-cutting manner the development of other aspects of people's social and economic lives. This vision is embodied in the National Programme for Social and Economic Development and the National Policy and Strategy Document for the Development of ICTs and the Digital Economy.

Document 1/152 (**Senegal)** (Case study) shares experiences of countries, and regional and international organizations, with regard to public policies and other measures relating to the legal framework for telecommunications/ICTs in rural and remote areas. It provides recommendations to promote the development of universal service/access, particularly in developing countries.

Document 1/157(Rev.1) **(Sudan)**(case study) shares information on the latest situation in Sudan in relation to ICTs and strategies in rural and remote areas, and provides an overview of the methods and strategies used in deploying ICTs. In response to a question from **Tanzania** whether Sudan had experienced any ownership problems with regard to the infrastructure built through universal service funds, **Sudan** informed the meeting that that it they had not and that the funds were mostly used for rural and remote areas. Document 1/160 (**Senegal**)(case study) provides an overview of Senegal's commitment to making access to telecommunications services a priority for all populations in rural and peri-urban areas. The document highlights the legal aspects of the Universal Telecommunication Service strategy in Senegal, particularly with reference to a new Electronic Communications Code for the country.

Document 1/169 (**Rep. of Korea)**(case study), highlights how Korea Telecom (Rep. of Korea) has worked in partnership with the Ministry of Post & Telecommunications Cambodia (MPTC) and Telecom Cambodia (TC) to provide public Wi-Fi and distance learning for schools in rural and remote areas of Cambodia.

Document 1/201 **(Zimbabwe)**(case study), provides input from telecommunication operators in Zimbabwe on the deployment of broadband in rural and remote areas, regulatory initiatives to narrow the digital divide and capacity building. The **United States** commended the innovative approach by Zimbabwe of getting input from operators who are the normal providers of infrastructure and services in the rural areas and suggested that other administrations could use this approach.

Document 1/224 (**Intel Corporation, United States**), , provides information on the transition to high-speed, high-quality-broadband 5G mobile broadband networks including the importance of Sub-1 GHz and FWA (Fixed Wireless Access) for the rural areas.

Document 1/225 (**Waseda University, Japan**) introduces the use of a light weight optic fibre cable covered by stainless sheath and polyethylene and which is standardized by ITU-T Recommendation L.1700 (2016) together with Recommendations L.110 (2017) and L.163 (2018). The cable is considered affordable and reliable for backhaul solutions when deploying infrastructure in rural and remote areas.

Document 1/230 (**Intel Corporation, United States**), shares an overview of the importance and evolution of Wi-Fi for high-speed wireless broadband access (including the complementary role of Wi-Fi in 5G and importance of Wi-Fi for the rural areas).

Document 1/245 (**Intel Corporation, United States**), provides information on broadband demand programs and financing mechanisms for rural and remote areas with focus on the Chapter 4 of the Q5/1 final report.

Document 1/251 (**Bhutan**)(case study) was presented by Bhutan. It highlights the use of Wi-Fi hotspots for public service delivery in 20 Dzongs, 4 Gewogs and 2 Thromde offices over the country. The Royal Government of Bhutan funds the pilot project.

Document 1/254 (**Bhutan**)(case study), also presented by Bhutan, shows how Bhutan's Ministry of Information and Communications (MoIC) reached out to operators in the country to gather case studies that could be of interest to the ITU-D study groups. This document contains two such case studies, one on a Trial with TV White Space Technology and one on Broadband Access Networks.

Document 1/150 (**BDT Focal Point for Q5/1**), shares information on work related Smart Green Villages and Internet of Things (SGVs & IoTs). The contribution summarises two initiatives planned by the BDT on Smart Green Villages and Internet of Things (SGVs & IoTs) that may be useful for developing countries.

Documents1/168 + Annexes (**BDT Focal Point for Q4/1**) contains 2018 data and charts from the annual ITU Tariff Policies Survey on Infrastructure development and sharing. It provides an overview of the trends in this area across the ITU membership which may be of interest to Q5/1.

Document 1/178 + Annexes (**BDT Focal Point for Q1/1**) highlights 2018 data from the annual ITU World Telecommunication/ICT Regulatory and Tariff Policies Surveys on regulatory practices related to universal service (definition, funding and financing, obligations, activities funded, etc.), broadband and ICT policies and plans, IXPs and municipal networks. It provides an overview of the trends in this area across ITU membership.

October 2019

Document SG1RGQ/141 **(Sri Lanka)**(case study informs about a study initiated in Sri Lanka Gamata Sanniwedanaya Gamata, to identify unserved and underserved areas in Sri Lanka and three such districts were identified. Field investigation was then undertaken in the districts, to check fixed and mobile voice service and broadband service availability. The study was made using a mobile monitoring vehicle to manually check signal strength, and identify areas where there was weak signal and service provision. Through comparing the results of the investigation with coverage information provided by operators, the Telecommunications Regulatory Commission of Sri Lanka (TRCSL) found that that coverage in the region was below satisfactory. Solutions, such as, raising mobile base stations were expected to improve broadband coverage to all identified unserved and underserved areas.

