Community Network Readiness Assessment Handbook

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Acknowledgements

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Introduction: About Community Networks

Community networks are networks deployed and operated by citizens to meet their own needs. In recent years, the community networks movement has grown, with more and more people pointing to them as a solution for connecting the next billion. Community networks are key to helping close the global digital divide.

This manual addresses two gaps identified by the community network movement: the failure of commercial telecommunications operators to provide decent access to communication to people at the "lower end of the market," and of the governments to create suitable regulatory and other conditions. As hardware becomes cheaper and more free software becomes available, the community network movement is accelerating. The emphasis in this book will be on Africa, but the movement exists worldwide, with many types of networks according to local conditions and needs.

A community network can be as small as a single Wi-Fi hotspot or as large as a small country (if you count a federation of local networks linked to each other, like Guifinet in Spain). A community network can be in a remote area or in a huge city (like New York City Mesh). It can take the form of a series of ethernet cables (as in Cuba), a local cellular system (as in Mexico), or most commonly, a Wi-Fi network (NYC Mesh and Guifinet supplement theirs with fiber backbone). It can provide services ranging from locally hosted offline resources, to local-only voice calls, to high-speed broadband connectivity. What all of these have in common is community governance or ownership.

Every country has a telecommunication regulation authority which determines what equipment and radio spectrum may be used and who can use it. These national regulators collaborate through the International Telecommunications Union (ITU). For example, Wi-Fi is a set of internationally recognized standard frequencies available for use without a license, subject to limitations on signal strength.

Within a country, the national regulator generally requires either an operating license or a license exemption from the operator of a telecommunications service. Hardware items such as radio transceivers can also be required to be licensed, as can the use of specific radio spectrum.

Besides communications regulators, most countries have a universal service agency. The agency is supposed to ensure that communication services reach all citizens, even where the market fails to do so. These agencies collect surcharges from commercial telecoms operators to create a universal service fund.

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The community governance of community networks must include interacting with regulators and universal service agencies, whose main interactions are with large companies like mobile (cellular) network operators (MNOs). Competing with companies for the attention of authorities is one of the biggest challenges facing community networks.

In Africa specifically, the very rapid growth of cellular networks dramatically changed the lives of many people. But it also highlighted deficiencies—areas where there is inadequate service, or where people can't afford to benefit fully. Mesh Bukavu and Pamoja Net are great examples of how community networks can help overcome obstacles to connection.

In the Democratic Republic of the Congo city of Bukavu, after the first government-ordered Internet shutdowns, local journalists and academics got together to create a community network, Mesh Bukavu. The idea was that they would have at least partial telecommunications during shutdowns (and reduce costs at other times). They didn't know, until a distant researcher informed them, that Bukavu was also home to the Internet gateway of Pamoja Net, a community network which serves Idjwi island on nearby Lake Kivu, where the community had no Internet access previously.

There is a need within the community network movement to integrate both understanding and practical work, between the micro and the meso levels. The **micro level** is what in commercial enterprise is called the end-user level. However, in community networks, by definition, everything starts rather than ends with the users since they are also the owners of their network. Community members have roles other than just using services. These roles can be technical or organizational.

The **meso level** is what connects the micro level to the macro levels of policy, market regulation, and global infrastructure. Like micro-level work, the work of connecting micro to macro is both technical and organizational. Some of this meso work can be undertaken by community members who are also involved at the micro level, but often, it needs additional skills and resources. It makes sense for such additional skills and resources to benefit multiple micro organizations. In other words, several grassroots community networks can be served by an umbrella organization. This umbrella organization can enable collective buying of equipment and connectivity, shared training of network operators, and so on.

Zenzeleni Networks in South Africa is an example of this: community co-operatives (Mankosi and Zithulele, with more on the way) are served by a nonprofit company, Zenzeleni NPC. The meso role can also be played by organizations with non-community network agendas (for example an academic institution or a development NGO).

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The road to building a community network has three major challenges. The first is that often people don't know what a community network is. When overcoming this challenge, the two that follow are:

- Assessing whether a community will benefit from and be able to sustain a community network. This is a complex decision because there are many variables: size of the community, its communication needs, its social cohesion, its disposable income and other resources, its proximity to infrastructure, and so on.

- Planning the construction of the network. This is also complex because of the interplay between technology and humans. Frequently overheard comments like, "community network construction is 90% talking and 10% installation" are of limited value, since so much of the talking is about what to install, when and where, and how to govern it.

The methodology and the tools presented in this book are intended to address the second and third challenges highlighted above. The book also features an appendix with a directory of courses and resources useful at various stages of such assessment and planning—and what comes next.

Community Networks As a Tool

In this assessment we understand community networks as a tool for communities to utilize information and communications technologies (ICTs) and digital resources in a way that is valuable for them. We now live in a world where increasingly public and private services are becoming digitalized, and where access to technologies and digital resources can offer ways to improve lives and livelihoods. Community networks give people a way to access digital resources as well as other benefits.

Community networks fill the connectivity gap in various ways. They may provide their users the only way to access the Internet or local digital content –hosted and distributed locally via digital or analogue (radio) technologies, or they may offer a more affordable or better alternative to the already existing communication channels.

As the owners and operators are also the users, community networks are generally more grounded in the users' needs. They can adapt the service to address challenges or meet new opportunities. Many community networks also develop additional activities or services. These might help people access devices or grow knowledge and skills to enable communities to use technology more effectively.

Community networks offer a way for communities to build deeper knowledge on how to manage ICTs and content in a safe and conscious manner. Today most people are only beginning to understand cybersecurity, personal security around technology, and how interacting with endless content affects us (including fake news, data mining, explicit content, and surveillance). Through owning, managing, and operating the community network, people are able to interact with technology in a less passive manner. This can lead to building awareness and demystifying some of the workings of technologies that are not only integrated in so many aspects of our lives, but on which we depend.

In some cases, a community network can also help localize income. In remote, or marginalized communities, households often depend on members leaving their homes to earn money in urban or production centers—by means of remittances. Community networks can become a local income stream for people operating the network or allow others to access opportunities digitally.

