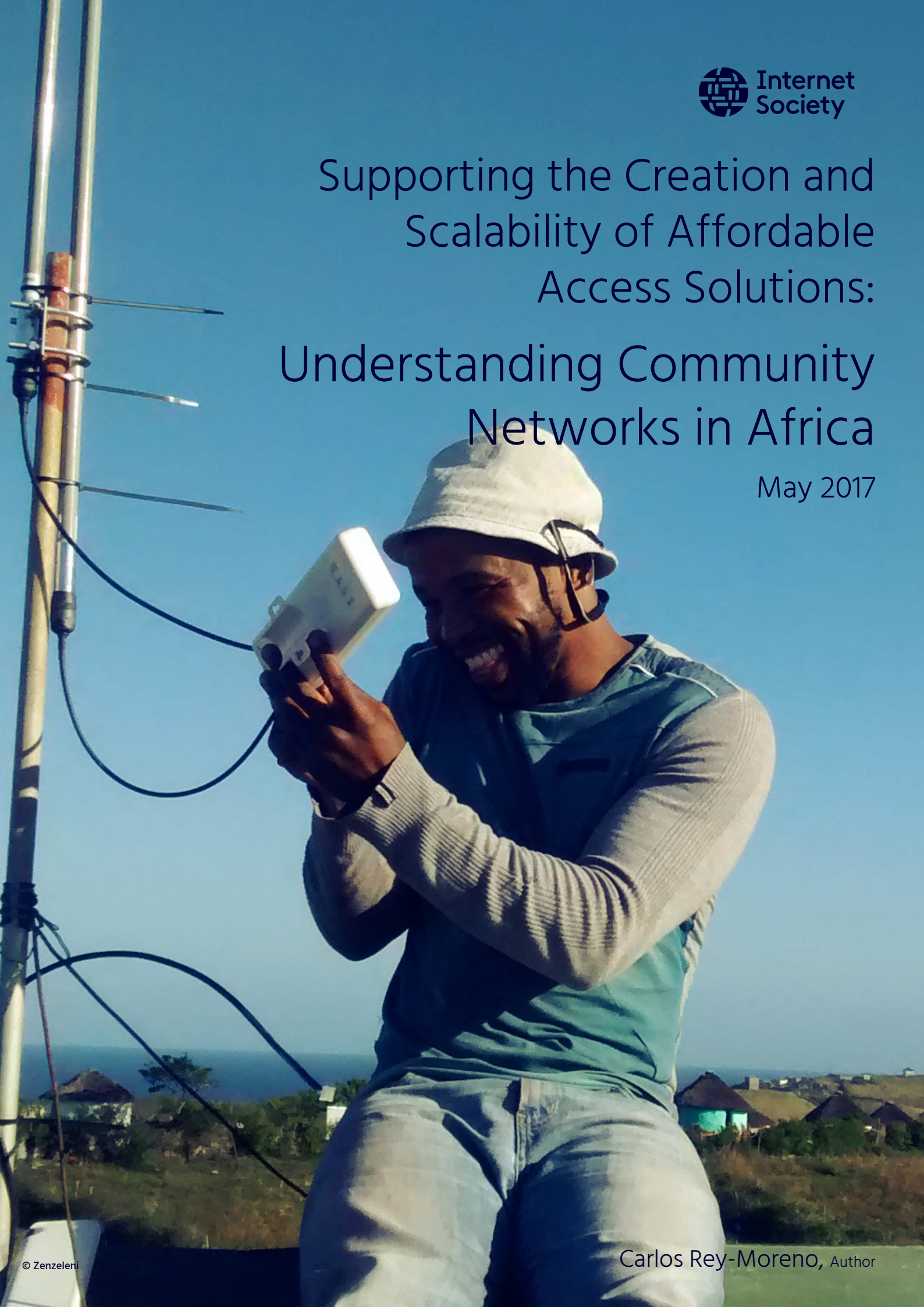


Supporting the Creation and Scalability of Affordable Access Solutions: Understanding Community Networks in Africa

May 2017



The installation of the mast



Executive Summary

There is widespread recognition of the opportunities and potential benefits of expanding access to the Internet, as recognized by the Sustainable Development Goal (SDG) targets. Yet, around four billion people still lack access to it.

Community networks, communications infrastructure deployed and operated by citizens to meet their own communication needs, are being increasingly proposed as a solution to connect the unconnected. However, in Africa, where the proportion of unconnected is among the highest globally, little is known about the role community networks are playing.

Building on the map of community networks in Africa produced in 2016 that provided a snapshot of the state of this model on the continent, this report delves deeper into the topic. The study is the result of a series of interactions with representatives of ten community networks, which included individual interviews, panel discussions, and presentations at the first Summit on Community Networks in Africa¹. In addition, this report draws on the answers from the 30 representatives and proponents of community networks in Africa who participated in the creation of the 2016 map.

Results from our research shed new light on the factors behind the establishment of community networks, highlighting the commitment of their proponents to the development of their communities, and the role that the network and its services play in it. The social context where these initiatives take place also plays a critical role. Several strategies are presented that contribute to the social cohesion that marginalized communities depend on. The services these networks provide and the way they are offered also align with their context. There is a strong emphasis on public access, intranet services that meet the local needs, and digital literacy to maximize the opportunities offered by the services. But most of the organizations analyzed have a broader vision, and the communication services are just one component of

the local economy they are creating to transform their communities. This context also plays a role in the economic sustainability of the initiatives, as low-income communities require some sort of seed capital to bootstrap the initiative. Once they are established, all of them have found ways to be sustainable, and in some cases, scale them to other places. They also want to improve, and a section with further recommendations is also included in this report.

The number of initiatives identified is relatively low considering the continent's size and population. Thus, this report analyses the barriers that prevent more community networks from appearing or existing ones from becoming sustainable and scaling. The barriers identified range from the lack of awareness of both the potential benefits of accessing information, and the Internet more generally, and the possibility for communities to create their own network, to the lack of income of the people who would like to start one. It is important to note, that most of the people within the next billion to be connected need to choose, daily, between Internet/communication networks and other vital necessities such as food and health. The unreliable (or the complete lack of) electricity in most of these areas, and the high cost of backhaul connectivity, also affects the capital required to start and operate one. The lack of local technical competencies, and a regulatory framework not conducive for the establishment of small, local communication providers, are also identified as the main barriers for growth of community networks in the region.

This report provides a new perspective on community networks on the continent. In Africa, a community network is not simply telecommunications infrastructure deployed and operated by citizens to meet their own communication needs; it is a tool to improve what a community is already doing in terms of their growth and development, by contributing to a local ecosystem that enhances the daily lives of those staying in the community.

¹ <http://www.internetsociety.org/events/summit-community-networks-africa/2016>

Despite particular exceptions, the community network model and concept is still in its infancy stages on the continent. However, there are reasons to believe it has the potential to expand rapidly. The ongoing technological advancements are simplifying deployments, operations and scalability. The increasing awareness of the value and impact of community networks, as well as the evidence that the work can be done locally by locals, is inspiring the creation of new networks and the expansion of existing networks across the region. The identification of other local stakeholders with a role to play, like the traditional authorities, churches, and local media, means that new strategic partnerships can be established to facilitate expansion. Governments can also contribute to their expansion, from creating a conducive regulatory framework, to using their educational programs to foster the establishment of community networks. The creation of a Community Networks Program to support communities willing to start their own networks is proposed in this report, and its main components are as follows: a school of community networks to build capacity, an observatory to generate and gather evidence, an exchange mechanism to facilitate peer learning; and a volunteer program that provides support on different topics.

A set of recommendations for different stakeholders is included to conclude the report and to outline a path forward, to ensure many other communities in Africa can benefit from the positive outcomes attributed to community networks identified by this research.

TunapandaNET team



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1 Introduction

Connecting the next billion users to the Internet is one of the central issues on the international Internet and Internet Governance agenda. Given the host of opportunities and potential benefits that are presented by expanding access to the Internet, as recognized by the Sustainable Development Goal (SDG) targets², the Internet Society (ISOC) considers connecting the next billion a key issue, especially as it relates directly to its mission and vision³.

Despite the success of the mobile revolution in Africa, there is a common understanding that market forces are unable to provide affordable access to communications to the economically disadvantaged segments of the population, which ultimately hurts their access to information and further exacerbates existing digital divides. For instance, the GSMA has recently expressed that to justify the cost of deploying a base station, it requires more than 3,000 active users⁴. This, and other factors⁵, have led governments, civil society, and the telecommunications industry to start looking for alternative solutions⁶. Community networks, which can be broadly defined as telecommunication infrastructure deployed and operated by citizens to meet their own communication needs⁷, have been part of the foundations of the Internet infrastructure since the early days. In recent years, the community networks movement has grown consistently, leading more and more voices to point to them as a solution for connecting the next billion, due to increasing evidence of the role they do, and can, play⁸.

The majority of the examples used to highlight the benefits of this model come either from Europe⁹, or more recently, from Latin America^{10,11} and Asia^{12,13}. On the African continent, where affordable access to communications is far from a reality, very little is known about what is happening in the community networks space. This is precisely the gap that this report aims to fill. Building on a recent survey that identified 37 community network initiatives in 12 African countries,¹⁴ this report presents an in-depth study of the community networks on the continent. This report is structured as follows:

- **Section 2** describes the methodology used in this report.
- **Section 3** contains a summary of the main characteristics across the 37 community networks mapped.
- **Section 4** includes the results of an in-depth study of ten community networks from eight different countries in Africa. Among the characteristics studied are: the context where they have been deployed; the social dynamics they need to consider; the details of the technical infrastructure; the services they provide; the strategies they have devised to remain sustainable; and the training they would like to receive to maximize the impact of the deployments.
- **Section 5** presents the barriers identified by experts and proponents of community networks that prevent more community networks from appearing on the continent.
- **Section 6** frames the results in a broader international context, highlighting opportunities for expanding the community network model.
- **Section 7** concludes the report by translating the opportunities described in Section 6 into recommendations for different stakeholders to support existing community networks to scale, and to enable more community networks to appear.

2 Several SDGs address inequalities in access to the internet and ICTs, most significantly Target 5.b (“enhance the use of enabling technologies, in particular ICT, to promote women’s empowerment”) and Target 9.c (“significantly increase access to ICT and strive to provide universal and affordable access to internet in less developed countries [LDCs] by 2020”).