Document SG1RGQ/165 (**Côte d'Ivoire)**(also for Q1/1)(case study) provides a practical example which can be implemented in other countries to finance projects for public benefit. The case study shows how Côte d'Ivoire has developed multiple sources of financing for telecommunication/ICT projects for public benefit. The project involves ICT/telecommunication providers and operators contributing to research, standardization, training, awareness-raising and studies, as a result of a Decree issued by the country's Government in November 2014. The decree sets the contribution rates for the allocation of ICT/telecommunication sector resources to public structures and the terms of payment. The document was well received and allocated to Chapter 4 of the final Report.

Document SG1RGQ/166 **(Burundi) (case study)** highlights how Burundi had established multipurpose community tele-centres, in order to connect rural areas and enable residents to connect to broadband Internet, thereby bridging the digital divide. The project was being implemented in four of the country's 18 provinces, with plans to extend it to all provinces by 2025. This was made possible by the existence of a national optical fibre network connecting Burundi to the submarine telecommunication cables of neighbouring countries. This was implemented by the Burundi Government with financing from the World Bank. The optical fibre management company which manages the fibre network, the Burundi Backbone System (BBS), was established in 2013 and is jointly owned by the Government and network operators.

Document SG1RGQ/175 + Annex (**Senegal)**(case study shares information of Senegal's Digital 2025 strategy. The strategy proposes that the legal framework of the telecommunication/ICT sector and its governance be updated. The contribution highlights the Senegalese Government's determination to implement universal access through decrees, in application of the country's electronic communications code. The purpose of the first decree is to define the implementing modalities for universal service/access and the organizational and operational rules for the country's Universal Telecommunication Service Development Fund (FDSUT), added Mr Sarr.

Document SG1RGQ/176 (**Kyrgyz Republic**) (also for Q1/1)(case study) explains how the unique natural setting and geographical terrain of the country, which led to the formation of cities in the valleys and villages in remote areas and mountain gorges, impacted the level of development and penetration of telecommunication services, as well as the technologies used. The result was use of mostly wireless technology to connect 31 cities and about two thousand villages. The contribution also provides information on how different measures adopted by the Government, including the installation of optical fibre for both backbone and national distribution networks. This helped to ensure access to modern communication services, not only in cities, but also in remote rural areas. Land use reforms were also implemented to expedite telecommunication/ICT installations.

Document SG1RGQ/177 (**Burundi**)(case study) outlines the latest development in rural broadband and digitalisation of 10 of 18 rural provincial offices in Burundi. It describes new initiatives related to broadband internet services for rural and remote areas undertaken by the Burundi Government to further promote universal rural telecommunication/ICT services and facilitate coordinated urban and rural development. It highlighted how the Government with financing from the World Bank, constructed 8,000 km of optic fibre around the country, covering the entire national territory, in order to provide Bujumbura and all provinces, with access to reliable broadband, while reducing costs. High maintenance costs have however been problematic.

Document SG1RGQ/178 (**Burkina Faso**)(also for Q1/1, Q6/1)(case study) provides information on the Digital Planning Roadmap adopted by the Government of Burkina Faso. The contribution further explained how this roadmap was going help reduce the country's digital divide in terms of access to high-speed and very high-speed broadband by 2030.

Document SG1RGQ/187 (**United States**)(also for Q1/1)(case study) provides a list of current and recent US exchange programs, focused on bridging the

digital gender divide. Some of the programs directly build capacity or enhance skills in ICT, while others encourage general empowerment of women and girls by providing the tools they need to create a more stable, democratic, and prosperous world. The contribution attracted a lot of debate and the Unites States was commended for bringing into the study, the gender gap issues. The meeting agreed that the gender issue be incorporated into the final Report of the Question. It was suggested that the issue could be explored as an annual deliverable for the Question (maybe with other Questions).

Document SG1RGQ/193 (**United States**)(case study) provides a list of current and recent United States programs with a focus on enabling rural connectivity in developing countries. Some of these programs directly work on technical support to developing countries to enable rural connectivity, while others support countries with policies and national strategies for connectivity.

Document SG1RGQ/195 (**Brazil**)(also for Q1/1)(case study) provides an overview and explained the expansion of Brazilian broadband network. According to the contribution, currently in Brazil, there are 4,482 municipalities covered with 4G technology, 5,454 municipalities with 3G, and 570 municipalities with 2G, with over 228 million Mobile Phone Service (SMP) subscriptions.

Document SG1RGQ/200 (**Russian Federation**)(case study) examines best practices in providing accessible banking services to people living in remote, hard-to-reach and sparsely populated areas. The federation working with the Post Bank, has introduced digital technologies and solutions to accelerate financial inclusion for the entire population, including hard-to-reach and sparsely populated areas, thereby ensuring universal access to these services

Document SG1RGQ/209 (**United States**)(also for Q1/1)(case study) provides an overview of how the United States Federal Communications Commission (FCC) is promoting last mile connectivity by using rural broadband “reverse auctions.” The contribution also suggested a broad list of best practices for using reverse auctions, and an annex provides an example of how bidding in in such and Auction works. The contribution generated a lot of interest and debate. The ITU Study Group 1 Chair proposed that a workshop on reverse auctions could be held to explore the concept, together with other financing mechanisms.

Document SG1RGQ/212 (**Republic of Korea** details how Korea utilized 5G for connectivity during the Seoul Olympics and extended the project to provision of connectivity in some rural and remote villages. The document gave insights into utilizing 5G to connect remote areas as evidenced by Korea’s village network solutions.