Understanding community networks as a tool requires defining the function of the tool. This ensures that any design, installation, operation, and performance of the community network is always measured against its intended function.

This Readiness Assessment Handbook is designed to allow those involved in developing a community network to understand the function of their community network within their specific community. It also provides a method to analyze and assess the required components to operate a community network in a sustainable way.

How to Use This Readiness Assessment

This Community Networks Readiness Assessment has been developed by community networks practitioners in Africa. It is aimed at Africa-based practitioners and organizations who want to expand into community networks. Our approach has been informed by the challenges we and our colleagues face and by the strategies people have used to overcome them.

This Readiness Assessment is part of a larger process towards developing a community network. The following diagram shows the various stages of development. It starts from the already existing work (or background) of the team taking on this assessment and ends at a fully operational community network. This process is not necessarily linear. In some cases, certain stages may need to be repeated.

Prior work in bridging the digital divide, community dev, etc. → Readiness assessment → Plan for seeding and implementation → Implementation, training and mentorship → Operating the community network

Note: this Readiness Assessment, and the Assessment results, are NOT an implementation plan or operations guide. This Assessment should be used to guide stakeholders to understand whether it is potentially valuable and feasible to develop a community network in a specific community.

This Readiness Assessment is made up of two main reading parts. The first, **Knowledge Areas of Community Networks**, offers an overview of key elements of community networks. The second, the **Assessment Workbook**, guides readers to assess a particular community's readiness. We also provide two tools to help in gathering the outcomes of the readiness assessment: the **Concept template** (found in this document) and the **Techno-economic template** (Annex 1). **Annex 2** in this document includes a directory of additional courses and reading material on community networks.

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│                     │─────│ Knowledge Areas of    │
│                     │     │ Community Networks     │
│                     │     │ (Theory)              │
│ Community Network   │     └───────────────────────┘
│ Readiness Assessment│     ┌───────────────────────┐
│                     │─────│ Assessment Workbook   │
│                     │     │ (Practical Guide)     │
└─────────────────────┘     └───────────────────────┘
                            ┌───────────────────────┐     ┌───────────────────────┐
                            │ Assessment Results    │─────│ Community Networks    │
                            │ (Output)              │     │ Concept (Tool)        │
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                            │                       │─────│ Techno-Economic       │
                            │                       │     │ Evaluation (Tool)     │
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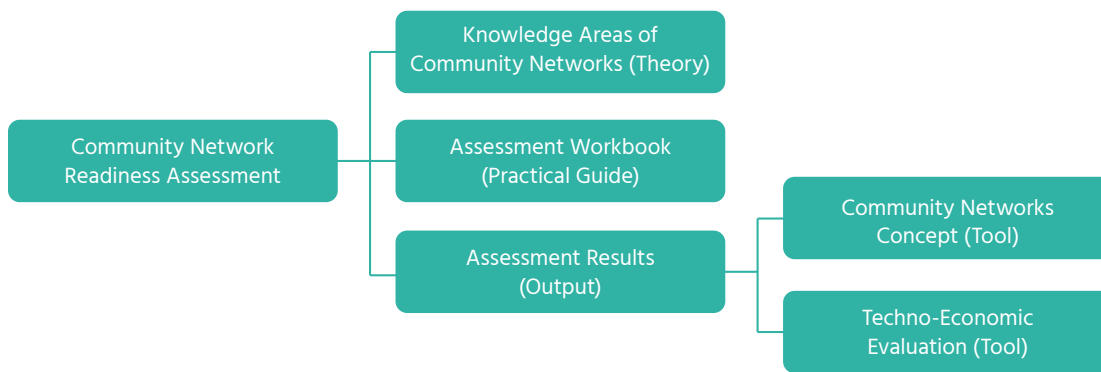
When undertaking the assessment, first read the Knowledge Areas theory, in Part 1. Then move onto the Assessment workbook in Part 2 (referring back to the theory, or additional research, whenever necessary). Use the 2 Assessment tools to gather the data, test it and document the final assessment.

We want to highlight that one of the core strengths of community networks is that they adapt to their community and environment. After helping several community networks develop their concepts and operate, our simple advice is that each community assessment is undertaken with fresh eyes and with deep appreciation for uniqueness and nuance. Developing a good assessment, and a good community network, requires constant questioning of any preconceptions about what a community may need or want. There is no single strategy, format, or solution for designing and operating a community network. Their success lies in how closely they adapt to their community—the strengths and challenges— and how well they position themselves within the micro and greater macro environments (refer to the definition of micro, meso and macro below).

The success of this assessment rests on understanding the information on the ground and the community itself.

Micro, Meso, and Macro Levels of Community Networks

There are three types of actors (systems, organizations, or individuals) which typically engage in enabling, catalyzing, developing, and operating a community network. They can be grouped into the following levels, micro, meso, and macro. **This Readiness Assessment is directed primarily at the meso level.**

Macro
Public administration, telecommunications industry, technical community, academia, civil society organization

Meso
Bridges the macro and micro realities to enable valuable access to ICTs

Micro
The community where the community network operates (users, operators, etc.)
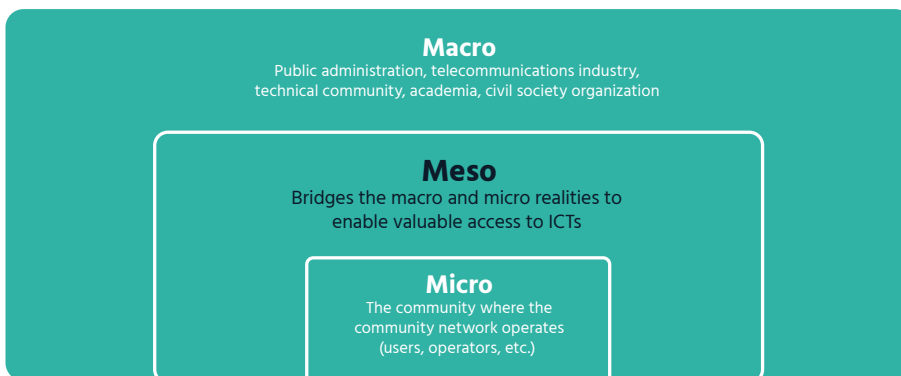
Micro level or micro organization: The micro level refers to the community. The community's knowledge and guidance are essential for a community network concept to be adapted. Community networks respond to a need and it is the community members who know what the need is. They understand what is valuable to them, what has failed in the past, and ultimately how the community network can address their requirements in a way that creates value. It is also the community that, as owner, operator, and user, ensures the network is established and cared for. In most cases, when a community network is established, it is hosted through a community-based organization (or legal vehicle).