3 http://www.intgovforum.org/multilingual/index.php?q=filedepot_download/3416/56

4 http://www.intgovforum.org/multilingual/index.php?q=filedepot_download/3416/412

5 http://www.intgovforum.org/multilingual/index.php?q=filedepot_download/3416/57

6 J. Saldana, A. Arcia-Moret, B. Braem, E. Pietrosevoli, A. Sathiseelan, M. Zennaro, Contributors: L. Navarro, C. Rey-Moreno, I. Komnios, S. Song, D. Lloyd Johnson, J. Simo-Reigadas. RFC 7962 “Alternative Network Deployments. Taxonomy, characterization, technologies and architectures,” Working Group Document in the IRTF GAIA (Global Access to the Internet for All) group, Aug. 2016. Available at: <https://www.rfc-editor.org/info/rfc7962>

7 <https://www.comconnectivity.org/article/dc3-working-definitions-and-principles/>

8 http://www.intgovforum.org/multilingual/index.php?q=filedepot_download/3416/412

9 <http://guifi.net/en/node/38392>

10 <https://rhizomatica.org/>

11 <https://www.altermundi.net/>

12 <http://wfor.cin/>

13 <http://nepalwireless.net/>

14 C. Rey-Moreno, M. Graaf, “Map of Community Networks in Africa”, 1st Report on the Dynamic Coalition on Community Connectivity: “Community Connectivity: Building the Internet from Scratch”. Ed. FGV Rio Editions. December 2016.

2 Methodology

The methodology used in this report is divided into three parts:

1. To compile the map of community network initiatives on the African continent;
2. To identify the barriers they face; and
3. To understand them in more detail in order to support the broader efforts of community networks in Africa.

The map of community networks initiatives presented in Section 3 is a result of contacting people who had been involved in community networks in Africa. The aim was to gather information about the community network they had been involved with as well as inquire about other community networks they were aware of on the continent. To complement this, Google searches of the term “community network” and derivatives of it in English and French were conducted. When a new community network was identified, a similar procedure to the one described above was followed. The full methodology to complete the map can be found in “Community Connectivity: Building the Internet from Scratch”,¹⁵ an edited volume focusing on community networks around the world. As described in the full methodology, other community networks on the continent might not have been captured in this report for a variety of reasons, including respect for their anonymity.

When collecting the initiatives included on the map, those individuals who were contacted were asked about the main opportunities afforded to community networks in Africa, and the main barriers preventing them from happening. A total of 30 experts contributed, and their answers were thematically coded before being used. A list of participants is provided in Appendix B. Their views have been summarized in Section 5 of this report.

The results used to understand community networks draw mainly upon the data gathered in Nairobi, Kenya, from 22 to 24 November 2016 during a series of interactions with representatives of community networks in Africa. ISOC convened the first Summit on Community Networks in Africa on 22 November 2016¹⁶, where representatives from ten of the 37 community networks identified were invited to present their initiatives. The summary of this first Summit, its participants, and the presentations given are available online¹⁷. A list of participants is reproduced in Appendix A. Information from the presentations, as well as the discussions that arose from the interactions with the audience, were captured and analyzed. This was complemented by data from one-on-one interviews with the representatives conducted on 23 November. Interviews lasted between 30-90 minutes (with more than eight hours of data collected in total), and followed a similar structure to the one used to describe community networks developed by the netCommons project¹⁸. This was further supplemented by the discussions during and after a panel session at the African Conference on Computer Human Interaction 2016, which was held on 24 November entitled: “Community Networks in the African Context: Opportunities and barriers”¹⁹.

The results were further enriched by informal interviews and conversations with community network proponents after presenting the map of community network initiatives at the 11th Internet Governance Forum (IGF) in Guadalajara, Mexico, in December 2016²⁰, and at the GAIA Workshop in Cambridge, England, in January 2017²¹.

Finally, the contents of this report were reviewed by representatives of the community networks that were present in Nairobi in November 2016 to correct any potential inaccuracies of the information included or any potential additional recommendations.

Like community networks, this has been a collaborative effort involving many people.

15 C. Rey-Moreno, M. Graaf, “Map of Community Networks in Africa”, 1st Report on the Dynamic Coalition on Community Connectivity: “Community Connectivity: Building the Internet from Scratch”. Ed. FGV Rio Editions, December 2016.

16 In the rest of the document “first Summit” is used to refer to this event

17 <https://www.internetsociety.org/events/first-summit-community-networks-africa>

18 D1.2, Report on the Existing CNs and their Organization (v2), <http://netcommons.eu/?q=content/report-existing-cn-and-their-organization-v2>

19 C. Rey-Moreno, J. Miliza, F. Mweetwa, G. van Stam, and D.L. Johnson. “Community Networks” in the African Context: Opportunities and barriers”. AfriCHI, 21st-25th November 2016, Nairobi, Kenya. ACM, 2016.

20 <https://igf2016.sched.com/event/8htn/dc-on-community-connectivity>

21 <https://www.cl.cam.ac.uk/~al773/gaiaworkshop/agenda.html>

3 Mapping Community Networks in Africa

The full map of community networks in Africa, with a description of each of them, is available online²². The following table below summarizes these findings:

| Name | Country | Started | Active? | # of Nodes | Internet? | Location | Funds for bootstrapping |
|--|--|---------|-----------|------------|-----------|--------------|-------------------------|
| Mesh Bukavu | Democratic Republic of the Congo (DRC) | 2015 | Yes | 10 - 15 | No | Urban | External |
| Pamoja Net | DRC | 2015 | Yes | 6 | Yes | Rural | External |
| Mesh Goma | DRC | 2015 | No | 15 | No | Urban | External |
| Akwapim Community Wireless Network | Ghana | 2005 | No | 20 | Yes | Rural | External |
| TunapandaNet | Kenya | 2010 | Yes | 4 | No | Urban | External |
| Connecting Eenhana | Namibia | 2015 | Partially | 7 | No | Rural/ Urban | External |
| Fantsuam Community Wireless Network | Nigeria | 2005 | Yes | 1 | Yes | Rural | External |
| Ibadan WUG | Nigeria | ? | Yes | 22 | Yes | Urban | Internal |
| Abaarso | Somalia | 2103 | ? | ? | Yes | Urban | External |
| Siyakhula Living Labs – Dwesa-Cwebe | South Africa | 2005 | Partially | 17 | Yes | Rural | External |
| Siyakhula Living Labs - Ntselamanzi | South Africa | ? | Partially | 10 | Yes | Rural/ Urban | External |
| Rural Telehealth | South Africa | 2003 | No | 7 | Yes | Rural | External |
| Peebles Valley Mesh Network | South Africa | 2005 | No | 6 | Yes | Rural | External |
| Bo-Kaap Mesh | South Africa | 2010 | No | 75 | Yes | Urban | External |
| Orange Farm | South Africa | ? | ? | ? | Yes | Urban | External |
| Kranshoek Mesh | South Africa | 2011 | Yes | 30 | Yes | Rural/ Urban | Internal |
| Zenzeleni Networks | South Africa | 2013 | Yes | 12 | Yes | Rural | External |
| Scarborough WUG | South Africa | 2003 | No | >200 | Yes | Urban | Internal |
| SoWUG | South Africa | 2010 | Yes | 29 | Yes | Urban | External |

²² http://internet-governance.fgv.br/sites/internet-governance.fgv.br/files/publicacoes/community_connectivity_-_building_the_internet_from_scratch_0.pdf

| | | | | | | | |
|--|--------------|------|-----------|------|-----|--------------|----------|
| Cape Town WUG | South Africa | ? | Yes | >100 | No | Urban | Internal |
| Johannesburg WUG | South Africa | ? | Yes | >100 | No | Urban | Internal |
| Durban Wireless Community | South Africa | 2004 | Yes | 50 | No | Urban | Internal |
| BB4All | South Africa | 2009 | Yes | ? | Yes | Rural/ Urban | External |
| Pretoria Mesh | South Africa | 2005 | Yes | 20 | Yes | Urban | External |
| ICT4RED | South Africa | 2012 | Yes | 12 | Yes | Rural/ Urban | External |
| Home of Compassion | South Africa | 2015 | Yes | 20 | Yes | Urban | External |
| The ICT for Rural Development Project | Tanzania | 2006 | Yes | ? | Yes | Rural | External |
| Sengerema Wireless Community network | Tanzania | 2008 | No | 17 | Yes | Urban | External |
| Mesh Sayada | Tunisia | 2013 | No | 12 | No | Urban | External |
| BOSCO Uganda | Uganda | 2007 | Yes | 43 | Yes | Rural | External |
| Macha Works | Zambia | 2006 | Partially | 99 | Yes | Rural/ Urban | External |
| Murambinda Works | Zimbabwe | 2000 | Yes | ? | Yes | Rural/ Urban | External |

Table 1: Summary of Community Networks in Africa²³.

A description of the categories in some of the variables in the table is provided below:

- Partially Active refers to those networks that had been Active but the people reporting about them acknowledged that, at the time when the map was created, some sections or the whole network were facing serious sustainability issues.
- Rural/Urban refers to those community networks deployed in towns relatively far from big cities/provincial capitals (referred to as Urban), but still having access to some infrastructure (tar road, hospital, sewage, etc.) lacking in more remote rural areas.
- Internal funds for bootstrapping²⁴ is associated with those community networks where the bulk of the investment for the telecommunications infrastructure was provided by the users, as opposed to those where this investment was provided by an external donor.

²³ Note the smaller South African Wireless User Groups (WUGs) have not been included in this table for homogenization purposes.

²⁴ Refers to the process of starting a project with very little resources.

4. Overview of Community Networks in Africa

This section contains an overview of the process followed for bootstrapping community networks in Africa, their technical characteristics, and the strategies they use to foster inclusion, ensure their sustainability, and scale.

4.1 Factors behind their establishment

The proponents of community networks provided a wide array of reasons to start a community network. The most repeated one was the need to provide connectivity in areas where there is none, or to provide cheaper connectivity where it is offered by other operators, mainly mobile operators. Both scenarios are too common in Africa. With community networks, affordable access can be provided in those areas that are unattractive to telecommunications operators and governments by pooling resources and buying services collectively.

Many respondents recognized that providing affordable connectivity reduces the barriers to access and share information and knowledge. This can be used, among other things, to leverage educational and employment opportunities (e.g., online training, access to and creation of jobs, funding sources, etc.). Additionally, access to information is described as the stepping stone for people, especially youth, to join the knowledge economy and start their own businesses – information technology (IT)-related or not – or to scale existing ones, with pricing and services that are relevant to their immediate community. There is wide recognition of community networks as being significant contributors to the local economy.