Document SG1RGQ/213 **(Côte d’Ivoire)** highlights the Lomé (Togo) workshop organized by the West African Regulators Association from 26 to 28 June 2019, where policy makers and Telecommunication/ICT Regulatory Authorities, discussed the need to consider community networks as a viable form of connectivity. The participants at this workshop call for reflection at the international level through the ITU for a more global response to this concept. The vocabulary committee could also be seized.

Document SG1RGQ/217 (**People’s Republic of China**)(case study) highlights the Telecommunication Universal Service policy and practices in China. It also

outlines measures to promote the construction of rural information infrastructure and mechanisms to achieve deep network coverage in rural and remote areas, as well as, and how to enrich the application of rural internet, guide and encourage residents in poor areas to use broadband.

Document SG1RGQ/229 (**India**)(case study) shares the model of the Universal Service Obligation Fund (USOF), rules and regulations, resources for collecting Universal Service Levy, and major programs. The contribution explains how with funding from USOF, apart from public service providers, private telecommunication service providers are creating infrastructure in remote and rural villages, and providing telecommunication services. India's infrastructure project termed the 'BharatNet project' is the first pillar of the Digital India Programme and has been hailed as the largest rural connectivity project of its kind in the world.

Document SG1RGQ/232 + Annex (**BDT Focal Point for Europe**) is a summary of the activities of the ITU Office for Europe for 2019, which included workshops and projects. It provided key outcomes, where possible, actions taken and events already held, as well as relevant web links to outcome reports and to event web pages. It also summarizes upcoming actions for 2019 and lists the 2019 training status of the ITU Europe network of Centres of Excellence.

Document SG1RGQ/236 (**Intel Corporation, United States**), presented by Vice-Rapporteur Mr Muluk, provides updated information on the global status of 5G, based on information from the Global Mobile Suppliers Association. The report identifies 769 operators running LTE networks and providing mobile and/ or fixed wireless broadband services in 225 countries worldwide.

Document SG1RGQ/239 + Annexes (**Federated State of Micronesia Telecom (Micronesia**)(case study), shares information on the implementation of current and future submarine cable projects in the Federated States of Micronesia (FSM) .The optic submarine cable system links four states, (Yap, Chuuk, Pohnpei, Kosrae) thereby connecting thousands of inhabited small islands. Challenges faced included right-of-way, lack of expertise, marine maintenance costs and training. The contribution was well received, as it was the first contribution that Q5/1 had received from a Small Island Developing State. The contribution was detailed and informative.

Document SG1RGQ/241 (**Zimbabwe**)(case study)(also for Q6/1), highlights the link between satisfaction of consumer needs and access to broadband. It concludes that investment, solutions to the digital divide, research and innovation, are key elements for broadband roll out and affordability of broadband access. The contribution recommends resolution of the problems related to these key elements in order to improve broadband coverage, broadband adoption and consumer satisfaction. Participants proposed that the document also be shared with Question 1/1 as it contained useful information for that question. The need to avoid duplication when writing reports for Questions which receive common contributions was stressed.

Document SG1RGQ/243 (**Intel Corporation, United States**)(case study), highlights the socio-economic benefits of 5G services provided in mmWave Bands. According to the results of a study contained in the document, 2034 mmWave spectrum will result in an increase of USD565 billion in global GDP and USD 152 billion in tax revenue, producing 25% of the value created by 5G.

Document SG1RGQ/254 (**The Association for Progressive Communications**) highlights how connectivity models for urban environments cannot simply be transplanted to rural areas and why many approaches to addressing rural connectivity fail. It recommends bottom-up approaches, which involve local communities and have real potential to address digital exclusion and incentivise economic growth.

Document SG1RGQ/256 (**Kenya**)(case study), Kipsaita, highlights Universal Service Fund projects in Kenya which include E-resource centres, research and development on universal access, computerisation of health centres, digitization of the education curriculum, programmes for people with disabilities, community telecentres and school based ICT centres. The fund also embarked on a project to construct new telecommunication infrastructure to provide mobile services to cover 80% of the geographical area in identified sub- locations. Two operators, Safaricom and Telkom Kenya Ltd, were awarded the contracts to construct the infrastructure.

Document SG1RGQ/259 highlights key lessons learned from the various contributions and provides a quick reference for use by administrations and' by the Question 5/1 team, in preparing its report. The lessons includes the realisation that rural areas are still largely unconnected and there is need to use a variety of measures including linking developing countries with submarine cables and constructing tele- centres in order to connect the rural areas.

Document SG1RGQ/258 shares for information ideas for collaboration with WSIS platform. The link between Question 5/1 was noted and it was agreed to explore ways of taking advantage of the WSIS activities, particularly in relation to action lines C1, C2, C3, C4 and C7.

Document SG1RGQ/ADM/25 contains a list of all documents submitted to Question 5/1 for the meeting.

Document 1/ADM/20 contains all the liaison statements that were submitted to SG1 Questions, including Question 5/1, for the September 2019 meetings.

Liaison statements:

Document SG1RGQ/132 + Annexes (**ITU-T Study Group 5**)(mapping) on ITU inter-sector coordination was reviewed and the proposed changes to add linkages between ITU-D SG1 Q5/1 and ITU-T SG5 Q4/5, Q6/5, Q7/5 and Q9/5 to the existing mapping was noted.

