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APC Submission to the ITU Open Consultation (online and physical) on Expanding Internet Connectivity for the Council Working Group on International Internet Related Public Policy Issues (CWG-Internet)

https://www.itu.int/en/council/cwg-internet/Pages/default.aspx

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1. Background

CWG-Internet has invited all stakeholders to submit contributions on international internet-related public policy issues relating to expanding internet connectivity, focusing on the following questions:

1. What are the challenges and opportunities for expanding Internet connectivity, particularly to remote and under-served areas? What are the roles of governments and non-government actors in overcoming these challenges?
2. Are there particular challenges facing land-locked countries in securing affordable Internet access? What can be done to overcome these challenges?
3. How can small/community/non-profit operators help in promoting the increase of Internet connectivity?

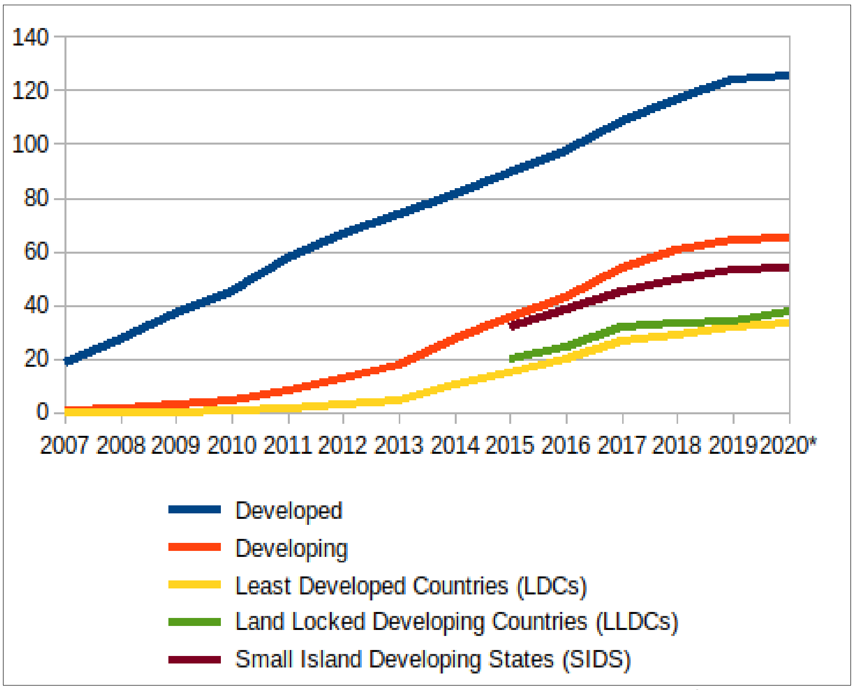
As part of its ongoing support for the work of the ITU CWG, the following presents the responses of ITU sector member, the Association for Progressive Communications (APC), to the above questions. APC welcomes this opportunity to contribute to the topic. As an international network of civil society organisations founded in 1990 APC is dedicated to helping to build a world in which all people have easy, equal and affordable access to the creative potential of ICTs to improve their lives and create more democratic and egalitarian societies. In line with this goal APC has been a member of ITU-D and ITU-R since 2014.

2. Responses to the Questions

1 What are the challenges and opportunities for expanding Internet connectivity, particularly to remote and under-served areas? What are the roles of governments and non-government actors in overcoming these challenges?

It has been close to three decades since the internet and mobile network technologies became widely available, yet almost half the world still remains unconnected[1]. The ITU's latest statistics show that growth in uptake of internet services from mobile networks continued to slow in 2019 as shown in the chart below. This is particularly noticeable for developing countries, where for the last three years, per capita mobile broadband subscriptions have remained in the low 60s percentage-wise, while the least developed and landlocked countries languish below 40%.

Chart: Percentage of population with a mobile broadband subscription



Source: ITU Facts and Figures 2020[2]

The expansion of connectivity to the rest of the world's population will therefore require major and concerted global effort, leveraging new technologies, approaches and business models, while addressing ongoing constraints to telecom infrastructure development resulting from limitations in policy and regulatory environments. An effort that is made all the more urgent in the context of the Covid-19 pandemic.