This ties into another subset of the reasons mentioned by the respondents: owning the network provides self-determination over the prices and the services offered, and it keeps profits local instead of extracting them to external and even global players. Thus, the emphasis is in community empowerment and investment, rather than in monetary profit, particularly when this profit is extracted from a community. In turn, such empowerment comes with a better understanding of the technology, which develops the technical capacity of those engaged with it and enables, for instance, the creation of locally relevant content and services. Additionally, it creates more decentralized, resilient, and agile networks that prevent abuse (e.g., spying, censorship, etc.) and control (throttling) from a single entity.

While in some cases it was the more informed community members who started the community network, individuals who were external to the community informed other communities about the potential of establishing their own network. In the latter case, close collaboration with local institutions and structures (tribal authorities, schools, hospitals, etc.) was established from inception to make sure the initiative aligned with local communication needs and sensitivities. In most of these cases, this was done by building the capacity of one or more community members with some of the skills and the interest to champion the project locally, to liaise between the external people and the locals and find a balance between community stakeholders. It was considered preferable to begin working with local institutions, structures, and champions where previous relationships existed. Both types of local champions – self-driven and externally fostered – have a vision of how they want their communities to be and of the role networking infrastructure and connectivity can play.

Apart from starting under different circumstances, it is also noticeable how the initiatives studied are located in a varied range of contexts. There is no distinct pattern that has been identified in all of them that can be prescribed as standard. Networks analyzed in this report are set in places that differ as much as:

- Remote areas in deep, rural South Africa, the Idjwi island in the Democratic Republic of Congo (DRC), or the refugee camps in northern Uganda with very low population densities, which are relatively difficult to access;

- Towns far from main cities such as Eenhana (Namibia), Kafanchan (Nigeria), Murambinda (Zimbabwe), Macha (Zambia), or Bukavu (DRC); and
- Two of the largest urban settlements in Africa, Kibera (Kenya), and Soweto (South Africa), whose population density is among the highest on the continent, but which lack the most basic infrastructure.

Additionally, due to the lack of economic resources, most of them started making use of seed funding available, such as the funding from the Canadian International Development Research Centre (IDRC) more than 10 years ago²⁵, the Seed Grants provided by the Open Technology Institute (OTI) in 2015²⁶, and different community networks awarded with funding from ISOC's Beyond the Net program²⁷. Once that funding was used to set up the infrastructure, most of those who received it found ways to generate enough revenue to sustain the initiative. For more information about ways community networks in Africa sustain their initiatives, see Section 4.4.

This partially answers a common question posed by the audience attending workshops, panels, or discussions about community networks: the origin of the funds required to establish one. While the importance of the initial capital needed to purchase the equipment and other materials required for the infrastructure cannot be disregarded, there was consensus among those at the first Summit that a vision should always come first. As Fred Mweetwa, from Macha Works, the oldest community network in Africa and one of the largest ones, repeated: "If you have a vision, the funds to start the initiative will come one way or another. It is also the other way around; when people receive funds but do not have a vision for the initiative, for their communities, that is when it does not go forward."

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This vision is at the core of the community networks analyzed: all of them want to make the communities they work with better places. That is the main reason behind their involvement in a community network. With time, some of these initiatives have managed to provide those involved in the management and operation of the network with some economic remuneration for their time and effort spent working on the project. Yet, there was a clear agreement that becoming involved in starting a community network was not worth the effort if the economic incentives were considered alone.

4.2 Socio-cultural aspects and dynamics

Unlike most initiatives in the Global North, in the community networks in Africa, especially those in rural areas, the term "community" has a more spatially specific meaning associated with it. For instance, in the case of Mankosi – a rural community in South Africa where Zenzeleni Networks is based – it refers to the people living on land governed by the traditional leader. Many nuances were added during the discussions with community network representatives at the first Summit, and, although more research in the area could shed additional light, a common thread appears to unite them: it concerns those living around the area where the network is deployed. This also comes with the acknowledgement that communities are different among themselves, and thus reinforcing the need for local participation to ground the initiative in each particular context.

²⁵ http://www.fmfi.org.za/wiki/index.php/First_Mile_First_Inch_Home_Page

²⁶ <http://communitytechnology.github.io/docs/seed-grants/>

²⁷ <https://www.internetsociety.org/what-we-do/grants-awards/beyond-net-funding-programme>

This concern is key to maintaining the social cohesion so necessary to the survival of tight-knit communities, as John Dada, from Fantsuam Foundation explained: “You just share, that was your insurance. If you didn’t have that insurance, nobody could survive. We depend on each other for food, for clothing, for healthcare, for whatever...”. This social cohesion is one of the biggest assets for this type of initiative in Africa, since, in most cases, the community already exists, and only the network is

missing. This social cohesion also means there are often various community associations that can provide the initial structure needed to start the community network. Thus, in different community networks present at the first Summit, measures have been implemented to maintain or reinforce that social cohesion so that the network is not perceived as a destabilizing factor.

As mentioned in Section 4.1, the

“The challenge we have in Africa [is that] the moment you run something, even if it is meant for the community, and people have a sense that, not factual, a sense that there is money being made, then the next thing is you are stealing money from them.”

local economic conditions require some sort of external funding to bootstrap these projects. This, however, is generally accompanied by suspicion about where the money comes from, the agenda behind having received it, or how the funds are being used. Michuki Mwangi from the Internet Society, clearly expressed the problem: “The challenge we have in Africa [is that] the moment you run something, even if it is meant for the community, and people have a sense that, not factual, a sense that there is money being made, then the next thing is you are stealing money from them.”

Thus, those given the mandate to manage the project, its funds, and its revenue, if any, are subject to scrutiny and sometimes criticism from others in the community. Given this reality, the first Summit attendees emphasized the need for transparency and accountability in a community network’s financial management. Integrating transparency and accountability in decision-making processes was considered an effective approach to building the community’s trust and reinforcing social cohesion on the project. Mechanisms such as collective authorization before funds can be spent and the availability of accounting books and audits, which anyone can consult, are practices shared among some of the initiatives. Sometimes due to lingering disputes or people’s reluctance to change, these tensions might be unavoidable.

The importance of sharing responsibilities and exposure when dealing with community issues was also highlighted. Having as many people as possible understand the process and the rationale behind the community’s decisions not only presents a common front when disputes and tensions arise, but it also provides for a diversity of views and backgrounds among those managing the initiative.

It was also considered important to “plant a good seed from the beginning” to avoid misunderstandings. Consistency throughout the initiative, with a long-term vision as well as clarity about the steps to take in the short term in relation to that vision, were recommended. In particular, clarity is considered essential when describing technical or other criteria required for selecting the people to work on the project or the locations where equipment is deployed. This most certainly can create tensions around privileging some over others. Moreover, commitments or responsibilities on the community side need to be clearly outlined. Thus, a protocol is followed, especially in those networks in rural areas, by which the traditional authority²⁸ is approached first to introduce the project, to obtain permission to deploy the network, and to ask for recommendations concerning the appointment of those best suited to handle the project in their community. This was the case with Macha Works, Murambinda Works, BOSCO Uganda, Fantsuam, Pamoja Net, and Zenzeleni Networks²⁹.

28 Many communities in Africa are governed by a Headman, Chief, which together with their councilors and advisors, compose the traditional or tribal authority of that particular community.

29 Please refer to Table 1 for more information about each of the community networks mentioned



Traditional authorities are just one of the three powerhouses identified by the participants. The church and the government were also identified as institutions to be respected and remain at peace with for the initiative to run smoothly. Yet, as Macha Works is demonstrating, if enough social cohesion has been built around the initiative, it can keep functioning even if it is at odds with one of them. In their case, the local religious mission in Macha wanted to prevent Macha Works from continuing to use their land. After Macha Works refused, the case was brought to the Zambian court. Still, the initiative is operating because, as Mweetwa described: “If you lose two [of the three powerhouses], that means you have lost everything.”

Other strategies applied to foster social inclusion and participation include the following: using visual posters created by Pamoja Net to warn about the risks of the Internet (e.g., phishing, fake news, privacy); co-creating solutions where local knowledge is embedded when externally initiated, like with the solar solutions used in Zenzeleni Networks or Pamoja Net; the use of analogies to enable people to relate community networks and their components to concepts they are familiar with; and providing targeted training to vulnerable groups, as Fantsuam is doing³⁰.

Additionally, with respect to gender equality, there was wide consensus surrounding the need for female role models in information and communications technologies (ICTs) that others can look up to. As such, in Connecting Eenhana, an effort was made to have female trainers on their team. In the case of Fantsuam, they have an emphasis on selecting female children for their training courses, and have mechanisms in place to assist their family with the fees if they cannot afford them. And, for Zenzeleni Networks, suggestions to open new spaces for the participation of women and to the specific recognition of women’s work are being considered by its board³¹.

4.3 Technical aspects and services offered

Similar to the varied contexts where these initiatives started, the technical characteristics of the initiatives that were analyzed for this report are quite diverse. Still, there are some common characteristics. In regards to the infrastructure, there are two common patterns to highlight among the networks represented at the first Summit: the provision of access via publicly available facilities, and the use of Wi-Fi to interconnect sites. For public access provision, many initiatives used the concept of the community center or Internet café, where computers are made available for people to access the services offered by the community network. In these cases, it is common to use thin clients³² to reduce costs, like in Murambinda Works, BOSCO Uganda, Macha Works, and Fantsuam. The latter has more than 240 computers for public use. To add some more numbers, BOSCO currently operates 32 community centers, Macha Works’ community center has been replicated in five other provinces, and Fantsuam operates a mobile service where it provides access to computer training and local content in villages for a week using 15 thin clients and a server. There are also several community networks that, although they are aware that not everyone has access to Wi-Fi-enabled devices, have deployed public hotspots for people to access their services using their personal devices – this includes SoWUG, Mesh Bukavu, TunapandaNet, Pamoja Net, Connecting Eenhana, and Zenzeleni Networks. In these cases, not only is access provided via Wi-Fi, but interconnection between sites uses Wi-Fi technology too. The use of a router for each connection (access provision and interconnection of sites) is the most common arrangement.

Additionally, due to unreliable (or the complete lack of) electricity in most of the areas where community networks are deployed, most initiatives have to rely on solar panels and battery banks to power electronic equipment.