Document SG1RGQ/134 + Annexes (**ITU-T Study Group 20**)(mapping) on ITU inter-sector coordination did not include any updates and was noted.

Document SG1RGQ/150 (**ITU-R Working Party WP4B**)(also for Q1/1, Q1/2, Q5) on interrelated activities of ITU-R and ITU-D in response to Resolution ITU-R 69 (RA-15) was acknowledged and the information on integration of satellite technologies with other technologies, to connect rural areas the information was found relevant for Chapter 5 of the final Report. The meeting agreed to send a response to ITU-R-WP4B.

Document SG1RGQ/154 (**ITU-R Working Party WP4A**)(also for Q1/1, Q1/2, Q5/2) also on interrelated activities of ITU-R and ITU-D in response to Resolution ITU-R 69 (RA-15) was reviewed. The meeting noted the draft

revision of recommendation in ITURS1782-0 on possibilities for global broadband internet access by fixed satellite and agreed that it would be useful to receive any future updates on the subject matter. It was therefore agreed to send an appropriate response to ITU-R WP4A.

Document SG1RGQ/157 (**ITU-T Study Group 15**)(also for Q1/1) on contributions from developing countries was noted. The liaison statement draws the attention of the Q5/1 team to contributions submitted to SG15 for its July 2019 meeting, notably contributions from the Democratic Republic of Congo, the Central Africa Republic, Palestine and Guinea Conakry. The information was found useful for Chapter 5 of the Q5/1 final Report. The meeting agreed to send an appropriate response to ITU-T SG15.

Document SG1RGQ/159 + Annex (**ITU-T Study Group 15**) on inter-Sector coordination was reviewed. The meeting noted the mapping of Q5/1 to ITU-T SG15 Q1/15 and Q16/15 on coordination of access and home network transport standards and optimal physical structure, and, agreed to request relevant information as necessary.

Document SG1RGQ/216 (**ITU Coordination Committee for Terminology (ITU CCT)**)(also for Q1/1) informs that at its 17 June 2019 meeting the ITU-CCT had not come up with a general definition of the terms “broadband, broadband access” and variants such as, “low-speed, medium-speed and high-speed broadband” that would suit the context of work of all the parties involved.

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Document 1/268 (**Japan**)(case study) highlights a study on e-education and agricultural consultation through ordinary use of portable emergency telecommunication systems in the rural areas of Nepal.

Document 1/279 (**Sudan**)(case study) provides insight into challenges faced by Sudan in rolling out broadband in rural and remote areas. A key challenge is the limitation of network infrastructure (optical-fibre).

Document 1/302 (Rev.1) + Annex (**Senegal**)(case study) updates previous contributions by Senegal on universal service access. The document highlights the establishment of a well-structured, participative and transparent governance model for the Universal Service Access Fund and the policies that relate to it.

Document 1/308-E contains the abridged report of a workshop held by the Question 5/1 Rapporteur Group at the ITU Headquarters in Geneva on 25 September 2019, on the topic of broadband development in rural and remote areas.

Document 1/316 (**Russian Federation**)(case study) provides updated information on work being done by the Russian Federation to provide universal services in rural and remote areas of the country, with the objective of eliminating the digital divide, and in particular on key aspects of a new legislative bill amending the Federal Communications Act.

Document 1/326 (**Algérie Télécom SPA, Algeria**)(case study) introduces aspects of integrating satellite and non-terrestrial networks (NTN) in 5G, according to the work of 3GPP as there is increasing interest for an integrated

satellite and terrestrial network infrastructure in the context of 5G. The **United States** intervened and noted that the document highlights early inputs to external standardization processes and that it might be premature to include much of this information in the Q5/1 report until those processes have concluded. It was suggested that a liaison statement between Question 5/1 and the relevant ITU-R study groups be sent to seek further information before including the information in the Q5/1 Final Report. This was agreed.

Document 1/327 (Rev.1)(**United States**)(case study) provides details of how the Universal Service Funds in the United States are managed and how effective the management framework is in promoting the acceleration of broadband connectivity in rural and remote areas. The contribution provides useful information for the part of the Draft Final Report related to financing models.

Document 1/331(**People's Republic of China**), provides information on the construction and deployment of management-based big data platforms to promote universal telecommunication services.

Document 1/338 (**Democratic Republic of Congo**) (case study) notes that one inexpensive way of democratizing access to new information and communication technologies is to provide each community in a socially underprivileged geographical area with teleservices (telephone, fax, Internet, telex, radio). Telecentres are deemed community-serving, because they bring together all available telecommunication facilities and other computer-assisted services for the benefit of the entire community, obviating the need for a portable phone and receiver for each household.

Document 1/354 (**South Africa**) (case study) on request of the submitter this document was deferred to the next meeting.

Document 1/361 (**Japan**) (case study) presents Japan's efforts to develop an environment for using 5G in regional or rural areas, focusing on 5G comprehensive demonstration tests and the concept of 'Local 5G'. As part of the demonstration tests, field trials have been carried out to study how 5G can address regional needs, including those in rural areas. Local 5G provides local communities with access to frequencies for deploying 5G networks locally to address regional needs.