Meso level or meso organization: The second type of actor functions as a catalyst or support—usually bringing knowledge, skills, or partnerships to the community—enabling them to understand the potential opportunities presented by the community network. In many cases this organization also supports the community to implement or operate the community network. A meso organization might be made up of people from the community who have gained skills and knowledge, or people from outside the community. The meso level typically has sound knowledge of the following:

17. The connectivity gap that exists in certain areas, the missed opportunities that this gap represents, and the socioeconomic impact this has

18. The national telecommunications environment, including telecommunications policy, regulations, and business and sector environment

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19. The technological, organizational, and social systems and strategies that can bridge the community and greater telecommunications realities, offering affordable, reliable, and valuable connectivity, and access to digital technologies

In a sector as established and regulated as telecommunications, it is important to have participants able to bridge technical, legal, regulatory, and organizational knowledge with the community's realities. In some cases, the meso acts as this bridge. The meso may also bring other important elements, such as strategies to access content securely, or to implement more equitable access.

This Readiness Assessment is directed at the meso organization, those bridging the discussions and efforts between the community (micro level) and the public administration, academia, telecommunications industry and others at the macro level. These organizations are best positioned to lead a readiness assessment. It is important to emphasize that the readiness assessment requires research and engagement with both the micro and macro levels. The assessment can only be realistic with grounded knowledge from the community, and the correct understanding of how the community's network design and operations can integrate into the macro environment.

Given the innovative and community-determined character of community networks it is important for the meso organization and the people undertaking this assessment to reach out to other community networks and other core actors in the movement. Supporting communities to create valuable solutions often comes with many challenges, and other community networks and technologists can help the reader to avoid unnecessary common issues, and in building informed and resilient strategies.

Macro level: There is a third level which influences the operations and feasibility of a community network. The macro level is made up of the public administration, telecommunications industry, technical community, academia, civil society organizations, and any other groups that influence how the community network integrates into the telecommunications sector. Macro level institutions may partner with the community network, either through the meso or micro levels. Even if they do not partner with the community network, the macro level has direct or indirect influence over the community network.

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Assumptions and Framework

Community networks have been developed across the world, in many different environments and adapted to different challenges. While this Assessment is written from an African perspective and for an African context, with the aim of bridging the digital divide, we can clarify the assumptions under which it was developed:

1. This assessment is technology agnostic. We do not believe there is a single technology that will bridge the digital divide. Many different types of community networks exist using completely different technologies. What they all have in common is that the technology adapts to the specifics of their communities, on both the micro (building value in the community) and macro (within regulatory and other environmental constraints) levels. That said, in our General Considerations section we focus more on Wi-Fi as it is often the most accessible Internet provision technology. The intention here is for the reader to use this as a guiding example (as with all other sections) and not as a recommendation to using Wi-Fi technology for community networks.

2. Community networks in this report are primarily a response to the digital divide. While the digital divide can be complex to define[1], we can refer to a definition by the Merriam-Webster dictionary: "the economic, educational, and social inequalities between those who have computers and online access and those who do not[2]". We understand the digital divide to be the product and reflection of historical, social, economic, and political inequalities. The digital divide can also be self-perpetuating, increasing existing inequalities going forward. In some cases, community networks also address technology appropriation, sovereignty, and net neutrality. In this assessment we focus more on the baseline issue of enabling access to digital content and the Internet where alternatives are not available or affordable.

3. Many of the communities in Africa that do not have access to quality, affordable telecommunication services may also face a range of other social and economic challenges. The sections in this guide therefore begin from a premise that many communities may not have the skills or finances available to initially operate the community network, and will therefore need to include other considerations in their assessment and deployment plan.

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1   More on the digital divide here https://www.itu.int/osg/spu/publications/worldinformationsociety/2007/WISR07-chapter2.pdf

2   Merriam-Webster dictionary https://www.merriam-webster.com/dictionary/digital%20divide

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4. A key challenge for sustainability is retaining skilled community networks operators (technical, business, and social) within the communities themselves. In these cases the community network will also need to consider generating income to retain people working in the community network. This differs from cases where community network practitioners are all volunteers with alternative income streams.

5. Community networks are adaptive. While they all have elements in common, each community network is responsive to its own community's needs. Each is unique in some respects, and its needs or aspirations change over time.

6. The objective of community networks is to benefit as many community members as possible, and not a select group. The digital divide is as much economic as it is social. It is important for communities to reflect on the impact of discrimination. The digital divide cannot be addressed if a community network perpetuates biases in terms of gender, social status, belief, age, ability, etc.

7. This assessment is complementary to the courses and literature that exist about community networks. It is essential that this assessment is undertaken by people with extensive knowledge in the specific community, as well as the national and local telecommunications operations and legal frameworks. Importantly, the people undertaking the assessment must be willing to keep learning, researching, and engaging with all stakeholders. Often well-intended initiatives aimed at increasing access to ICTs and other resources do not consider the operational (and socioeconomic) realities of the communities in which they operate, resulting in these initiatives failing. This assessment is therefore aimed at giving users the ability to gain as much information as possible about the necessary requirements for setting up community networks—to give the community network the best possible chance of success. The sections in this Assessment aim to build an understanding of the complex layers involved in community networks and offer strategies to adapt this assessment to individual communities. The guidelines included are just that: guidelines. Each community is unique, and therefore each assessment is unique.

8. Lastly, this Assessment is not intended as a plan to undertake a full feasibility study, which is often resource-heavy and costly. The assessment will offer valuable input to any community network deployment plan. The process and conclusions of the assessment will also offer insight into the areas that will need to be researched further, the type of partners that can be approached and the type of resources that will be necessary for any successful deployment.