In terms of services, it is important to note that not all the networks are connected to the Internet, for instance, Mesh Bukavu and Connecting Eenhana are not connected. Some connect to the Internet on site, using different technologies used by the Internet service providers (ISPs) in the area. For example, Macha Works connects to the Internet using WiMAX, while Fantsuam uses VSAT (satellite) and Murambinda Works uses fibre. Others have built their own backbone also using Wi-Fi to arrive at a place with more affordable Internet connectivity (e.g., BOSCO Uganda has 14 high sites³³ and Pamoja Net, Zenzeleni Networks and SoWUG have one).

³⁰ <http://www.fantsuam.org/projects>

³¹ T.S. Hussen, N.J. Bidwell, C. Rey-Moreno and W.D. Tucker, “Gender and Participation: Critical Reflection on Zenzeleni Networks in Mankosi, South Africa” AfriCHI, 21-25h November 2016, Nairobi, Kenya. ACM, 2016.

³² A thin client is a lightweight computer that is purpose-built for remoting into a server (typically cloud or desktop virtualization environments). It depends heavily on another computer (its server) to fulfill its computational roles

³³ A high site allows networks to overcome the need of line of sight between Wi-Fi wifi routers, especially when there are long distances between them. In rural areas this is normally a tower, where you can install your antennas. In urban areas, having access to the roof of a high building is also considered a high site.

Due to the expensive cost of backhaul connectivity³⁴, several networks are not providing Internet access. For those that are providing Internet access (Macha Works, Murambinda Works, BOSCO Uganda, and SOWUG), all services that are available online are available to the users. Other networks, however, use their Internet connection to download specific content and store it on their local servers (like TunapandaNet or Pamoja Net). This makes the content locally accessible in their community network. Noticeably, all of them place strong emphasis on services that do not require an Internet connection and can be provided on an intranet. This meets the double requirement of not needing additional running costs to provide them, and of allowing local content to be easily accessed.

Some examples of these services include:

- Pamoja Net has set up a screen at each of its three information centers (similar to an Internet café) on the island of Idjwi, where local news is uploaded every day. This is complemented by updates coming from the Internet such as weather forecasts.
- Mesh Bukavu has made a server available where local news websites, educational material (an offline version of Wikipedia, more than 36,000 electronic books, and PDF courses), and other resources can be locally accessed. Additionally, it provides a secure chat service that allows journalists to communicate openly, or to send audio they record to the local radio station.
- BOSCO Uganda has established a collaborative network through an internal content management site (intranet), a voice over Internet Protocol (VoIP) telephony system, and a collaborative Wiki. There is also pre-loaded educational content. This has enabled projects like the BOSCO Uganda classroom-to-classroom project, which has linked schools in the United States to rural schools in northern Uganda. Students and teachers map and test water collection sites and share results through intelligent mapping on the Wiki.
- Connecting Eenhana offered a small digital noticeboard providing wide coverage in the Eenhana Town Council, which displayed updates about documents, health, education, and local government. Community members could download content for free onto their mobile phones or tablets, or by using a computer at one of the partnering institutions.
- Zenzeleni Networks offers VoIP calls among analogue handsets attached to the routers and Wi-Fi-enabled devices that connect to them.
- TunapandaNet allows remote video streaming of their educational material to allow more people to participate in their training. Additionally, they have developed SWAG³⁵: “A gamified, open-source e-learning platform meant to deliver education content especially in areas without an Internet connection. It allows users to create and share their content within the platform without the need for the Internet.”

In addition to telecommunications services, a strong emphasis was placed on the transfer of technical skills so communities can maximize the impact that connectivity can have in their lives. As in the case of sharing management responsibilities described in Section 4.2, it was considered important to provide training to as many people as possible. The different training programs offered by the community networks represented at the first Summit are listed below:

- Fantsuam offers training on basic computer literacy, computer maintenance, computer-based test training for university entry examinations, community-based wireless networks, and continuing professional development for internally displaced teachers. Additionally, it runs a Cisco academy.
- Murambinda Works offers computer literacy courses, International Computer Driving License (ICDL³⁶) courses, and Internet training to school teachers.
- BOSCO Uganda offers training in touch typing, IT and Web 2.0, leadership, center management, human rights, basic maintenance of computers and solar power systems, troubleshooting, renewable energy, and entrepreneurship.

³⁴ In communications, backhaul is the portion of the network that comprises the intermediate links between the Internet connection and the local access network.

³⁵ <http://swag.tunapanda.org/about/>

³⁶ <http://icdlafrika.org/>

- Connecting Eenhana conducted workshops in digital storytelling, and practical experiences on networks, web development, and server management.
- TunapandaNet delivers three-month intensive learning experiences in technology, design, and business.
- Zenzeleni Networks provided training and learning experiences for wireless networks deployments, solar panel installation and maintenance, and provides an ongoing platform to acquire management skills.
- SoWUG provides digital skills training, including cybersecurity and human rights online.
- Macha Works provides training in computer hardware maintenance, ICDL, and A+ training³⁷.

Regarding the usage of the services described above: 14,000 people have benefited from BOSCO Uganda's training, there are more than 1,000 active devices on SOWUG's network, more than 500

students and 200 teachers have been trained by Murambinda Works, and more than 100 students have graduated from TuanapandaNet's program.

However, telecommunications and training are not the only services these initiatives are providing. In most cases, these services are simply part of an entire ecosystem geared toward the development of their communities.

However, telecommunications and training are not the only services these initiatives are providing. In most cases, these services are simply part of an entire ecosystem geared toward the development of their communities. In some initiatives, the network and the telecommunication services were only developed after several years to

complement the social and economic services that some of the organizations were providing. This is the case for Fantsuam, which has programs on microfinance services, HIV/AIDS, and agricultural extension; Macha Works, which has an array of programs ranging from an international school and a community radio, to a restaurant and a biofarm; and TunapandaNet, whose main focus is the training mentioned above. In other cases, it is the revenue from the telecommunications infrastructure and its services that are supporting other social services. This is the case for Zenzeleni Networks, which is starting to provide microloans and assist students to attend higher education institutions, and Murambinda Works, who maintains the only foster home in the region and has provided small funds to assist with trips to the district hospital for rural patients.

4.4 Strategies for sustainability and scaling

In order for community networks to be sustainable, they not only need to generate enough revenue to cover their maintenance and operational costs, but they need to address other social, technical, and legal barriers as well. In this section, however, only the strategies used for the economic sustainability of community networks will be discussed. This will be followed by those strategies used to scale their activities to benefit other places.

Apart from the seed-funding mechanisms described in Section 4.1, community networks studied in this report have used a range of funding streams to acquire the initial capital, and to sustain and scale their networks, including:

- Crowdfunding campaigns, either online or via personal or collective fundraising campaigns (mainly in collaboration with partners in Europe and North America).
- The donation of equipment, services, or funds via corporate social responsibility or research programs.
- Matching fund mechanisms, where donors match the amount contributed by the communities.
- One initiative, Macha Works, could access Universal Service and Access Funds (USAF).

³⁷ <https://www.cybrary.it/course/comptia-aplus/>

These funding mechanisms align with the aforementioned statement that if someone has a vision, they will find ways to sustain it. Using Fred Mweetwa's words:

"In our culture, you grow up as a child and your parents sustain you, but at some point you need to stand by yourself; [it's] similar with this. Donors should implement something like this, so people don't get comfortable with receiving external funds and are less motivated to find their way."

Experiences shared by SoWUG emphasized that when a community network without an efficient business model and an organizational system receives financial grants and donations to pay for monthly operational costs and sustain its operations, it can derail the initiative. In the case of Fantsuam, it was the other way around; they started with their own funds, and according to Dada: "It was better to start that way, so we could learn to stay on our feet very quickly – not [remain] donor dependent. And that spirit of independence has [continued] until now." Additionally, both Mweetwa and Dada have rejected funds from donors, as sometimes they want to maintain internal control of the agenda.

People in resource-constrained scenarios are familiar with finding ways to keep things going if they see value in them. So, once they have obtained the funds to bootstrap the network, they find mechanisms to sustain it as the opportunities appear. In relation to the discussion about participation in Section 4.2, one participant also stressed, "if everyone understands then you can get more chances to make the project sustainable". This is reinforced when local people build the network and are also able to manage it, as others become interested and start contributing too. Thus, in most of the initiatives, the other services provided by the organizations are what sustain the telecommunication services. This is the case, for instance, of the cellphone charging service offered by Zenzeleni Networks; the money received by TunapandaNet for their professional services (mobile application development and marketing research); and the printing, photocopying, and trainings offered by Murambinda Works. When the projects by BOSCO Uganda have been replicated in other communities, small-holder farming and saving groups contribute to the Internet costs. The most relevant case is Macha Works, where, in Fred Mweetwa's words:

"In rural Africa, [the] budget varies throughout the year, as there is a gap of income in between the planting and the harvest [five months]. So, we look at which department does not have money, then we finance that. Also, when that department which we are financing, when it makes more money, it has to finance the other. So, the restaurant shares parts of its revenue for the bandwidth, the bank shares part of the commission for the bandwidth. The same with the radio station. Crafts are advertised on the local radio and on the Internet, and part of the money from selling them goes for the bandwidth. When people pay to get the International Computer Driving License, a part of it goes to pay the bandwidth."

Fantsuam Foundation's experiences are similar, specifically when balancing finances over the multiple activities it offers. For instance, it advances cash to farmers to keep their grain until they can sell for a better price and, thus, it is easy for Fantsuam to recover the microloans it offers to them. In turn, recovering those are key for its capacity building program.

In-kind contributions are key to reducing costs, no matter if they are time for maintaining and operating the network and its services or making plans and decisions; accessing a roof or a wall to mount equipment or space in a house for storing equipment; borrowing tools; or preparing a meal for those installing the equipment. The more people share the vision, the more of these kinds of contributions will appear. For instance, in BOSCO Uganda, most new community centers are in-kind contributions of the community groups in those villages. According to Dada, regarding their mobile community centers described in Section 4.3: "The church in [the] village receiving it provides a room, subsidizes these trainings, pays for their transport, pays for staff and the accommodation while the staff is there, and the personal stipend for the children who are attending the training." BOSCO Uganda also has arrangements with communication tower owners to exchange services for space on their towers.