Document 1/375 (**China Telecom, People's Rep. of China**).The document details the innovative approach used by China Telecom in coming up with ways of ensuring universal service and access for Sichuan Province, which has a poor economy and is characterized by complicated terrain, thereby reducing the digital divide. The approaches used are aimed at ensuring network construction and incentivizing network use in the area, by designing packages and tariffs that are cheaper and tailored for the communities. Smartphones and broadband terminals were offered for free to encourage use.

Document 1/378 (**Intel Corporation, United States**) provides updated information on the global status of 5G and the importance for developing countries. It underlines that for the timely introduction of commercial 5G services, the assignment of 5G related low-mid-high frequency bands to operators is important.

Document 1/379 (**Intel Corporation, United States**) provides updated information on the progress of Wi-Fi 6 (IEEE 802.11ax) technology. It highlights that Wi-Fi 6 technology is ready to utilize the 6 GHz spectrum for next generation applications.

Document 1/382 (**Zimbabwe**) highlights different types of partnerships, together with details that reflect their indirect impact on the financial burden of connecting rural areas. These partnerships include public-public partnerships, public-private partnerships, intergovernmental partnerships and partnerships between international organizations and specific countries.

Document 1/384 (**KT Corporation, Rep. of Korea**)(case study) provides details of Korea Telecom's capacity building program which has seen 3.3 million Koreans and 16 thousand institutions benefit. Those trained people receive information technology qualification certificates. The programme is carried out in conjunction with various government agencies, regional governments and Non-Governmental Organizations.

Document 1/386 (**Waseda University, Japan**)(case study) shares the information on two practical examples of implementation of optical fibre rural connectivity solution. The solution follows new ITU-T Recommendations L.1700, L.110 and L.163 that identify the requirements of the solution for affordably and quickly narrowing the urban-rural digital divide.

Document 1/389 (**GSMA**) provides information on the barriers to mobile network coverage. It also includes information for policy-makers to adopt policies that will support mobile operators' efforts to provide affordable mobile internet services.

Document 1/362 + Annexes (**BDT**), introduced by the **BDT focal point for Question 5/1**, contains a toolkit for regulators, governments, service providers and communities to address the inadequate communication service delivery in developing countries. It offers last mile connectivity solutions to connect the unconnected people in developing countries. Participants were invited to submit their comments to BDT within the next two weeks. There was also mention of a forthcoming report on power supply.

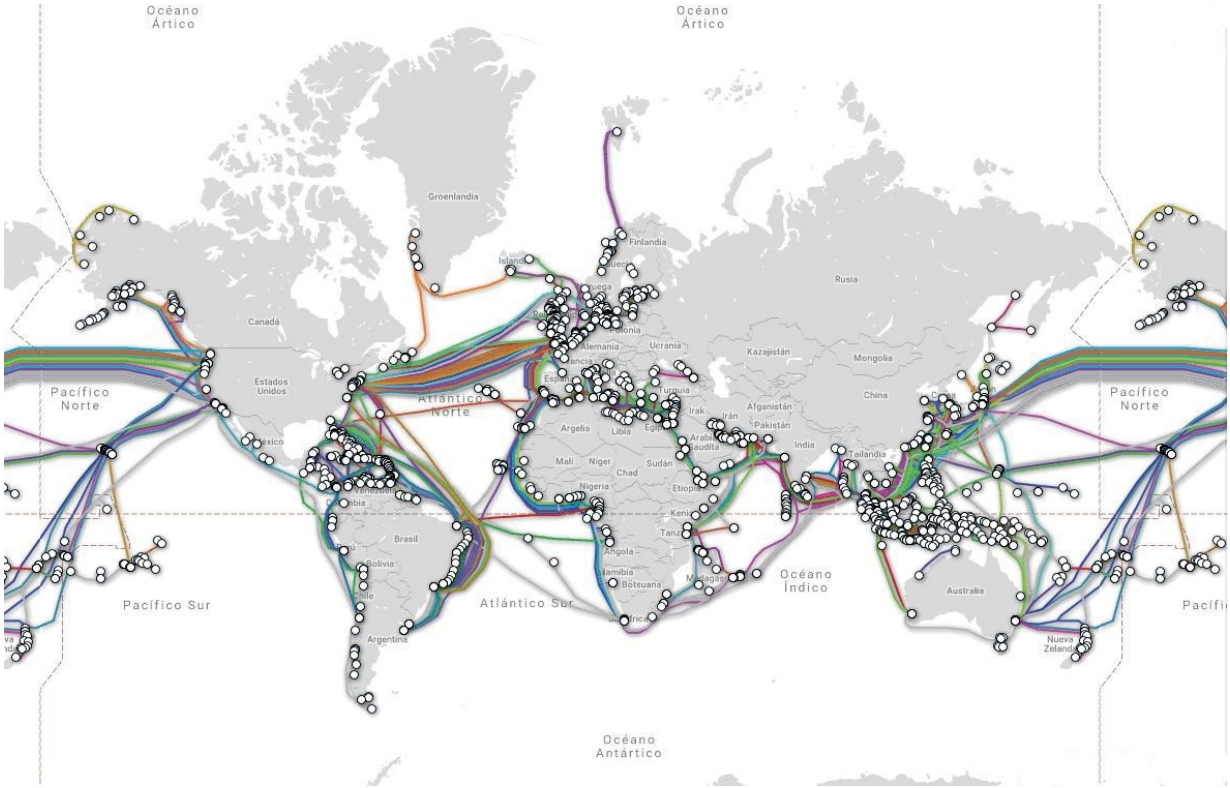
Document 1/ADM/32 contains a list of all documents submitted to Question 5/1 for the current study period so far. Document 1/398 contains a list of the lessons learnt from the various documents submitted to Question 5/1 for the current meeting.