Part 1 – Knowledge Areas of Community Networks

We have divided knowledge on community networks into six core areas that are fundamental to the understanding, design, installation, and operation of community networks, from an assessment perspective. These areas are closely interconnected, and the sections aim to offer insight into the various complexities, challenges, and strategies in community networks.

Please read all the sections before attempting to undertake the readiness assessment process described in the Workbook. We also encourage you to complete the complementary reading on all the knowledge areas and engage other community networks to deepen understanding and appreciation for community networks.

The Community

In this section we aim to answer the following questions:

- **How are communities defined?**

- **What is the role of the community?**

- **What is the role of community networks champions?**

The community is at the center of a community network.

It is important to start by defining the community that the network aims to service. Communities may be defined by a geographical area, a linguistic or ethnic group, or by people coming together for a common purpose. It may be clearly defined and recognizable to outsiders (such as a community of schools), or it may be a loose affiliation (such as a group of individuals in a diverse neighborhood). The community may have an established organizational structure or none at all. Community members may have overlapping roles and relationships—much more so than typical industry-related work structures. In community networks, a network technician may be someone's mother, sister, wife, or neighbor. This applies to all aspects of the community network, where members involved in governance and operations are also its users. In assessing a community network concept, these roles and relationships must be considered.

A community network is a tool for bridging the digital divide. This requires the network to be designed and operated in a way that is inclusive and does not intentionally, or unintentionally, exclude disadvantaged users. The digital divide cannot be addressed if a community network perpetuates biases in terms of gender, social status, belief, age, ability, etc. As such, the digital divide is as much economic as it is social. It is important for communities to reflect on the impact of discrimination. Discrimination and inclusion are sensitive issues that must form part of the ongoing discussions.

However, sometimes there may be circumstances that arise which lead the community to determine that someone should not use the network—perhaps because they are causing harm in a particular way. (For example, a company that is exploiting community members.) In these types of instances, decisions should be considered with great care, weighing the impact that including or excluding a certain group could have on the community network.

While it is not realistic for a community network to address all systemic inequalities, it is an opportunity to be more humane and to do things differently. Community networks can be a tool to cater for differences and marginalized groups. In bridging the digital divide—with inequality at its root—community networks should not seek to amplify privilege.

Communities are fluid. They have many dynamics and identities. Community members might also change over time. Community networks might require groups that do not usually cooperate to do so. There are many tools that are used to identify and map community stakeholders, and we include guidelines for this in the tasks below. Understanding and working with the unique, dynamic, and changing nature of a community is important. In an assessment, it is equally important to understand the community as it is currently, how it has changed from the past, and how it is likely to change in the future. A successful community network meets and works with the community dynamics, avoiding problematic dynamics and leveraging positive ones.

Different communities may have different needs or different perceptions of what they value. They may also have different assets. It is the unique community that defines the function of the network. In turn, the function of the network defines the technical and regulatory needs, or the constraints and possibilities. All of the above define the organizational strategies.

The Champions

A community network often begins when someone from a community, or someone from a meso organization, agrees to look into developing one. Considering the many layers and dynamics of a community, it can be argued that it is not possible to identify and map a community, without the participation of people in that community. This brings us to two possible main actors: the local champion or the meso champion.

The local champion understands the community. Typically the meso champion understands the possibilities and constraints within the greater national environment. We need both elements to understand if and how a community network might be developed in a community.

The champions are responsible for developing understanding about the community. They also create needed buy-in at the community (or micro) level, and with key partners (or macro levels). Without these, the assessment would not be realistic. The local, micro, champion might be an organized group of individuals or an existing community organization.

The role of the champion groups in both the micro and meso levels is to drive the initiative from an idea to a realistic, applicable form. This requires understanding the local and macro dynamics as well as a willingness to learn about all the elements that make up a community network. It requires the ability to research and learn from many different types of people and experts, and also to communicate the idea of the community networks effectively. While the community network aims to be inclusive, in most cases it will take a few people to drive it through the initial stages. These initial stages of development are difficult, and the champions will require patience, inner drive, creativity, resourcefulness, and stamina. How the assessment itself is conducted can make or break the support and viability of the community network. It is therefore important to identify champions with the right qualities, knowledge, and skills.

Moreover, the champion group that is identified, specially locally within a small community, will by default transfer how the community feels about them personally, to the project. This can act for or against the community network initiative. To better illustrate this point, we include two scenarios experienced by two different meso organizations:

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Scenario One

A community group approaches the meso organization asking for support to develop a community network. The community network is to provide Wi-Fi connectivity to residents in an area where connectivity is not affordable. The meso responds positively, understanding that the community is in need and that the existing backbone can extend to the area. A process begins to identify the local geography and identify its highest points. Unbeknown to the organization, the champion group are all people associated with a particular political party. The community reacts to this initiative in a divided manner. Only high sites owned by people with the same political affiliation are accessible and people with a different political affiliation accuse the champions that they will only serve their own party supporters. Threats are issued to remove or damage any infrastructure as it is seen as a "party exclusive" initiative.

Scenario Two

A meso organization agrees to help extend services to a community of schools. One school principal is particularly responsive and keen to collaborate. Naturally, the meso focuses their attention on this school following the approach that with good leadership this school could be the champion school and a pilot for other schools to follow. The organization starts hearing from different community members that this principal is known for his self-serving attitude to projects. Months into the project it becomes clear that the principal and champion is indeed primarily after personal gains and does very little for the school and community.

From the scenarios above it is important to understand how community dynamics and the reputation of a champion, or champion groups, transfers directly to how the community perceives the community network concept. It also shows the importance of understanding from the inside who constitutes the community, and how groups within the community relate to one another. A meso organization cannot undertake a community identification and mapping alone, and will require a local, micro level, champion group.

As it is important to leverage existing, positive community dynamics, the local champion group, or micro organization, would ideally be a respected member of the community, with a leadership role and capabilities. Community leaders are experts in their environment. As a leader they will also have other responsibilities in their community and probably do not have the understanding or channels to gain insight into all the elements required for a community network.