Governments play the key role in this process, to eliminate the key barriers to telecom infrastructure improvements, using an 'ecosystem' approach based on co-ordinated efforts at national and international levels to address all the remaining bottlenecks currently constraining connectivity growth. In this respect, APC also observes that aside from the

1 The latest ITU estimate is that 51% of people in the world were online in 2019 https://www.itu.int/en/myitu/News/2020/12/11/08/36/Universal-connectivity-urgency-billions-offline-Doreen-Bogdan-Martin

2 https://www.itu.int/en/ITU-D/Statistics/Pages/facts/default.aspx

need to address remote and under-served areas with new infrastructure, these efforts are also necessary for the billions of existing subscribers who are ‘barely connected’ due to the high cost of use, who need more affordable flat-rate environments. It is also important to guard against hype around the potential of some new and emerging technologies such as 5G and AI, which, while potentially improving the experiences of people already connected in urban areas, can distract attention from the urgency of expanding basic internet access, attracting capital that would otherwise be used on initiatives that aim to address digital inclusion.

From a technological perspective, there are also many exciting developments that help to improve connectivity options, including low cost Software Defined Radio (SDR) for GSM/LTE and TV White Space spectrum sharing, mesh networking and long distance low power WiFi, LoRa and HF radio data links. All of these technologies have been tested in the field by a number of APC’s members and partners operating small/community/non-profit networks[3]. While they show much promise, their potential to scale and to go beyond trials and demonstrations to widespread deployment is largely hampered by the lack of conducive national policy and regulatory environments which present a number of barriers to these operators.

There are a wide range of actions[4] governments and regulators can take to address these issues, centering around the recognition that commercial national network operators can be complemented by a diversity of small/community/non-profit and and social-purpose networks operated by local authorities, small businesses, co-operatives, NGOs and voluntary associations of users. Many of these have already been quick to adopt new technologies where regulations allow, demonstrating their agility and interest in providing services in areas unserved by national commercial networks. The most important elements to here are:

- Establishing appropriate licensing fees for small/community/non-profit network operators and limiting license compliance burdens

- Providing access to sufficient radio spectrum by promoting sharing of the largely unoccupied spectrum assignments in remote areas and making new wavebands available

- Ensuring that small/community/non-profit operators have equal access to voice and data interconnection with other domestic operators,

- Using Universal Service Funds to support the many and diverse local initiatives which can now help to address goals for universal access in under-served areas.

There are many other key measures necessary to expand internet access that some governments are already taking to improve the environment for investing in connectivity infrastructure for all operators, such as making more spectrum available, imposing infrastructure sharing and dig-once requirements, or providing public access facilities, which continue to be an important means of addressing connectivity needs where people cannot afford their own high speed connections or access devices, or simply lack a safe and supportive space for navigating the internet. In addition, adoption of clear targets and

3 https://www.apc.org/en/project/connecting-unconnected-supporting-community-networks-and-other-community-based-connectivity

4 See this APC report for further details of the measures that government actors are adopting https://www.apc.org/en/pubs/expanding-telecommunications-operators-ecosystem-policy-and-regulatory-guidelines-enable-local

monitoring mechanisms helps to ensure that the effectiveness of policies and regulations can be measured.

Indirect factors that limit access and demand also need to be addressed by national administrations. The most important of these are limited energy supply, lack of basic ICT literacy, e-money platforms and other applications and content of local relevance, along with import duties or other taxes on ICT products and services that limit uptake.

Non-governmental actors also play a key role in addressing many of the issues described above including:

- Establishing Private-public partnerships (PPPs) in backbone infrastructure investment

- Supporting awareness raising activities among communities, governments and development actors to increase their knowledge of the range of potential options available for remote and under-served areas to gain access, along with the policy and regulatory support gaps.

- Supporting capacity building events among local actors to build the skills needed to deploy and operate small/community/non-profit scale networks.

- Supporting content and applications development to provide information, communication and transaction services useful to remote and under-served communities.