Many Africans are already spending considerable amounts of their disposable income on communications, mainly due to the high costs of communication in many African countries. The opportunity afforded by community networks to provide cheaper prices offers another revenue stream to make this model sustainable. In fact, a voucher system offering discounted prices to access the Internet is a key source of revenue for those community networks connected to it. Free Internet would be ideal, but there is also the recognition that there is a need to cover the operational costs. Given how important and expensive voice communications are in rural Africa, networks like Pamoja Net or Zenzeleni Networks are also experimenting with alternative and affordable voice services. Others, like Mesh Bukavu, are considering a registration fee for those using the intranet services. In their case, for instance, they know how much money and time students could save if information about canceled or rescheduled classes were populated in the network. Also, those with an intranet portal with local content, like SoWUG and Mesh Bukavu, are considering offering local advertisements on the portal as an additional revenue stream. Something that seems to be a pattern among many initiatives is that the more workshops they do to make people aware of the services offered and the benefits they have, the more people start using the services – demonstrating the value and importance of convening people, and effective outreach and communication.

As mentioned in Section 4.1, the interviewees did not get into community networking because of the monetary incentives. Yet, some strategies have been used to reward the volunteer work required, like in the case of Zenzeleni Networks with free mobile phone charging and the use of an LED light for those housing the routers. In most cases, as highlighted by Mweetwa for Macha Works: “When they make money, they share the money.”

Only two of the projects described in the previous section have scaled so far as to reach other communities, Macha Works and BOSCO Uganda – three if we consider the mobile community centers used by Fantsuam. The former two will be the focus of the analysis in the rest of this section, as they have managed to provide and sustain permanent infrastructure and services.

In both cases, they have actively approached other communities to extend their model. When they approach new communities, they meet with their leaders to request information about the individuals in their communities who fit the profile they are looking for. In the case of Macha, they look for and interview people with the potential skills to supervise either the technical side or the training side. In the case of BOSCO Uganda, they go through the sub-county leaders, acquire the names of the community groups that are registered, and assess and then reach out to them. Some of the assessment criteria include community groups that have some leadership structure (e.g., chairperson, treasurer, secretary), which are known by the sub-county authority or the local leaders, and have some idea of what they want to do on their own before someone comes to help kick start their idea – i.e., that they already have a vision for their communities. In the case of

several candidates, they select the group that is committed to the type of contributions required (see above).

It is worth noting that in the case of Macha Works, these visits are made either in the company of Chief Chikanta or carrying a letter from him. His endorsement carries great weight when introducing the idea to other chiefs. Another difference between the two is the way the initial training is delivered. With BOSCO, those who are given the mandate by the community and/or the traditional leadership to be responsible for the project received their training in situ, but in the case of Macha Works, they go to Macha to get to know how it works for a period of three to six months, depending on how long they take to be “functional”. The training from BOSCO includes how to type, scan, print, and take photocopies, and basic finance practices, such as cash book management, to support their work and ensure accountability. This is because in both cases, once the new project begins, they are independent – i.e., they have to come up with their own business model and revenue streams to sustain the services. Still, they receive ongoing support and training from both institutions. For instance, BOSCO refreshes the training every three months, or does on-site training where they monitor progress of the site, and ensure they can become trainers at their own centers.

4.5 Ways forward

During the first Summit, participants were asked about how ISOC or similar organizations could contribute to the sustainability of their networks or to expand the model to other places.

One of the ideas that came from the participants was creating a repository of experts that could be contacted in case they had questions about a given topic that was preventing their community network from moving forward. Such advice would range from national and regional issues regarding regulation or the particulars of the ICT ecosystem (options to access backhaul in a particular location, for example) to more global ones with relation to technical issues around the infrastructure and the services used in the community network. In addition, offering mentorship when a community network is writing a grant or a funding proposal was also mentioned.

On top of the repository of expertise, offering a repository of resources (innovations and educational materials) was mentioned by many of the participants. The possibility of having some of these educational materials translated to local languages was also mentioned, as was the creation of training videos that people with limited reading abilities could follow. Such a repository of knowledge could also enable the possibility of providing online training tools, such as massive open online courses (MOOCs) and/or monthly webinars on different topics.

Another capacity building opportunity proposed by almost everyone was the creation of an exchange program between community networks. That is, a program that facilitates the ability to visit other communities where

networks have been deployed to learn first-hand how peers are solving similar challenges they might be facing. All representatives at the first Summit were not only open, but also honored to host representatives of other community networks in their communities.

A more structured capacity building program was also suggested, and even given the name the "School of Community Networks". This school should cover theoretical as well as practical issues around access and backhaul infrastructure, services, institutional and economic models, as well as regulation. An additional suggestion is that after attending and graduating from the school, students can be sponsored with some networking equipment to continue putting into practice what they learned.

Teachers at Pamoja Net.



5 Barriers to the creation and scale of community networks

The number of initiatives identified is relatively low considering the continent's size and population. Thus, it is important to understand the barriers that prevent more community networks from appearing or existing ones from becoming sustainable and scaling. The barriers identified by community network proponents and experts have been grouped into four umbrella categories: social, economic, technical, and legal.

5.1. Social

A lack of awareness of both the potential benefits of accessing information, and the Internet more generally, and the possibility for communities to create their own network, are the main barriers identified by the experts consulted that hinder the creation and scale of community networks. As Josephine from TunapandaNet emphasized:

“We mostly look to the government to solve the issue of connectivity, but never have we seriously considered that the answer is in communities. I also think that a huge percentage of people living in rural areas still do not understand the power of connectivity and the impact it would have in their lives.”

One of the main reasons cited for this gap is the lack of relevant local content on the Internet. As Mweetwa summarized: “Actually, what we see is that maybe 90% of the information you access on the Internet is foreign. But ... what does Internet mean, to Africa; for Africans?”

It is one thing to know about the Internet and the benefits of accessing the information available, but building infrastructure from the ground up to access it is another story. For the latter, it was argued that it takes considerable effort to change a mindset imposed after generations of colonial ruling. As a result, many are reluctant to engage in doing something different – not only in the communities, but in established businesses and other institutions, and other stakeholders relevant to community networks. For example, Zenzeleni Networks struggled for months to open a bank account because the bank managers in the closest town could not believe that people from rural areas were creating their own telecommunications cooperative. Similarly, the University of Johannesburg could not believe that people from Soweto were providing free access to the Internet by themselves. So, this lack of awareness is not only limited to rural areas and marginalized communities, but extends to those working or living in urban areas and more informed environments. They do not know that community networks are possible either. There were many of those attending the first Summit or the follow-up panel who did not know it is possible either, and this lack of awareness has been observed elsewhere by other experts after giving presentations about community networks.

Additionally, the incentives to set up community networks are not very clear to many. As Sebastian Büttrich, involved in the Sengerema Wireless Community Project in Tanzania, rhetorically asked: “Why build networks if you already have mobile connectivity?” His question points again to lack of awareness of the potential benefits for a community to engage in this process, and a lack of awareness of technical infrastructures and how they work.

In this scenario, excluding exceptional cases, many community networks in Africa were started thanks to the assistance of people external to the community, with academic and research institutions having special representation. These initiatives face additional barriers, as depending on the local partner, issues around gatekeeping and political use of the partnership can arise. This may undermine the efforts from those in the community with the enthusiasm, time, and skills required to overcome the barriers mentioned in this section.

5.2 Economic

As Patrick Gichini from TunapandaNet said: “Here in Africa, sometimes it goes down to the question of choosing between Internet/communication networks and other vital necessities such as food and health.” Thus, if people need to make this type of decision with regard to personal expenditure on communications, it is difficult to imagine how they will be able to buy their own devices to create a community network, which is the case of most similar initiatives in high-income areas. Concerning the costs of telecommunications infrastructure, it is important to bear in mind the additional costs required, such as the power infrastructure needed due to the unreliability or nonexistence of the grid in most of the places where these projects exist or could be deployed. The cost of this power infrastructure accounts for more than 70% of the capital required. Additionally, telecommunications equipment is not even available domestically in many countries and needs to be imported. Most participants at the first Summit pointed to the high costs associated with import taxes and the customs bureaucracy as another barrier for them.

The amount of initial capital needed depends on the area that a community wants to cover, but in general terms – and due to the explosion of low-cost telecommunication devices – it is less than what people may think. In addition to the cost of setting up and powering the local telecommunications infrastructure, if the community would like to connect the network to the Internet, it needs to face the high costs of backhaul connectivity, which in 2017 can still go as high as 1,000 USD per megabit per second (Mbps) for an Asymmetric Digital Subscriber Line (ADSL) type connection in some rural areas. Thus, even if the community manages to secure seed capital to cover the capital expenditure (CAPEX), creating sustainable business models to cover the recurrent payments for the backhaul connectivity becomes challenging. To many of the people interviewed, this cost presents one of the biggest barriers for higher uptake of the community networks model, as it requires a considerable level of aggregated demand to make it cost effective. This, in turn, makes it more difficult for community networks to scale.

Meeting the cost of the backhaul makes it even more difficult to generate sufficient revenue to financially reward those involved in the management of the network. Those involved in community networks do it more as a community service; however, it is customary that when they spend a day working outside their home, they should receive some sort of stipend in return. Thus, voluntary work may work for a while, but people need to earn a living to continue engaging in the long term.

The slow, if existent, penetration of Internet-abled user devices (mobile phones, tablets, computers, etc.) was also another barrier that was consistently mentioned, as they are very expensive for the low-income earners in most of these areas.

5.3 Technical

The lack of local technical competencies was often mentioned as the main barrier to the creation and scale of community networks in this dimension. Patrick from Pamoja Net summarized this by stressing: “In many of these communities in Africa where communication is a huge problem, the residents do not have the necessary knowledge [to] solve these problems and thus have to rely on outsiders for help in setting [up] their own networks.”

Although there are notable exceptions, this is true for most of the community networks in Africa. In the best-case scenarios, those “outsiders” have trained locals on how to maintain, operate, and scale up the network. However, sometimes it is difficult to find people with the skills and the commitment to complete the training because “[those] with knowledge leave to find better opportunities elsewhere, [and] those that have remained are too busy carving out a living for themselves,” explained Dada. “[This creates] a perpetual cycle of training and retraining.” The lack of electricity, as well as other physical infrastructure, poses an additional barrier to the technical trainings mentioned above.