The role, approach, and attitude of the meso when working with the local champion and community are also critical to the success of building a healthy, productive dynamic that results in value for the community.

Scenario Three

A meso organization approaches a community to undertake a needs assessment for a community network. In the community there is a group of people who are organized and undertake the needs assessment efficiently, reflecting the community's realities. The meso who is managing a grant fund to undertake this research pays a small amount to the community and retains most of the funds, reporting the community's work as their own. The meso however sustains that as they are the ones bringing solutions and opportunities to the community their behavior is justified. This creates essentially an extractive relationship where the meso's agenda supersedes the community needs.

Unfortunately, the scenario above has been experienced by many communities where outside experts arrive with a "savior" mentality and approach, believing that their perspective is superior to that of community members. This is also very common in all kinds of development work. The savior approach often leads to tension, mistrust, and dependence. Moreover, in many cases the meso, or experts involved, truly believe they are doing something good or justified. It is essential for a meso organization to undertake exercises of introspection and question their own agenda and ethics. This is complex work, as we all at some level have personal agendas, or specifics of what we feel is right. This might not be aligned to what the community understands as right, or what can truly bring value to the community. It is important to keep questioning one's motives and maintain an open dialogue among champion groups and stakeholders who are affected.

The meso champion role must include listening to the solutions, aspirations, and needs coming from the local champion and community. Ideally the role of the meso organization in shaping the community network concept will be to gather information on external requirements, constraints, and opportunities. External requirements are elements such as telecommunications sector requirements, potential technologies, best practices, and partner opportunities.

Key Takeaways

Communities are not homogenous. They are composed of different people with different needs and different values. Just as people change over time, so may these needs or values. When considering setting up a community network it is essential to have a good understanding of the community.

Champions or champion groups (both at the community micro level and the meso level) are critical partners in establishing trusted, knowledgeable, and relevant relationships that will be essential to immediate and long-term success. Building a trust-based relationship requires ongoing, open, and transparent dialogue.

The Function and Services of the Community Network

In this section we aim to answer the following questions:

- **What is the value proposition of the community network?**

- **What are the roles of the community network?**

- **Why is it important to consider technology adoption?**

- **What is the responsibility of the meso and micro champions in introducing ICTs?**

A community network's functions and services refer to its role in the community, and what it offers users to bridge the digital divide. These services may be accessed through financial payment or through a different kind of contribution.

Some community networks start with single, or multiple, points of access in public spaces, to which users go to connect. Others service homes, businesses, and institutions. Some community networks deliver content that is produced or hosted locally, while others simply connect to the Internet. Some community networks do all of the above. Community networks may shift over time—starting with one service (or in one particular area), and later expanding to others. The services therefore can be understood as a response to what people need or find valuable. If people do not find the community network valuable, they are unlikely to use or support it. People value different things in different ways. In terms of community networks, they could value connecting to their loved ones; accessing information to organize a trip, study, or work; finding new opportunities; or laying a

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claim to something. People could value the network as a space to come together and strategize about how to get their products to market, or perhaps how to engage their local municipality to improve basic services.

In communities where we find the digital divide, we also often find other related issues such as lack of access to digital devices or lack of electrical power. Some community networks therefore decide to combine their telecommunications services with other ICTs services or other value-added services. Access to content may therefore be complemented by access to digital devices and the training or support to use these devices. Services could also include charging any batteries of digital devices.

Just as people value different things, meso organizations might interpret people's needs differently. It is therefore important to establish early in the process of exploring a community network a common understanding of what the community's needs and values are. This could be simple or complex—depending on the community. Using a business approach, we know that people are likely to find value in something that offers them better quality services, or cheaper services, than those that they are accustomed to. This promise of value is called a value proposition. If, for example, people use a large portion of their income to access the Internet and the community network offers them cheaper Internet, the value proposition is simple. Yet the value proposition does not have to be economic. With community radio or a local server, the value proposition may be that the information is broadcast in a local language, making information more easily accessible to more people.

Sometimes, however, the value proposition may be more complex. Perhaps a community has no connectivity, low exposure to digital technologies, and limited knowledge of the benefits these could offer. In this case, it would be much harder to define a value proposition, as what is being presented is not easily identifiable as being better than something else. Rather, it is totally new. In this case it would be necessary for people to understand how changing their behavior and adopting a new way of being or new solution, could add value to their lives.

Over and above the actual services, a community network can also offer value by playing both a social and economic role in the community.

The **social role** of a community network refers to the social dynamics or social change that are sparked through the operation, governance, and use of the community network. This can bring value in many ways. For example, someone may find that in learning how to operate a network, they contribute positively to their community of family, friends, and neighbors. The exposure, satisfaction, achievement, and sense of agency might contribute to their self development. Others involved in governance may also develop as they become involved in finding solutions to communal challenges.

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Users on the other hand may benefit from the ability to rapidly access knowledge, contact people, or seek resources that help improve their personal, professional, or social development. All the above can in turn lead people to organize themselves in new ways and develop other valuable initiatives.

The **economic role** refers to a community network being a means to earning and retaining income locally. In some cases, such as Zenzeleni community networks in South Africa, the community network is one of the first opportunities where people can earn money from their homes without needing to leave and work in the cities or gold mines. Generating money locally is one of the prerequisites for enabling people to remain with their families and not to migrate. It can spark a local economy, and lead to local socioeconomic development. While the social and economic roles are not direct services of the community network, they can be recognized as clear value propositions.

Technology Adoption

Technology adoption refers to people's use of technology. In terms of community networks, this refers to all parts including, governance, and operations as well as the use of the services themselves. Different people adopt technologies at different times. The typical process of adoption could be slow, where only a few people take up the new idea at first. This initial group may take the idea forward in their community and encounter resistance. This group may have to work slowly to build awareness and trust. From here the technology would be adopted by a wider group—perhaps peers or family members of the initial group. This larger group would then influence others until even more people adopt the new idea. Throughout this process however, there will be people who adopt the new idea and those that seek to oppose or challenge it.

The Diffusion of Innovation Theory[3] describes this process and the people involved in each stage. These are referred to as the innovators, the early adopters, early majority, late majority, and laggards (refer to the table below). Our community network core champion group could be understood as the innovators and early adopters.