Liaison statements:

Document 1/295 (**ITU-R Study Group 5**) shared the revised Question ITU-R 238-3/5 on "Mobile broadband wireless access systems"

Document 1/294 (**ITU-R Study Group 5**) shares for consideration the revised Question ITU-R 77-8/5 on "Consideration of the needs of developing countries in the development and implementation of IMT".

Annex 3: Map of the global submarine cable network



Source: Submarine Cable Map by TeleGeography (Accessed 12/12/2019)

Annex 4: Listing of submarine cables (A-Y)

ACS Alaska-Oregon Network (AKORN)	Aden-Djibouti	Adria-1	AEConnect-1
Africa Coast to Europe (ACE)	Alaska United East	Alaska United Southeast	Alaska United Turnagain Arm (AUTA)
Alaska United West	ALBA-1	Aletar	Alonso de Ojeda
ALPAL-2	America Movil Submarine Cable System-1 (AMX-1)	America Movil-Telxius West Coast Cable	American Samoa-Hawaii (ASH)
Americas-I North	Americas-II	Amerigo Vespucci	Antillas 1
APCN-2	Aphrodite 2	Apollo	Aqualink
ARBR	ARCOS	ARSAT Submarine Fiber Optic Cable	Asia Africa Europe-1 (AAE-1)
Asia Pacific Gateway (APG)	Asia Submarine-cable Express (ASE)/Cahaya Malaysia	Asia-America Gateway (AAG) Cable System	Atisa
Atlantic Crossing-1 (AC-1)	Atlantis-2	Atlas Offshore	AU-Aleutian
AURORA Cable System	Australia-Japan Cable (AJC)	Australia-Papua New Guinea-2 (APNG-2)	Australia-Singapore Cable (ASC)
Avassa	Azores Fiber Optic System (AFOS)	Bahamas 2	Bahamas Domestic Submarine Network (BDSNi)
Bahamas Internet Cable System (BICS)	Balalink	BALOK	Baltic Sea Submarine Cable
Baltica	Bass Strait-1	Bass Strait-2	Basslink

Batam Dumai Melaka (BDM) Cable System	Batam Sarawak Internet Cable System (BaSICS)	Batam Singapore Cable System (BSCS)	Batam-Rengit Cable System (BRCS)
Bay of Bengal Gateway (BBG)	Bay to Bay Express (BtoBE) Cable System	BCS East	BCS East-West Interlink
BCS North - Phase 1	BCS North - Phase 2	BERYTAR	Bharat Lanka Cable System
Bicentenario	BlueMed	Bodo-Rost Cable	Boracay-Palawan Submarine Cable System
Boriken Submarine Cable System (BSCS)	Botnia	Brazilian Festoon	BRUSA
BT Highlands and Islands Submarine Cable System	BT-MT-1	BUGIO	C-Lion1
Cabo Verde Telecom Domestic Submarine Cable Phase 1	Cabo Verde Telecom Domestic Submarine Cable Phase 2	Cabo Verde Telecom Domestic Submarine Cable Phase 3	CADMOS
CAM Ring	Canalink	CANDALTA	CANTAT-3
Caribbean Regional Communications Infrastructure Program (CARCIP)	Caribbean-Bermuda U.S. (CBUS)	Caucasus Cable System	Cayman-Jamaica Fiber System
Ceiba-1	Ceiba-2	Celtic	Celtic Norse
CeltixConnect-1 (CC-1)	CeltixConnect-2 (CC-2)	Challenger Bermuda-1 (CB-1)	Channel Islands-9 Liberty Submarine Cable
Chennai-Andaman & Nicobar Islands Cable	Chuuk-Pohnpei Cable	Circe North	Circe South
COBRAcable	Colombia-Florida Subsea Fiber (CFX-	Columbus-II b	Columbus-III

	1)		
Comoros Domestic Cable System	Concerto	Converge ICT Domestic Submarine Cable	Coral Sea Cable System (CSCS)
Corse-Continent 4 (CC4)	Corse-Continent 5 (CC5)	Cross Straits Cable Network	Crosslake Fibre
Curie	DAMAI Cable System	Danica North	DANICE
Denmark-Norway 5	Denmark-Norway 6	Denmark-Poland 2	Denmark-Sweden 15
Denmark-Sweden 16	Denmark-Sweden 17	Denmark-Sweden 18	Dhiraagu Cable Network
Dhiraagu-SLT Submarine Cable Network	Diamond Link Global	Didon	Djibouti Africa Regional Express 1 (DARE1)
Dumai-Melaka Cable System	Dunant	E-LLAN	EAC-C2C
East-West	East-West Submarine Cable System	Eastern Africa Submarine System (EASSy)	Eastern Caribbean Fiber System (ECFS)
Eastern Light	ECLink	Elektra-GlobalConnect 1 (GC1)	EllaLink
Emerald Bridge Fibres	Energinet Laeso-Varberg	Energinet Lyngsa-Laeso	England Cable
Equiano	ESAT-1	ESAT-2	Estepona-Tetouan
Europe India Gateway (EIG)	FALCON	Far East Submarine Cable System	FARICE-1
Farland North	FASTER	Fehmarn Bält	Fiber Optic Gulf (FOG)
Fibra Optica Austral	Fibralink	Finland Estonia Connection (FEC)	Finland-Estonia 2 (EESF-2)
Finland-Estonia 3	FLAG Atlantic-1	FLAG Europe-Asia	FLAG North