Additionally, most of the representatives attending the first Summit commented that electronic devices do not last long in their regions, which often means additional costs for maintaining or replacing equipment. Sometimes it is due to heat affecting the routers used in the case of Namibia, the dust in the computers, as is common in the rural areas of Zambia or Zimbabwe, or the fake Ethernet cables detected in Nigeria. The high cost and lack of local availability of rugged equipment prevents low-income communities from making use of them. Other materials required to set up a community network, such as electrical and solar equipment, poles, etc., are not available in a common hardware store in Africa, and expensive to import.

Another technical barrier listed is that existing technologies available to set up community networks are not well suited to the terrain where some of the community networks are located. For instance, in Eenhana (Namibia), where the terrain is very flat and covered with tall trees, they could only use Wi-Fi³⁸, which requires line of sight (LoS) between the routers that create the network if they are at a certain distance. Similarly, in Kafanchan (Nigeria), where hills are common, Wi-Fi does not cater for those non-line of sight (N-LoS) scenarios.

38 In Namibia, as in many other countries in Africa, industrial, scientific, and medical (ISM) bands are the only ones that can be used on a license-exempt basis.

5.4 Legal

The lack of government support was highlighted by most of the respondents as an important barrier. The reasons for this lack of support ranged from “total disinterest” or the lack of awareness that community networks are indeed possible, to having regulations in place that prevents or makes it difficult for community networks to exist. As Dada stressed:

“An appropriate regulatory framework supported by informed national political will makes a lot of difference to the development and deployment of community networks in Africa. As one of the fastest-growing ICT markets globally, Africa can become a major hub for community networks if an enabling environment, comprising of adequate power and affordable Internet access, were made available.”

From the directives of the United States Federal Communications Commission (FCC) and the European Commission that prevent changing the firmware of a given router, to the series of Internet shutdowns in many African countries or the more specific barriers experienced by Mesh Sayada in Tunisia, it seems that governments are blind to the growing evidence that community networks could indeed be the solution to provide affordable access, not only to the Internet per se, but to e-government services that the very same people that they are trying to target cannot access.

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Another reason for this lack of support is the so-called regulatory capture mentioned by many of the respondents. This suggests that big telecommunications companies lobby to either create a regulatory framework that only favors them, or prevent a regulatory framework from being applied that would highlight the telecommunications

companies’ dominant and anti-competitive positions, especially the incumbent’s. This effectively prevents new entrants, such as community network operators, to provide affordable access.

Mamello Thindyane, formerly involved with the Siyakhula Living Labs in South Africa, and principal research fellow at the United Nations University Computing and Society, proposed another reason for legal and regulatory roadblocks:

“Community networks are antithetical to the way big corporations and governments run – i.e., they are not about the concentration of power and control, but about distributing and decentralizing access to network resources. So, fundamentally and ‘subconsciously,’ they might not have much support from governments and private industry.”

This was corroborated by Nicola Bidwell, from the University of Namibia, who locates community networks in a gray space that is totally new for regulators, which in turn struggle to deal with them. This was further validated by the experience from Zenzeleni Networks, which experienced a six-month delay in obtaining its license exemption, despite being assisted by one of the most experienced regulatory advisors in the country, simply because the regulator had not seen a case like that before.

According to the experts interviewed, the lack of more explicit support for the community network approach from regulators and policy-makers is combined with other regulatory barriers, namely:

- Small segments of the available spectrum are assigned for license-exempt use.
- Big segments of spectrum that are suited for N-LOS scenarios – i.e., the bands being freed up with the switch from analog to digital TV and unused GSM spectrum – are allocated nationally but are effectively empty or unused in rural areas.
- Lack of, or limited, open access national fibre backbones, which would facilitate the reduced cost of backhaul.
- High import duties and customs fees on telecommunications equipment and user devices.
- High regulatory fees on unlicensed wireless equipment purchase and use.
- Long waiting periods to obtain the permissions and licenses to deploy and operate such networks.
- Lack of clarity about whether part of the USAFs could be used for these types of initiatives.

At the same time, community network representatives did not appear to be well versed in the local policy environment regulating their activities either. This may become an additional barrier as their activities could be compromised by not complying with certain regulations or legislation, while at the same time failing to be considered as a serious alternative to receiving the aforementioned support from governments and regulators since they, as many representatives emphasized, “do not speak the same language”.



6. Considerations for developing community networks in Africa

6.1. Defining community networks in Africa

In Africa, a community network is not simply telecommunications infrastructure deployed and operated by citizens to meet their own communication needs; it is a tool to improve what a community is already doing in terms of their growth and development, by contributing to a local

In Africa, a community network is not simply telecommunications infrastructure deployed and operated by citizens to meet their own communication needs; it is a tool to improve what a community is already doing in terms of their growth and development, by contributing to a local ecosystem that enhances the daily lives of those staying in the community.

ecosystem that enhances the daily lives of those staying in the community.

The way different institutions are managing this local economic ecosystem in their communities to maximize the benefits for their users resembles the commons model described by the Nobel Prize-winning economist Elinor Ostrom³⁹. Other community networks in the world are using a similar model for their

telecommunications infrastructure ecosystem, with the most relevant example being guifi.net⁴⁰. Among the initiatives researched, only SoWUG seems to be following a similar approach, although still in a very preliminary stage.

6.2 The early stages of telecommunications self-provision

These benefits are reaching a very small number of communities in Africa. According to the experts interviewed, this is related to the lack of awareness about the fact that community networks are at all possible. This in itself is tied to a broader lack of awareness about how telecommunications services are provided, which is related to either the lack of local, relevant content on the Internet or the lack of awareness about its existence due to the use of formats not appropriate for the literacy levels among the unconnected.

It is hypothesized that telecommunications and computer science are relatively new fields, so it is understandable that only a very small fraction of the population has mastered them. This contrasts with other activity areas, such as electricity, mechanics, plumbing, and building that – through generations of hands-on engagement and the creation of low-cost and plug & play resources – have become more accessible for people without higher education or specialized education.

The same way that complex engineering expertise and knowledge of physics and chemistry is hidden behind solar panels, which transform sunlight into electricity that is then stored in batteries and available for use at night, community network activists and entrepreneurs have been hiding the complexity surrounding Internet infrastructure and creating nearly plug & play solutions that allow people with little technical knowledge to deploy, operate, and maintain their own communications

39 E. Ostrom. *Governing the commons: the evolution of institutions for collective action*. Cambridge University Press, Nov. 1990.

40 <http://guifi.net/en/node/38392>

networks. On the hardware side, projects such as the Mesh Potato from Village Telco (VT)⁴¹ and the forthcoming LibreRouter are clear examples of this,⁴² while OpenWRT-based firmware solutions such as LibreMesh⁴³ and VT's SECN⁴⁴ exemplify this hidden complexity on the software side.

Armed with these solutions, community networks worldwide are known to play a major role in building a broader understanding about telecommunications, networking, and computing among its members. This usually facilitates more active engagement with technology, leading to the expansion of the infrastructure and the creation of services and content that is relevant to the local context and needs of their members/users. More broadly, this engagement allows them to be active participants in an ever-expanding digital world. The community networks analyzed in Africa show a similar pattern: the more people are aware that these solutions exist, the more they start providing themselves with connectivity.

The community networks analyzed in Africa show a similar pattern: the more people are aware that these solutions exist, the more they start providing themselves with connectivity.

6.3. Stakeholders and strategic partnerships

To not only raise more awareness about community connectivity, but to do so in a socio-cultural acceptable way, the role of the three powerhouses mentioned in Section 4.2 in promoting and enabling this model is critical.

The role played by traditional authorities on the initiatives studied has been extensively documented in this report. In the most notable case, the support of a chief was key to enabling Macha Works to scale the model into communities in other chiefdoms. Engaging with the houses of traditional leaders to introduce them to the benefits that community networks could bring to the areas they govern would contribute enormously to the change of mindset required in community members to be more receptive to the idea of building their own communications infrastructure.

The churches, especially those in rural Africa, have also been proven important in enabling the growth and expansion of community networks, as Fantsuam, BOSCO Uganda, and the initial stages of Macha Works demonstrated. Thus, it seems pertinent to take them into consideration when exploring awareness-raising and outreach strategies.

Similarly, governments recognizing the role that community networks can play as a legitimate alternative form of connectivity, with regard to stimulating the local economy and accelerating its dynamism by providing universal access to communications, and with it to their e-government services, could be very beneficial in terms of raising awareness. In most disadvantaged communities, public channels (both radio and television) are the only electronic means of communications available. In addition, most information is accessed when visiting government facilities (e.g., clinics, police stations, post offices) for other purposes. These channels could be used to promote and disseminate information about community networks. In addition, skills on how to roll out and maintain community networks could be developed within the different vocational training programs offered to youth or unemployed individuals.

On a similar note, the role of private media should not be disregarded or downplayed, either. The attention community networks receive compared to top-down approaches to providing connectivity is negligible. Although there have been exceptions, capturing the interest of national or international news agencies in this model is difficult. Local media outlets, however, could be interested in the impact this model may have on local communities, which in turn would benefit them as well, as the case of Mesh Bukavu demonstrates (see Section 4.3).

Thus, targeted awareness-raising campaigns among these stakeholders could go a long way in scaling the model to other areas.

41 <https://store.villagetelco.com/mesh-potatoes.html>

42 <https://librerouter.org/>

43 <http://libremesh.org/>

44 http://wiki.villagetelco.org/Main_Page#Mesh_Node_Firmware



6.4 Local community network champions

Being aware that community networks are a possibility is just the beginning. The next step is finding people who are motivated enough to start one.

In this regard, there seems to be a hypothesis arising from the contexts where these initiatives have taken place so far. The more people there are near where the project started, the greater the chances are to find people with the different skills, passion, and motivation necessary to take the project forward.

In a similar vein, when more people become aware of the model, the more likely it will be to find those who want to go that extra mile and get involved. Thus, the limited number of people aware of this possibility, coupled with the resources and expertise needed seems to justify the involvement of people external to the communities (and most times to the country) in the initial stages of community networks in Africa.

Luckily, there are already several people hailing from the communities themselves, as those presenting at the first Summit demonstrated, who can speak in person about this process. Supporting them to become role models for their own and neighboring communities would go a long way to extending the model. As they understand local codes, norms, and practices, they are better suited to infuse a similar vision into others. They will also be seen as equals. These experienced people generally want to stay local and invest time in making their communities a better place. Gertjan van Stam, who was key in bootstrapping Murambinda and Macha Works, calls them African Engineers, and describes them as those individuals:

“well acquainted with the local beliefs, customs, and values embedded in [African] worldviews, cultures, histories, and religions, and know how to link both artifact and people in a holistic manner. [These individuals are] involved in the balancing act of the demands of daily life and wholesome relationships. It is a person that is able to know the meaning of events by all involved in interacting with it, in any stage of sensitization, design, implementation, and operation⁴⁵.”