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3   More information on the Diffusion of Innovation Theory available here https://www.ou.edu/deptcomm/dodjcc/groups/
     99A2/theories.htm

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Fig. 1—Adopter categorization on the basis of innovativeness[4]

2.5%	13.5%	34%	34%	16%
Innovators	Early Adopters	Early Majority	Late Majority	Laggards
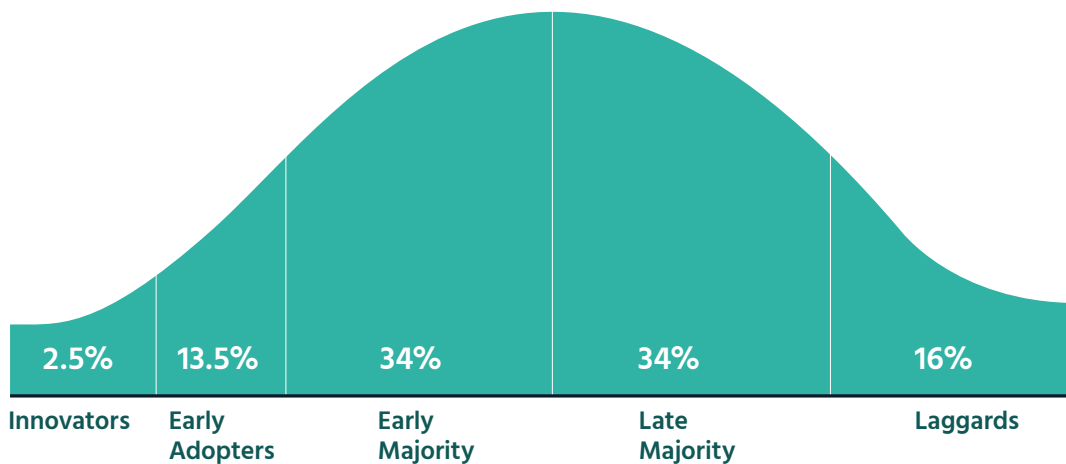
In an assessment it is important that the meso and micro champions identify these different categories to understand who the network would realistically serve. Early adopters and early majority would typically be people who are already familiar with a version of the solution. For example, people who are already digitally literate, who use ICTs, and who already value or prioritize access to digital resources. Depending on what the new community network concept offers, early adopters would also need to be people who recognize the value proposition of the community network service (when compared to an alternative).

Adoption can also be accelerated, or deterred, through influence. An interesting example from an existing community network is when the Chief in a community supports the community network concept and use. This can influence people not because of skill but because of the change in mentality that a leader can affect. The influence of community leaders can also be adverse, where the leader does not support the initiative, usually due to politics, and the adoption is slow due to resistance to the initiative, rather than lack of aptitude or need.

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4   Retrieved from https://www.ou.edu/deptcomm/dodjcc/groups/99A2/theories.htm

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Ethical Considerations and Responsibilities of the Meso and Micro Champions

It is important to acknowledge that while the Internet and digital resources can be understood as a universal, public, and common good, there are also risks related to using them. These could include Internet safety, invasion of privacy, identity theft or cyberbullying among other things. While these risks are present for all users, those with less or no previous digital exposure or experience are more vulnerable. We must consider that as the people enabling digital access, we have a responsibility to the users. It is important to create the space to discuss these risks and threats when presenting the value and potential services of the community network, while developing strategies and practices to mitigate risks for the most vulnerable users.

Key Takeaways

> While a community network aims to create a collective solution to a collective problem, it is also true that not everyone in the community will necessarily understand or support the community network concept from the onset.

Nor will everyone start using it at the same time. This is not unique to community networks, but normal when introducing new ideas and innovations. Understanding this can help us to engage and support a community more effectively. It is important to discuss both the potential benefits and risks of using digital technologies and the Internet.

Practical Recommendations for the Assessment

- Take time to understand what people in the community value and align the potential services and solutions of the community network to these values. We cannot simply assume, or convince someone, that because we think that digital technologies are an asset to our lives, it will be so for others. It is important to start by listening to people describe their lifestyles, and then share and discuss information about how they may use ICTs to their advantage.

- Create time and support the local champion group to share the value proposition with community members. Be flexible to adapting the value proposition, and services, according to feedback from the community. Remember that the value of a community network may come as much from the services as from the role or function it plays in the community.

- Create locally relevant materials to initiate discussions about ICTs and the role of the community network—both the potential benefits and risks. Create materials and undertake workshops where both positive and negative aspects are discussed. The materials should be contextualized and in a language that the majority can understand. For people who are hearing or visually impaired, or with low literacy, audiovisual content can be most successful. It is the role of both the micro and meso champions to understand what is the most appropriate to build awareness in the community, and in what areas. The meso should be prepared to research effective, ethical communications strategies with each community.

- Visiting and liaising with peer community networks that operate in similar environments works well to build awareness.

Telecommunications Frameworks and Community Networks

In this section we aim to answer the following question:

- **What are the different kinds of legal frameworks required to deliver the identified services and functions (including telecommunications regulation, or other regulations which would impact the community network)?**

- **How can these legal frameworks affect the community network?**

A community network is part of the telecommunications sector. Understanding the sector, the different public and private organizations involved, the official and unwritten rules, and the role of partners is essential to the stability and sustainability of a community network. Note that each jurisdiction's (or country's) regulatory framework differs significantly to one another. The information in this section aims to give an introductory appreciation for some of the most common aspects and scenarios. It does not cover all possible cases and it is up to the meso to ground this knowledge in their national and community context. There are excellent resources with more in-depth information on policy and regulatory considerations in the directory at the end of this document.

To operate legally, a community network will require permission from the national regulator of the country in which they intend to operate. This permission may come in the form of a license, an official letter, or in other formats, but we will continue to refer to these permissions as "licenses." It is also important to understand that a community network may need more than one kind of license to operate different elements of their network.

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Some common distinctions between different types of licenses include: providing telecommunications services, transmitting in certain spectrum bands, and deploying and operating infrastructure.