(EESF-3)	(FA-1)	(FEA)	Asia Loop/REACH North Asia Loop
Flores-Corvo Cable System	FLY-LION3	FOS Quellon-Chacabuco	Gemini Bermuda
Geo-Eirgrid	Georgia-Russia	Germany-Denmark 2	Germany-Denmark 3
Glo-1	Glo-2	Global Caribbean Network (GCN)	GlobalConnect 2 (GC2)
GlobalConnect 3 (GC3)	GlobalConnect-KPN	GlobeNet	GO-1 Mediterranean Cable System
Gondwana-1	Greenland Connect	Greenland Connect North	GTMO-1
GTMO-PR	GTT Atlantic	GTT Express	Guadeloupe Cable des Iles du Sud (GCIS)
Guam Okinawa Kyushu Incheon (GOKI)	Guernsey-Jersey-4	Gulf Bridge International Cable System (GBICS)/Middle East North Africa (MENA) Cable System	Gulf of California Cable
Gulf2Africa (G2A)	H2 Cable	Hainan-Hong Kong Submarine Cable System	HANNIBAL System
HANTRU1 Cable System	Havfrue/AEC-2	Hawaiki	Hawk
HICS (Hawaii Inter-Island Cable System)	HIFN (Hawaii Island Fibre Network)	High-capacity Undersea Guernsey Optical-fibre (HUGO)	Hokkaido-Sakhalin Cable System (HSCS)
Hong Kong-Americas (HKA)	Hong Kong-Guam (HK-G)	Honotua	i2i Cable Network (i2icn)
IMEWE	INDIGO-Central	INDIGO-West	Indonesia Global Gateway (IGG) System

INGRID	Interchange Cable Network 1 (ICN1)	Interchange Cable Network 2 (ICN2)	International Gateway (IGW)
IOX Cable System	IP-Only Denmark-Sweden	Ireland-France Cable-1 (IFC-1)	Isles of Scilly Cable
Italy-Albania	Italy-Croatia	Italy-Greece 1	Italy-Libya
Italy-Malta	Italy-Monaco	JaKa2LaDeMa	JAKABARE
Jakarta Surabaya Cable System (JAYABAYA)	Jakarta-Bangka-Bintan-Batam-Singapore (B3JS)	Jambi-Batam Cable System (JIBA)	Janna
Japan Information Highway (JIH)	Japan-Guam-Australia North (JGA-N)	Japan-Guam-Australia South (JGA-S)	Japan-U.S. Cable Network (JUS)
JASUKA	Java Bali Cable System (JBCS)	Jerry Newton	Jonah
Junior	JUPITER	Kanawa	Kattegat 1
Kattegat 2	Kerch Strait Cable	KetchCan1 Submarine Fiber Cable System	Kodiak Kenai Fiber Link (KKFL)
Korea-Japan Cable Network (KJCN)	Kumul Domestic Submarine Cable System	Kuwait-Iran	La Gomera-El Hierro
Labuan-Brunei Submarine Cable	Lanis-1	Lanis-2	Lanis-3
Latvia-Sweden 1 (LV-SE 1)	Lazaro Cardenas-Manzanillo Santiago Submarine Cable System (LCMSSCS)	Lev Submarine System	LFON (Libyan Fiber Optic Network)
Libreville-Port Gentil Cable	Link 1 Phase-1	Link 1 Phase-2	Link 2 Phase-1
Link 2 Phase-2	Link 3 Phase-1	Link 3 Phase-2	Link 4 Phase-2
Link 5 Phase-2	Lower Indian Ocean Network (LION)	Lower Indian Ocean Network 2 (LION2)	Luwuk Tutuyan Cable System (LTCS)
Lynn Canal Fiber	MainOne	Malaysia-Cambodia-	Malbec

		Thailand (MCT) Cable	
Malta-Gozo Cable	Malta-Italy Interconnector	Manatua	Mandji Fiber Optic Cable
Maple Leaf Fibre	MAREA	Mariana-Guam Cable	Mataram Kupang Cable System (MKCS)
Matrix Cable System	Mauritius and Rodrigues Submarine Cable System (MARS)	Maya-1	Med Cable Network
MedNautilus Submarine System	Melita 1	Meltingpot Indianoceanic Submarine System (METISS)	Mid-Atlantic Crossing (MAC)
Middle East North Africa (MENA) Cable System/Gulf Bridge International	Miyazaki-Okinawa Cable (MOC)	Monet	Moratelindo International Cable System-1 (MIC-1)
N0R5KE Viking	National Digital Transmission Network (NDTN)	Nationwide Submarine Cable Ooredoo Maldives (NaSCOM)	NATITUA
Nelson-Levin	New Cross Pacific (NCP) Cable System	Nigeria Cameroon Submarine Cable System (NCSCS)	NordBalt
North Sea Connect (NSC)	North West Cable System	Northern Lights	NorthStar
Nunavut Undersea Fibre Optic Network System	NYNJ-1	Okinawa Cellular Cable	Oman Australia Cable (OAC)
OMRAN/EPEG Cable System	Oran-Valencia (ORVAL)	Orient Express	OTEGLOBE Kokkini-Bari
Pacific Caribbean Cable System (PCCS)	Pacific Crossing-1 (PC-1)	Pacific Light Cable Network (PLCN)	Palapa Ring East
Palapa Ring Middle	Palapa Ring West	Palawa-Iloilo Cable System	Pan American (PAN-AM)