- Providing financing for wholesale backbone infrastructure, national retail networks and small/community/non-profit infrastructure deployment initiatives.

- Providing inputs to national policy development through public consultations.

While such measures can all have a strong impact on the expansion of internet connectivity, there is also an overarching point frequently ignored in efforts to address the access gap. Those with the least connectivity are primarily also those who are most excluded economically, socially and politically. Their lack of access is first and foremost a result of this exclusion, and while the internet may present opportunities for some social advancement, it will not alter the structural social and economic processes that cause inequality and exclusion in the first place.

Similarly, the discrimination women face on the basis of social and cultural norms is one of the most pronounced causes of the gender digital divide. Often women cannot own devices since men are favored in the household, women's internet usage is monitored by men, women face greater threats and violence online, and women are under-represented in STEM (science, technology, engineering and mathematics) spaces.

2 Are there particular challenges facing land-locked countries in securing affordable Internet access? What can be done to overcome these challenges?

Levels of internet access are particularly low in the land locked LDCs, many of which lack population scale/density or economic development levels to attract sufficient commercially driven competitive infrastructure development, and must often also pay for transit capacity from neighbouring countries to connect to the global internet transit providers. However if governments, internet providers, telecommunication and data centre operators are able and willing to collaborate, they can share the cost of infrastructure and co-invest in the needed facilities with willing support from development partners.

A recent example is Burkina Faso's establishment of a virtual landing and internet exchange point this year[5] with support for a fibre link to the border with Ghana for onward connection. This is expected to considerably reduce the cost of international capacity and increase the choices available to operators in Burkina Faso for purchasing transit links to the global networks. At the same time Burkina Faso continues to seek options to increase the reliability of its international infrastructure by diversifying its cross-border connections with at least one, ideally two or more links to each of its neighbouring countries. In addition the country benefits from the progressive regional regulatory environment in West Africa, where the regional economic community of ECOWAS has mandated all of its member states to ensure that the region's landlocked countries have equal access to the submarine capacity available from the coastal states.

Land-locked countries may also be subjected to interception or internet shutdowns given their underlying international connectivity will run through neighbouring countries, and would be prone to interruption whether it be intentional or accidental, having a devastating effect on the critical nation infrastructure and major disruptions to services across various sectors within a particular land-locked country. This underscores the importance of securing international agreements on internet shutdowns for landlocked countries.

3 How can small/community/non-profit operators help in promoting the increase of Internet connectivity?

Off-the-shelf digital network equipment has now become widely available and as a result, there are increasing numbers of small/community/non-profit public networks based on these new low-cost Wi-Fi, GSM/LTE and fiber technologies. Driven by the involvement of the local population in their deployment, governance and maintenance, these initiatives are often non-profit social purpose enterprises, usually called "community networks". Their numbers are still relatively small, mainly due to limited awareness of new opportunities to self-provide communications infrastructure, but also because of the various regulatory barriers referred to above and covered more extensively in APC's recent report[6] on Policy and regulatory guidelines to enable local operators. Nevertheless a rapidly increasing number of community networks are now operating in at least 25 developing countries[7].

While small/community/non-profit networks have recently begun receiving growing attention as one of the potential means of helping to address digital exclusion, they are clearly not the only answer to this problem. For example, in some developing countries, access to national commercial networks has recently been extended into some more remote areas by operators using new low-cost mobile base station equipment, low-earth orbit satellites or even high altitude platforms (HAPS) such as Google's Loon. Other initiatives have focused on infrastructure sharing strategies and/or dedicated rural

5 https://www.telecompaper.com/news/burkina-deploys-new-internet-exchange-point-and-virtual-landing-point--1353359

6 https://www.apc.org/en/pubs/expanding-telecommunications-operators-ecosystem-policy-and-regulatory-guidelines-enable-local

7 See: https://www.giswatch.org/community-networks and for detailed information on community networks in developing and developed countries. Also see: https://www.apc.org/en/pubs/community-networks-case-studies

wholesale mobile operators[8] which spread the costs of their networks by selling services to multiple retail operators. However there are also still very few of these types of initiatives, and their effectiveness in different contexts is not yet well understood. In addition, these strategies may not address the needs of the many that live on low-incomes in more urban areas, where there may already be coverage from commercial networks, but effective usage is not affordable.