Licenses for Service Provision

Take the following example of a community network that buys broadband from an operator (e.g., a Wireless Internet Service Provider (WISP), fixed line, or mobile operator). For the purpose of this explanation, we will call this community network Africa CN. Africa CN then sells the bandwidth in two ways. First, to other community networks and WISPs. Secondly, to the Internet voucher sellers in the community. In both of these cases the service provider is Africa CN, and therefore the license requirements fall on Africa CN. The community voucher seller in turn sells the service as data vouchers to community members. In this case the licensing requirements fall on the vouchers sellers.

Not all community networks may need to operate all the service levels described in the example above, and not all levels (for example, voucher sellers) may require licenses.

Furthermore, it is also important to understand the licensing requirements for a service provider. Following our example, Africa CN needs to ensure that the operator from whom it buys bandwidth is compliant with the corresponding regulator. If Africa CN is buying bandwidth from an unlicensed operator, it could get into trouble.

The licensing requirements also vary according to the services that a community network offers (e.g., wholesale bandwidth, Wi-Fi access, co-locating, etc.). Each service level has different legal, technical, economic, and engineering obligations imposed on it by industry standards and the regulatory framework.

Spectrum Licensing

Community networks, like other telecommunications operators, could make use of both licensed and license-exempt spectrum bands for the provision of Internet or mobile services. The choice of spectrum must consider various aspects.

 First, one needs to understand which spectrum bands and licenses are accessible. In many countries certain spectrum bands are assigned and licensed, through bidding processes, to large operators. This is particularly the case for bands used to provide mobile broadband and mobile telephony. In this case, the community network would either need to acquire a special concession from the regulator or ministry or would need the operator to allow them to use the spectrum assigned to the operators. Both of these are lengthy and uncertain processes.

> **Examples**
>
> **Some examples of successes to access these bands happened in Mexico, where Rhizomatica was able to convince IFETeL, the national regulator, to set aside International Mobile Telecommunications (IMT[5]) spectrum that had not been assigned for "social purpose use" in most Mexican provinces as a pilot. Telecomunicaciones Indígenas Comunitarias (TIC) applied for this and was granted the management of the spectrum. Colnodo, in Colombia, was also able to develop an agreement with the national ministry and from there acquire a special permit from their regulator for a pilot to use available mobile spectrum. However at the end of the pilot phase they were not able to change the spectrum regulation and Colnodo was forced to stop using the spectrum until a new regulation or extension of the pilot can be agreed upon.**

Another possible, albeit difficult, avenue is that of un-used allocated spectrum. In many countries the spectrum allocated to large operators is used heavily in densely populated urban areas, but almost unused in sparely populated, usually rural, areas. (The studies area in the directory has more information). For many years Zenzeleni networks in South Africa has been advocating to access assigned mobile spectrum on a secondary basis, meaning if it is not used by a large operator in a given area, regulators should let community networks use it. To date however, the advocacy has not resulted in access to said spectrum.

A second key consideration when identifying a suitable spectrum for the community networks is the cost. The costs include the license fees, which may be once off or annual, as well as ongoing technical requirements (such as certain quality of service) and administrative processes which can be significant and costly. As is explored further in the next section, the type of technology (hardware and software) required to operate certain spectrum bands can also increase the costs of operation, requiring more expensive equipment and more specialized skills. A general rule is that the further the signal can travel and permeate and the faster the bandwidth—for example, mobile spectrums that can cover large areas with a single tower through 4G—the more licensing it requires.

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5   https://www.itu.int/ITU-D/tech/MobileCommunications/Spectrum-IMT.pdf

In most cases community networks use license-exempt spectrum, meaning bands that can be used or accessed without requiring a dedicated spectrum license[6]. The most used license-exempt spectrum band used by community networks is that used by Wi-Fi technologies. Not only because it is license-exempt, but also because it uses low-cost technology that is relatively easy to operate (more on this in the following sections). The frequencies allocated to Wi-Fi (2.4 GHz, 5GHz, or 6GHz), and the conditions for using it, differ from country to country. The Association for Progressive Communications (APC) is developing a map showing the various spectrum bands, showing which bands have been allocated and which are free[7].

Deploying and Operating Infrastructure

Licenses and license-exemptions may also be required for deploying and operating telecommunications infrastructure (whether wired or wireless). In the case of South Africa, these types of licenses are determined nationally and for District Municipalities. In both Kenya and Uganda, there are three geographical tiers.

Types of Legal Vehicles and Licensing

In some cases, the kind of legal vehicle that a community network takes on (a nonprofit organization, a cooperative, proprietary limited, etc.), targeted beneficiaries (for example disadvantaged peoples), and the area (such as under-served rural areas) could influence the type of license or ease of attaining the license or exemption. Governments always have political targets for development, and the provision of ICT services is high on the list of political agendas worldwide. Likewise, these targets will often focus on particular areas, and they may favor certain types of organizations. Legal vehicles are discussed further in the following sections, but it should be noted here their potential influence of licensing.

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6   The International Telecommunication Union recommends certain spectrum bands are maintained as licenses-exempt. The licensing requirements however are determined at national levels usually through a National Telecommunications Act.

7   You can find this information on: https://policy.communitynetworks.group/country-profiles

Key Takeaways

Community networks will probably require specific licenses or permissions from a regulatory body in their country to operate. Licenses correspond to a legal vehicle (or organization), the one under which the community network operates, or its partner. The types and number of licenses will depend on which parts of the network each organization is responsible for operating, the technology, and the radio frequency (or spectrum) used.

The spectrum accessible to community networks also determines what telecommunications services they can offer. The legal vehicle that the community network is constituted under may also affect what kind of license, or concession, it can access. Likewise, the costs of licensing and administrative burden of license reporting can also be a strong determining factor of the community network services. Similarly, the spectrum will determine the technology as well as the amount of infrastructure required to cover a particular area. All factors have to be considered in relation to one another when assessing the readiness of a community network.

Network Technical Considerations

In this section we aim to answer the following questions:

- **What are the main technical components of a community network?**

- **What technology can deliver on the identified services and function within the regulatory framework?**

- **What are the operational and business practices necessary to deliver on the identified services and functions within the regulatory framework?**

There is no single technological solution for all community networks. The best technology will be the one that offers the best set of advantages and least number of constraints for the community. This may differ from community to community, even within one country or region.