Similar people in other communities are not short in numbers, they just need to become aware of the model, and be given opportunities and support.

The convening of the first Summit was a first step in the right direction. It gave those who participated part of the recognition they deserve for starting these transformative projects under such challenging circumstances – recognition they do not receive from their governments, and sometimes, even from their communities. Thus, such events demonstrate the value of convening people to build a community among the individuals creating and operating community networks as well. At the same time, as the days spent in Nairobi in November 2016 and the subsequent communications that have taken place have shown, the connections, acknowledgement of shared struggle, and good will created at the gathering – as well as the message of future support sent by ISOC – has spurred their confidence and commitment to go an additional extra mile.

All the community network representatives recognize the importance of such awareness. That is why most community networks have specific programs to sensitize people about this knowledge and its potential benefit, not only in accessing information already available on the Internet, but in the creation of content as well, as described in Section 4.3.

⁴⁵ van Stam, G. (2016). African Engineers and the Quest for Sustainable Development: Levelling the Ground for all Players. In IEEE PES Power Africa, 28 June - 2 July 2016, Livingstone, Zambia.

In fact, when asked about the capacity building requests needed to sustain their efforts ISOC could assist them with, most of them referred to how important it is to equip others with skills so they could maximize the potential benefits the network could have for the community. This is more time consuming than the one-person-show approach, but as the African saying aptly suggests: "If you want to travel far, go together."

A third set of people who have been involved in the creation of community networks are those with ties in rural and marginalized areas who are studying or working in IT-related fields in urban areas

In fact, when asked about the capacity building requests needed to sustain their efforts ISOC could assist them with, most of them referred to how important it is to equip others with skills so they could maximize the potential benefits the network could have for the community.

or more informed environments.⁴⁶ Experts like Chief Chikanta went a step further during the first Summit and suggested that it is their responsibility to bring that knowledge back to their communities. The link between universities and community networks is evident in Africa, but additional efforts could be made in this regard,

especially in those countries with few or no community networks. To this end, ISOC chapters on the continent seem well positioned to make this link with university students and IT professionals, who, by belonging to the communities, are considered to be role models as well.

However, no matter how hard these role models work to plant the seed of the project – being transparent and accountable, building capacity and sensitizing community members, and trying to provide as many channels for participation as possible – it might not be enough. In almost every project, there are people more interested than others, for a variety of reasons, in actively engaging and participating, so it should not be expected that community networks are any different. The situation is different when the community network (un)intentionally perpetuates existing gender and social inequalities that lead to an imbalance of power. The limited participation of women at the first Summit and in the decision-making structures of the community networks in general could point to the reinforcement of this phenomenon, although it could also be that women are "negotiating intersecting power relations differently."⁴⁷ Although this is a topic that should be given greater consideration, strategies implemented by the community networks represented at the first Summit, and described in Section 4.2, should be used as an example.

6.5 Strategic communications – Creating a community networks narrative

For the awareness raising to be as efficient as possible in reaching out to more African Engineers, materials need to be created with evidence that entices the different stakeholders to engage with the model.

Although some evidence has been gathered in this report about the number of community networks, the users of some of their services, and other metrics, systematically quantifying both the social impacts of the spinoff initiatives as well as the economic investment that has gone into them is a necessary and prudent next step.

However, this is neither a priority for community networks nor do they generally have the capacity, resources, and skills to conduct such research. This reinforces the role that universities and other research institutions could play if they were to collaborate more closely with community networks. This collaboration needs to come from a common and respectful understanding of the roles and strengths of both communities and research institutions to avoid gatekeeping issues identified by community networks proponents (see Section 5.1), as well as to leverage the skills and knowledge of both sets of stakeholders and maximize their effectiveness.

⁴⁶ The Greek community network Sarantaporo.gr is the most notable example of this approach: <http://www.sarantaporo.gr/>

⁴⁷ T.S. Hussen, N.J. Bidwell, C. Rey-Moreno and W.D. Tucker, "Gender and Participation: Critical Reflection on Zenzeleni Networks in Mankosi, South Africa" AfriCHI, 21-25 November 2016, Nairobi, Kenya. ACM, 2016.



After collecting the evidence, the data should be curated and presented with appropriate language to the targeted stakeholders below. If successful, this could enable a dialogue for:

- Governments and policy-makers to become more aware of how this model compares to other access models and how it aligns with the goals of their digital and rural development agendas in particular, while at the same time recognizing how their own policies and regulations are limiting or fully preventing community networks from flourishing.
- Businesses and telecom operators to understand that community networks are as valid as any other player in the telecommunications industry.
- Donors to obtain a clearer idea of both the transformational aspects community networks can offer to marginalized communities in terms of self-determination and agency, and how much it costs to bootstrap one.
- Researchers to acknowledge the value of the data obtained from these initiatives despite the uniqueness of the context where they take place. Finding ways to make research on community networks more attractive for publication would also incentivize more researchers to conduct work on the topic, which in turn will facilitate the creation of more evidence to better understand the pros and cons of this model as it compares to others.
- Potential implementers, individuals, and communities, to be equipped with a clear understanding of what it takes to start a community network, the tools needed to make that happen, and what potential incentives exist for them to do so.

The creation of a Community Network Observatory, that not only curates and presents this evidence, but also monitors growth, challenges, available resources, and opportunities within the community networks movement, could be an interesting way of aggregating all the knowledge produced.

6.6 Considerations for funding and sustainability

A commonality shared across the community networks studied is the lack of economic resources in the communities, as described in Section 5.2. The seed funding available for those with a vision has proven to be key for the development of the community network movement on the continent. This

A commonality shared across the community networks studied is the lack of economic resources in the communities, as described in Section 5.2. The seed funding available for those with a vision has proven to be key for the development of the community network movement on the continent.

was highlighted by the IDRC funding more than ten years ago, the OTI Seed Grants provided in 2015, and the different community networks awarded with funding from ISOC's Beyond the Net program. Once that

funding was used to set up the infrastructure, most of those who received it found ways to generate enough revenue to sustain the initiative, despite the challenging environments where they work. It is worth mentioning that additional funds are needed by community networks in Africa to cover the lack of electricity in the locations where they are deployed, a lack that is usually covered by solar power systems.

Other mechanisms to gather funds within communities to bootstrap networks could work in Africa as well. This mechanism would allow for a “pull” approach – where the communities are the ones requesting the network and gathering the funds to bootstrap it. Although the pull approach is more likely to be sustainable – with Rhizomatica in Mexico⁴⁸ or Altermundi in Argentina⁴⁹ as current examples – the barriers identified above in terms of awareness and low income levels, along with other cultural factors specific to the African context, may prevent it from happening. Some of the

48 <https://rhizomatica.org/>

49 <https://www.altermundi.net/>

processes highlighted in previous sections could transform this scenario, such as having the blessing of the traditional leaders, and having documented and easy to communicate evidence of the benefits of community networks. For now, in those community networks in Africa who have scaled into other areas – BOSCO Uganda and Macha Works – a “push” approach has been used instead.

With the removal of some of the barriers in Section 5 and the consolidation of the model, the experience of successful African community networks suggests that more opportunities to generate revenue from the community networks will appear, which in turn will make it more feasible for communities to gather the funds to establish, maintain, and sustain one. Even if they cannot gather the initial capital, this could be offered as a low-interest loan that they could then repay with the revenue obtained from the services provided by the community network. For this low-interest loan schema, or a more grant-type approach, another solution would be to fill this gap via the use of the USAF, which often go unused or misspent in many African countries⁵⁰.

With regard to revenue generation to repay the loan, knowledge about local needs and the expenditure capacity available provides one of the biggest opportunities for community networks in Africa. If this knowledge is combined with business and marketing training, as the participants at the first Summit requested, and tools for easier billing and accounting were made available, community networks could contribute even further to the local economy and provide better incentives to those involved. This may also open the space for other community members with a more business-driven mentality or entrepreneurial spirit to collaborate with those individuals who have a community service mentality.

Limited funds are available to purchase end-user devices. An idea to address this issue was mentioned by Joseph Bishi from Murambinda Works in Zimbabwe, who suggested:

“Provide loans to the community and its members to purchase [end-user devices], and allow them to pay [them] back in installments. As an interim solution, many community networks have created community centers, where people can come and use devices on a shared basis.”

6.7 Developing local capacity for community networks

As highlighted by the representatives of the community networks at the first Summit, even if people are aware of and willing to commit to starting a community network, the needed funds are available, and there are no regulatory barriers, some basic capacity building and support is required.

Until now, this has taken place in an informal and voluntary fashion via different mailing lists⁵¹, or via personal contacts where those with more expertise support those individuals wishing to start a community network. However, questions often go unanswered, or people lack the contacts, language skills, or courage to pose the questions in the first place. Additionally, the number of community networks has been relatively small with respect to the number of experts with the time, commitment and capacity to assist those starting. However, if the barriers described in Section 5 are lowered to the point that any community in Africa can start a community network, the number of requests is going to grow exponentially. The success of existing community network models has already proved this: once a model works, such as the case of Rhizomática⁵², a targeted umbrella organization needed to be created to provide training and support for those communities interested in engaging in replication and scaling⁵³.

Thus, at first glance, it may appear that there is a shortage of expertise to mentor community networks in Africa. Yet, a program similar to the bounties approach offered to software developers to troubleshoot issues, fix bugs, enhance security or fix a particular problem within a program, could be used for supporting community networks when facing some of the issues mentioned above. In this sense, networking, economic, business/marketing, and regulatory experts not necessarily involved with community networks could be interested in becoming part of the initiative. In particular, people with technical skills have shown strong interest over the years in volunteering to help set up networks. With ISOC taking a leading role among the technical community, an international Community Network Volunteers program could be established. A mechanism for selecting and rating those expert volunteers – as well as a financing mechanism to pay for those consultations and support their travel (if funding allows) – would then need to be devised and put in place for this to succeed. Similarly, community networks selected for this program could be allocated a finite number of consultations per year, for each network to decide how and when to use them. In exchange, beneficiaries of the program should then be mandated to offer capacity building and mentorship for youth in their communities, as well as communicate their experience through local and regional media outlets and via blogs relevant to the community networking space (e.g., the ISOC blog).