While knowledge of the potential for community networks in different environments is also still relatively low, many of their features suggest that they can be particularly effective at addressing connectivity needs. In particular, due to their low usage fees, levels of adoption in community networks may be higher than in commercial networks because they are usually based on cost-recovery rather than maximizing profit. In addition community members can often gain access by making in-kind contributions, such as labour, or providing electricity and/or a building and roof to host equipment and masts. Community networks also often have specific social objectives such as supporting local content and skills development, and addressing the exclusion of women and other marginalized groups, which can improve the potential to ensure inclusion of all members of the community, rather than only those with the ability to pay.

Aside from the well-documented benefits of access to voice and internet services that connectivity offers to remote and under-served populations in the global South, as well as the commercial benefits to existing national networks from the traffic generated by the local network users, social impact research carried out by APC shows that community networks have a range of other economic and social benefits[9]. For example, in the rural areas studied, where the only other means of internet access is through mobile operators, it was found that many of the frequent users interviewed spent between 10% to 40% of what they had previously spent on mobile data.

There are many forms of community networks, not only in terms of the different communication technologies adopted, but also in their institutional structure and governance models. Different levels of community involvement and related institutional models reflect local and national cultures and socioeconomic contexts. Depending on the legal environment for cooperatives vs. non-profit associations and clubs, the cooperative or non-profit membership association models appear particularly well suited to small/ community/non-profit network endeavours. Rural cooperatives in telecommunication, energy production, savings, agriculture and food distribution have already existed for decades in both developed and developing countries. So it appears these models may become more widely adopted among community networks, given the objective of providing affordable communications combined with the cultures of resilience, community involvement and resource sharing present in rural areas, or provoked by community networks. These models also fit well with network topologies comprised of wireless links between neighbouring homes which share the available capacity.

The earliest instances of community networks actually focused on the provision of voice telephony over copper cables, which emerged in the USA at the beginning of the 1900s when rural residents set up cooperatives to manage their infrastructure. Many still continue today as the 850 member organizations of the Rural Broadband Association[10]. Although similar electricity co-operatives were subsequently established, this model for operating

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8 For e.g Africa Mobile Networks (AMN) http://www.africamobilenetworks.com

9 See Section 3 of the APC community networks case study report for further examples of benefits https://www.apc.org/en/pubs/community-networks-case-studies

10 http://www.ntca.org

infrastructure services did not become widely adopted in other parts of the world, and it was not until the 1970s and 1980s that other forms of community networks emerged, where communications infrastructure was set up by academic and research groups, and NGO communities[11], prior to the internet as we know it today.

These networks were initially built on public telecom infrastructure using cables designed for voice services, and many of these organisations later set up their own optic fibre and wireless networks, and some even launched micro-satellites[12], mainly for research purposes. Although these types of community networks reflect the basic principle of 'self-provision', they were essentially private network deployments by organisations wishing to augment their internal connectivity needs. It was not until the turn of this century that the general public began to set up extensive numbers of their own networks, triggered by the development of low-cost Wi-Fi routers using license-exempt radio frequencies[13]. Using these devices community groups set up networks to split the cost of broadband connections, improve network performance, and to share access to local online information servers. Now well-established in developed countries, some Wi-Fi-based community networks have tens of thousands of members (e.g. APC member Guif.net in Catalonia (Spain), Freifunk in Berlin and NYC Mesh in the city of New York[14]).

The growth of these networks has also been assisted by the mesh networking protocols which have been added to some Wi-Fi routers, making it easier to join a community network because the routers automatically interconnect directly with each visible neighbour to create a reliable 'mesh network[15]' which create the shortest route to the destination. These protocols also make it possible to route around obstacles such as buildings and hills that may block wireless signals, and in addition, the networks are more resilient because the networks usually have multiple upstream routes and can automatically select the neighbouring device with the most efficient path for the transmission of traffic.