Pan European Crossing (UK-Belgium)	Pan European Crossing (UK-Ireland)	Pan-American Crossing (PAC)	Paniolo Cable Network
PASULI	PEACE Cable	PENBAL-5	Pencan-8
Pencan-9	Persona	PGASCOM	Picot-1
PIPE Pacific Cable-1 (PPC-1)	Pishgaman Oman Iran (POI) Network	PLDT Domestic Fiber Optic Network (DFON)	PNG LNG
Polar Circle Cable	POSEIDON	Prat	Qatar-U.A.E. Submarine Cable System
Quintillion Subsea Cable Network	Redellhabela-1	Rockabill	Russia-Japan Cable Network (RJCN)
Rønne-Rødvig	S-U-B Cable System	Saba, Statia Cable System (SSCS)	SABR
SAFE	Saint Maarten Puerto Rico Network One (SMPR-1)	Sakhalin-Kuril Islands Cable	Samoa-American Samoa (SAS)
San Andres Isla Tolu Submarine Cable (SAIT)	SAT-3/WASC	Saudi Arabia-Sudan-1 (SAS-1)	Saudi Arabia-Sudan-2 (SAS-2)
Scandinavian Ring North	Scandinavian Ring South	Scotland-Northern Ireland 1	Scotland-Northern Ireland 2
SEA-US	sea2shore	Seabras-1	SEACOM/Tata TGN-Eurasia
SeaMeWe-3	SeaMeWe-4	SeaMeWe-5	SEAX-1
Segunda FOS Canal de Chacao	Seychelles to East Africa System (SEAS)	SHEFA-2	Silphium
Singapore-Myanmar (SIGMAR)	Sirius North	Sirius South	Sistem Kabel Rakyat 1Malaysia (SKR1M)
SJJK	Skagenfiber East	Skagenfiber West	Skagerrak 4

SMPCS Packet-1	SMPCS Packet-2	Solas	Sorsogon-Samar Submarine Fiber Optical Interconnection Project (SSSFOIP)
South America-1 (SAm-1)	South American Crossing (SAC)	South Asia Express (SAEx2)	South Atlantic Cable System (SACS)
South Atlantic Express (SAEx1)	South Atlantic Inter Link (SAIL)	Southeast Asia Japan Cable (SJC)	Southeast Asia-Japan Cable 2 (SJC2)
Southern Caribbean Fiber	Southern Cross Cable Network (SCCN)	Southern Cross NEXT	St. Pierre and Miquelon Cable
St. Thomas-St. Croix System	Strategic Evolution Underwater Link (SEUL)	Subcan Link 1	Subcan Link 2
Sumatera Bangka Cable System (SBCS)	Suriname-Guyana Submarine Cable System (SG-SCS)	Svalbard Undersea Cable System	Swansea-Brean
Sweden-Estonia (EE-S 1)	Sweden-Finland 4 (SFS-4)	Sweden-Finland Link (SFL)	Sweden-Latvia
SxS	Taba-Aqaba	Taino-Carib	Taiwan Strait Express-1 (TSE-1)
Tamares North	Tampnet Offshore FOC Network	Tangerine	Tanjun Pandan-Sungai Kakap Cable System
Tannat	Tarakan Selor Cable System (TSCS)	Tasman Global Access (TGA) Cable	TAT-14
Tata TGN-Atlantic	Tata TGN-Gulf	Tata TGN-Intra Asia (TGN-IA)	Tata TGN-Pacific
Tata TGN-Tata Indicom	Tata TGN-Western Europe	TE North/TGN-Eurasia/SEACOM/ Alexandros/Mede	Telstra Endeavour

		x	
Tenerife-Gran Canaria	Tenerife-La Gomera-La Palma	Tenerife-La Palma	TERRA SW
Thailand-Indonesia-Singapore (TIS)	The East African Marine System (TEAMS)	Tobrok-Emasaed Cable System	Tonga Cable
Tonga Domestic Cable Extension (TDCE)	Trans-Pacific Express (TPE) Cable System	TRANSCAN-2	TRANSCAN-3
Transworld (TW1)	Trapani-Kelibia	TT-1	Tui-Samoa
Turcyos-1	Turcyos-2	Tverrlinken	UAE-Iran
UGARIT	UK-Channel Islands-7	UK-Channel Islands-8	UK-Netherlands 14
Ultramar GE	Ulysses 2	Unisur	Unity/EAC-Pacific
Venezuela Festoon	Vodafone Malta-Sicily Cable System (VMSCS)	WALL-LI	WARF Submarine Cable
West African Cable System (WACS)	Yellow		

Source: PriMetrica, Inc. (Last updated on 5 December 2019)