The important role of universities and research institutions described in previous sections arises here yet again, as most initiatives have relationships with national or international universities providing technical support or co-creating solutions to meet the communities’ needs. It is also worth exploring ways of including them if the broader Community Network Program is created.

As a supporting mechanism to the above, sponsoring members from the communities where these initiatives are taking place to attend and participate in national, regional,

50 <http://a4ai.org/are-universal-service-funds-being-used-to-close-the-online-gender-gap/>

51 World Summit on Free Information Infrastructure, Village Telco, LibreMesh, etc.

52 <https://rhizomatica.org/>

53 Telecomunicaciones Indigenas Comunitarias, <https://www.tic-ac.org/>

Installation of mesh network
access point in Bukavu



and international conferences and events should be encouraged. It is common to see those individuals who are involved in assisting communities to set up their networks – whether they be researchers, activists, advocates, or members of the umbrella organizations providing such support – present at events related to community networks. However, it is very rare to see representatives from the communities themselves at these events. It may well be that some of them are not interested in attending, but that was not the case for most of those who attended the first Summit. This not only allows them to be exposed to and learn from other initiatives, but to network on their own terms with the people they would like to collaborate with or learn from in the future. This fellowship approach is important as it expands human networks and expertise. If such a mechanism is to be implemented, those communities selected for this program could be given a yearly allocation for attending relevant conferences or events. A similar program is provided by the Association for Progressive Communications (APC) to its members, and could be considered for reference⁵⁴. Additionally, positive discrimination toward women should be encouraged to address the gender disparity existing within the community networks studied so far.

Peer exchange should also be encouraged. Beyond the positive outcomes expected from the knowledge exchange, particularly for the visitor, a positive impact in the hosting community is expected as well. Having community members from other countries learn from their experience is a great way to recognize the good work being done locally.

The more formal School of Community Networks has also been suggested as a way forward in other gatherings related to community networks, such as the meeting of the Dynamic Coalition on Community Connectivity (DC3) held during the 11th IGF in Guadalajara, Mexico, in December 2016. Similar programs have been organized in the past as part of the different trainings on wireless networking from the International Center for Theoretical Physics (ICTP)⁵⁵ and the TRICALCAR program⁵⁶, and they should be considered as a prime example to build upon. ISOC's experience with their Developing Countries Workshops⁵⁷ would be incredibly valuable when replicating this for community networks as well. The materials developed for these training courses should be accessible both online and offline in order to enable those in low bandwidth areas to access them. In addition, and when funds allow, they should be offered in video (or audio) format, which also aligns with the other suggestions put forward during the discussions with DC3 members during the IGF. Although animated videos dubbed into different languages could initially be created, videos created by Africans for Africans could have a greater impact in the long-term as the viewer would be able to more effectively connect with the people appearing in the videos, which would likely encourage members in the community to work harder or get more engaged.

6.8 Policy and regulatory engagements

Even if all the above have been addressed, community networks still face significant barriers since they generally do not neatly fit into the regulatory environment that is designed for former national monopolies and other big telecommunications companies.

One of the results of this reality is that community networks in Africa predominantly use Wi-Fi because it is the only technology available where affordable equipment exists that can make use of the few unlicensed spectrum bands available. However, Wi-Fi is not an optimum technology for providing connectivity in rural areas since it uses higher frequencies that effectively have a shorter range for the same amount of power transmitted, and it suffers when there is N-LOS between the transmitter and the receiver. There are other technologies such as TV white spaces (TVWS) that use lower frequencies than Wi-Fi and allow outdoor N-LOS connectivity. However, despite initial expectation and developments, this technology has not yet reached the economies of scale and maturity required for these types of projects. This has certainly been influenced by the slow pace at which governments are creating regulation to use the TV bands that were emptied during the analog to digital migration⁵⁸. It is important to note that most of the bands that will be emptied in this process are empty by default in most rural areas, as operators with national licenses do not have any commercial interest in making use of them in such areas. Moreover, using a dynamic spectrum approach would prevent community networks from interfering with primary users operating on those bands.

A similar case occurs with the Global System for Mobile (GSM) frequencies, which are barely used in rural areas even though they are allocated nationally. Given the importance of oral communication in Africa, the efficiency of GSM in dealing with voice communications, and the high degree of penetration of basic mobile phones across the continent, it is pertinent to explore options to allow communities to access unused GSM spectrum and support those doing so.

All the above is related to local telecommunications infrastructure, as most community networks do not have the resources to build their own backhaul. In that sense, as highlighted by the interviewees, making more open access national fibre backbones available will significantly reduce the cost of backhaul.

54 <http://www.apc.org/en/projects/member-exchange-and-travel-fund-metf>

55 <http://wireless.ictp.it/training.html>

56 <https://www.apc.org/en/projects/lac/wireless-lac-tricalcar>

57 <https://www.internetsociety.org/history-timeline/internet-society-launches-developing-country-workshops>

58 South Africa is an example for this: http://www.itweb.co.za/index.php?option=com_content&view=article&id=161513:Dlodlo-flips-the-script-on-digital-migration&catid=260

7. Recommendations

Below are sets of recommendations relevant to each stakeholder group that are meant to help facilitate the establishment of community networks and support existing ones in the African region. Ideally, each stakeholder group should work together to coordinate efforts via the development of strategic partnerships among them.

To communities:

- Continue engaging in and supporting such initiatives, as there are many organizations willing to support the work that is currently being done and extend it to other areas.

To governments:

- Promote and disseminate the community network model through their existing dissemination channels.
- Include curricula for the roll-out and maintenance of community networks into their existing skills development programs.
- Make USAF or other new funding mechanisms available for the deployment, operation, and maintenance of community networks.
- Create a more conducive regulatory environment by making more unlicensed spectrum available (particularly in those bands that are allocated nationally, but not used in rural areas, such as TV, GSM, etc.), implementing measures to reduce the backhaul costs such as more open access fibre national networks, and reducing the fees and taxes to import and use telecommunications equipment.
- Allow experimental licenses on a fast-track basis to ensure efficient start up for community networks.

To development organizations:

- At the local level: make funding available to deploy community networks for those who are sincerely committed to the development of their communities, while also being mindful that addressing the barriers faced by community networks may require a more flexible approach in terms of project/program management.
- At the international level: make funding available to support the creation and maintenance of structures and programs that support those starting or operating community networks. Examples include the Community Networks Volunteer program, the School of Community Networks (including the creating and maintaining the platform to host the training materials), the Observatory of Community Networks, and/or the peer exchange mechanism.
- Recognize and respect the role that local actors (traditional leaders, government, and local religious organizations, as well as community members themselves) can play.
- Raise awareness among local actors about the potential benefits of community networks.
- Contribute to build capacity and engage in advocacy to address the barriers identified in this report, specifically around policy and skills.
- Work with local communities to identify what is most useful to them before deciding on a course of action related to funding.

To the technical community

- Continue creating solutions that reduce the complexity to deploy, operate, and maintain networks, and accompany them with educational materials on how to make use of them. Include modules about community networks in their capacity building activities.
- Offer community networks free or cheaper access to critical infrastructure resources.

To research and academic institutions:

- Identify additional barriers of adoption and best practices from other initiatives to help overcome them.
- Generate evidence and data about the impact of community networks.
- Provide support and training as well as create awareness through their community engagement programs.

To private media:

- Pay more attention and provide more coverage to the developments in the area.

Training workshop for the Bukavu people to explain the functioning and use of the community network.



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Appendix A Presenters at the First Summit on community networks in Africa

| Representatives name | Community Network Name | Country |
|----------------------|------------------------|------------------------------|
| Tonny Okwonga | BOSCO Uganda | Uganda |
| Benjamin Murhesa | Mesh Bukavu | Democratic Republic of Congo |
| Fred Mweetwa | Macha Works | Zambia |
| Joseph Bishi | Murambinda Works | Zimbabwe |
| Masibulele Siya | Zenzeleni Networks | South Africa |
| Thato Mfikwe | SoWUG | South Africa |
| Patrick Byamungu | Pamoja Net | Democratic Republic of Congo |
| Josephine Mliliza | TunapandaNet | Kenya |
| Annastasia Shipepe | Connecting Eenhana | Namibia |
| John Dada | Fantsuam Foundation | Nigeria |

Appendix B Community network experts interviewed

- Stephen Song, Village Telco/Bo-kaap (South Africa)
- Gabriel Nhinda, Connecting Eenhana (Namibia)
- Nicola Bidwell, Connecting Eenhana (Namibia)
- Sebastian Büttrich, Sengerema Wireless (Tanzania)
- Elektra, Village Telco, Freifunk, B.A.T.M.A.N.
- David Johnson, Peebles Valley/MasiMesh (South Africa)
- Andy Gunn, OTI
- Ryan Gerety, OTI
- Gertjan van Stam, Murambinda/Macha Works (Zimbabwe/Zambia)
- Amos Nungu, The ICT for Rural Development Project (Tanzania)
- David Carman, Scarborough WUG (South Africa)
- William Tucker, Rural Telehealth/Zenzeleni Networks (South Africa)
- Mamello Thinyane, Siyakhula Living Labs (South Africa)
- Benjamin Murhesa, Mesh Bukavu (DRC)
- Josselin Magloire Youmbi (Cameroun)
- Nizar Kerkeni, Mesh Sayada (Tunisia)
- Manfred Takondwa Makawa, Connecting Eenhana (Namibia)
- Mike Jensen, APC
- Patrick Gichini, TunapandaNet (Kenya)
- Josephine Miliza, TunapandaNet (Kenya)
- Mario Marais, CSIR
- Trésor Tshisekedi Mutapay, Mesh Goma (DRC)
- Masibulele Siya, Zenzeleni Networks (South Africa)
- Amreesh Phokeer, Masimesh (South Africa)
- Alfredo Terzoli, Siyakhula Living Labs (South Africa)
- Thato Mfikwe, SOWUG (South Africa)
- Rael Lissoos, Dabba Networks (South Africa)
- John Dada, Fantsuam Foundation (Nigeria)
- Michael Graaf, Zenzeleni Networks (South Africa)
- Pacifique Zikomangane, Mesh Bukavu (DRC)

The installation of the mast





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Supporting the Creation and Scalability of Affordable Access Solutions:
Understanding Community Networks in Africa

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