Depending on their level of functionality and power, Wi-Fi routers now only cost between USD 20 and USD 200, although shipping charges and import duties can double their cost, particularly in developing countries. In 2019 a new low-cost open hardware wireless router called the LibreRouter[16] became available that was produced by a community network support group in Argentina (APC member Altermundi), with features specifically designed to support the needs of community networks, particularly in developing countries. These features include low cost, the ability to more easily repair the device, capacity to use a wide range of power voltages, and multiple radios to support long multi-hop links.

In a recent technology trend that echoes the emergence of low-cost Wi-Fi hardware twenty years ago, innovation in cellular networking has similarly resulted in small-scale mobile networks based on new low-power base station (BTS) equipment now costing as little as USD 1 500[17]. The devices emulate the base station on general purpose software defined

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11 E.g BITNET, USENET, APC member networks, Geolink etc

12 E.g The UoSat-5 LEO satellite developed by the University of Surrey was used extensively for transmitting health information from developing countries prior to the availability of the Internet. https://onlinelibrary.wiley.com/doi/abs/10.1002/sat.4600130606

13 Initially in the 2.4Ghz band and then later the 5.8Ghz band

14 http://guifi.net http://freifunk.net https://www.nycmesh.net/

15 Mesh Networking https://en.wikipedia.org/wiki/Mesh_networking / https://libremesh.org/howitworks.html

16 The LibreRouter currently costs about USD 150 ex China, for further details see: http://www.librerouter.org

17 These devices are now being manufactured by a variety of companies such as Osmocom, Sysmocom, Fairwaves, YateBTS, Nuran, Parallel Wireless and Baicells. As part of its Open Cellular (OC) division, the Telecom Infrastructure Project (TIP), a consortium led by Facebook, has recently produced low-cost prototype devices based on open source technologies https://telecominfraproject.com/opencellular

radio devices (SDR) which support a wide range of different radio frequencies. Equipment which supports voice/sms (2G) services has been available for about 10 years, and 4G/LTE devices are now also available. Deployed by community networks, for example APC members Colnodo in Colombia and Rhizomatica in Mexico, along with other partners in Brazil and Indonesia, these low-cost/low-power systems are also being used by some national commercial operators to extend coverage, and by some of the specialized commercial wholesale operators mentioned above.

The emergence of low-cost mobile network equipment is of particular significance for areas with low income levels and/or lack of basic literacy which means that voice telephony services using feature phones are a priority. Although limited awareness of the potential for these new mobile networking technologies is a contributing factor, the scarcity of mobile community networks is mainly a reflection of the policy and regulatory constraints faced by these initiatives in establishing small scale services based on GSM/LTE technologies.

Aside from similar regulatory burdens in the provision of Wi-Fi services mentioned above, the key barrier for small/community/non-profit mobile networks is that access to the radio spectrum bands used for mobile services is highly restricted. Often the GSM/IMT bands are already all allocated to the existing operators, and there is no provision for their re-use/sharing by third parties in rural areas that are unoccupied by the spectrum licensee. Similarly the newer LTE bands are either not yet assigned for mobile applications (used by TV broadcasting) or only available at costs that are unaffordable for small/community/non-profit networks. This is mainly because most national policy makers and regulators are as yet unaware of the possibilities for operating these types of mobile networks, and have not updated their spectrum management and mobile licensing frameworks accordingly.

As a result, although temporary use of mobile spectrum by community networks has been granted in a handful of countries, so far Mexico is currently the only nation where the spectrum has been formally assigned on a more permanent basis to community networks. In the other countries community networks have been allowed in certain areas to trial the use of mobile spectrum on a pilot/test license basis in areas where the national commercial networks are not present. In the Philippines, a ‘hybrid’ strategy was initially adopted where the community networks formed a partnership with one of the national operators, where they essentially acted as a franchise reseller of its services in areas which it did not cover (subsequently the national operator changed strategy and the networks have since converted to Wi-Fi).

Business Models for Small/Community/Non-profit Networks

The business models used, along with cost recovery strategies and startup financing in these networks vary widely, and are closely related to the institutional structures adopted for ownership and governance of the network. In this respect it can be noted that most small/community/non-profit initiatives have adopted a model where the local community owns and operates the physical access infrastructure to provide communication services to the end-user on a cost-recovery basis. The North American Internet Registry ARIN defines[18] community networks as follows: “A community network is deployed, operated, and governed by its users, for the purpose of providing free or low-cost connectivity to the community it services. Users of the network or other volunteers must play a primary role in the governance of the organization, whereas other functions may be handled by either paid staff or volunteers.”

18 https://www.arin.net/participate/policy/nrpm/#2-11-community-network

Depending on the local conditions, in some cases other less ambitious models may be adopted, such as in providing support services for deployment and/or management of the underlying network infrastructure that is actually owned by third parties.

In general, start-up and operating costs for small/community/non-profit networks are relatively low compared to commercial networks, not only because they can start at a much smaller scale, but also due to the low cost of the equipment, opportunities for in-kind contributions (especially labour and premises on which to mount masts or electronic equipment (which may also include providing electric power), and the sharing of other institutional resources in the area. Nevertheless, financial resources are often very limited in these remote and under-served areas, and this can be exacerbated by factors such as lack of affordable energy sources, high costs for upstream connectivity, and low economies of scale.

Often connected with the institutional model adopted, but also depending on the specifics of the implementation strategy and local conditions, the cost recovery strategies and startup financing mechanisms adopted are likely to vary considerably between different initiatives. There are essentially three different cost recovery models in use, both in terms of how users may (or may not be) charged, and also in relation to other sources of operating or startup resources. These are:

1. Free access for all or some users (sometimes only at certain times), potentially subsidised by other users with a higher ability to pay. As indicated above, pure free access for all, perhaps provided by an NGO or government unit, is not the most scalable or sustainable option, but in some cases may be necessary where incomes are very low, or where there are other options to cross-subsidise the cost, at least initially. This is the strategy adopted by APC partner PamojaNet in the DRC, where small businesses with the ability to pay help cover the cost for provision of free access to the public in off-peak hours. It is also possible that free access could be provided only to certain groups within the community, such as students.
2. Full cost recovery from end users via a monthly or annual subscription, or on a pay-as-you go basis, usually per day/week/month for Wi-Fi/LTE networks, or on a per call basis for mobile GSM networks. This type of cost recovery can also be achieved through a mix of monthly fees and usage fees, mainly for mobile networks with off-net calls being charged for, but also in Wi-Fi networks with high backhaul costs, especially where upstream connections may have metered usage based on traffic – such as where 3/4G networks are used to provide the upstream connection, and in some satellite links. This is the model adopted by APC’s mobile network partner TIC AC in Oaxaca, Mexico, and many of the Wi-Fi based networks.
3. Reduced cost recovery from end users, with the deficit covered by financial or in-kind contributions from third parties. These contributions are likely to be from NGOs supporting the network and, as has been the case in many community networks, also potentially from a) corporate social responsibility programmes of the commercial suppliers of both equipment and services (such as routers and backhaul/upstream capacity), b) upstream capacity and technical skills from nearby academic and research organisations c) government rural broadband programmes and Universal Service Funds.

Conclusion

Despite the evident value of small/community/non-profit networks in addressing needs for connectivity in the areas in developing countries without affordable communications infrastructure, there are still relatively few such networks in these locations. Although there is clearly a lack of awareness of their potential, and human capacity limitations, the primary restriction is the lack of conducive regulatory environments in most developing countries as indicated above. Although a few countries have adopted a licensing framework which includes provision for community operators, such as Argentina and Brazil, in general, license fees and the compliance requirements of the license are too onerous for small networks. In addition the commercial conditions required to access the fibre backbones of national operators for upstream links is often not cost effective relative to the low volume of traffic of small networks, resulting in unsustainable services. Lack of access to fixed and mobile spectrum, or interconnection of voice calls directly with the national operators can also be an issue, often necessitating the use of international VoIP trunking on backhaul links, which further adds to operational costs and lower quality services.

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