From the previous sections we can appreciate that the technology must be able to deliver the services that the community requires and values, and to a designated area. We also know that the technology, and how we deliver it, needs to fit into the regulatory

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framework and licensing requirements that the community network can attain. The choice of technology has a direct bearing on the operational and financial model of the community network. This section discusses the technologies most used by community networks, and some challenges and considerations to make an informed decision.

We can distinguish two different technical parts of a network: the community network backhaul and the local access network. For the purposes of this section, we refer to backhaul as the core part of the network that the community network operates, and that in turn connects to the service provider or national and international carrier. We refer to the local access network as the part of the network to which users connect. We focus on Wi-Fi technology here not because it is the only technology that a community network can use, but because it is the easiest at the entry level and most likely to be relevant to a readiness assessment.
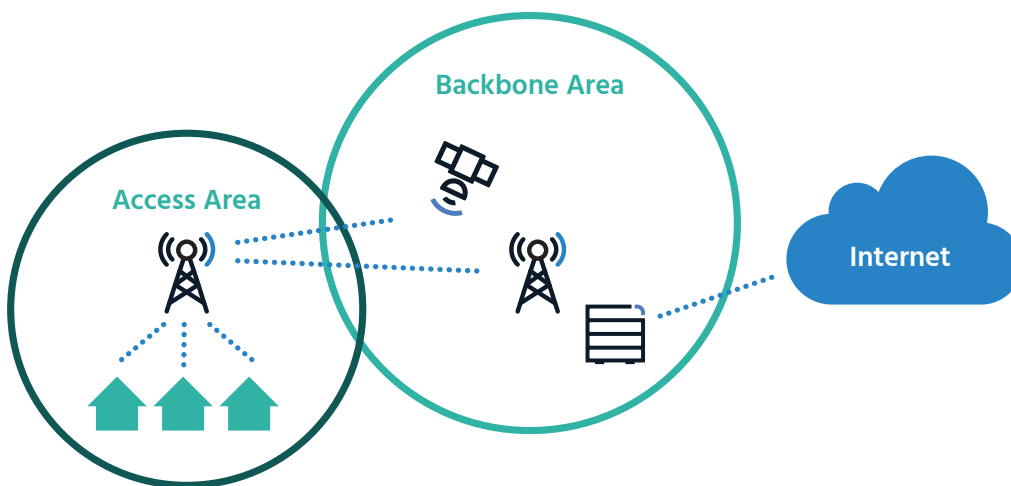
A Brief Overview of Technologies Used for Backhaul and Local Access Network.

There are two types of **backhaul technologies**. These are wireless and wired technologies.

Wireless Backhaul

These technologies use antennas to transmit and receive electromagnetic waves (microwaves and radio waves) between connected points. These are high-speed, high-capacity wireless connections with the ability to transmit voice, video, and data. Wireless backhaul technologies include Wi-Fi, satellite, TV White Spaces (TVWS), and mobile. See below for detailed explanations of these:

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Wi-Fi is probably the most widely used backhaul technology in community networks. One of the advantages of Wi-Fi is that the technology is relatively low cost and easy to use. It also uses unlicensed-exempt spectrum. Wi-Fi technology has the capacity to transmit a large amount of bandwidth over significant distances. However, Wi-Fi is a directional technology and requires Line of Sight (LOS), meaning the antennas in the network must not have obstructions between them for the transmission to have good quality. As such this technology can be difficult to use in areas which have many trees, hills and mountain or buildings. Rain and high levels of humidity can also obstruct the signal.

To transmit Wi-Fi between obstacles it is necessary to create an alternative connection route to circumvent/bypass the obstructions. Creating these alternative routes require more equipment, more people and time to maintain them, adding to the cost and complexity of the network. Another challenge in operating Wi-Fi networks is that the signal between antennas must be well aligned. Wind and any other movements in the tower or mast that hosts the antennas can often misalign them, affecting the quality of the signal and service. Considering that a backhaul may run over many kilometers and to many different places, aligning antennas is an ongoing requirement. Compared to other technologies and licensed spectrums, Wi-Fi requires quite a lot of infrastructure and network devices, towers, or masts to cover distances and circumvent obstructions in each of the various antennas, routers, etc. Each of these also require the provision of power. In general terms the more components a network has the more costly it becomes to operate it, since it requires replacing components, travelling to different locations, powering each location, etc. That said, Wi-Fi remains one of the most cost-effective technologies to use.

Television White Space (TVWS) has been used as backhaul experimentally in several community networks, such as Kondoa in Tanzania, Pathardi in India and Colnodo in Colombia. The advantages of TVWS is that it does not require line of sight and transmits high quality signals over terrains with obstructions. Here the radio waves are able to navigate many obstructions, without the need to create alternative routes. As backhaul, it is an interesting emerging technology. The challenge with this technology is that many countries have not redefined and allocated the TVWS spectrum (traditionally assigned for analogue broadcasting), making it difficult to access it, except on an experimental basis.

Currently, the equipment to take advantage of TVWS is also expensive and difficult to access. Most of the technology available is also indicated to be operated over short distances, and with limited throughput (under 30 Mbps). In the case of networks supported by Colnodo, the TVWS technology was donated by Microsoft and its maximum throughput was 20 Mbps. While this worked at first, once it was damaged they were unable to replace it due to the elevated cost. These and other characteristics are a result of TVWS not being fully commercialized as an Internet service solution. These could be addressed as its application becomes more widespread.

Satellite technology has the advantage of reaching the most isolated places directly. This cuts out the operational complexity and cost of installing and maintaining towers and other backhaul equipment over long distances. As a backhaul option, it has been limited due to cost and technical constraints. It has high initial installation costs and data is usually capped, unlike many wireless wholesale options. Technically, the latency of geo-stationary satellites (600-800 milliseconds) also poses constraints as a backhaul technology, as this is significantly slower that other backhaul technologies' latency (5-25 milliseconds).

That said, it is worth following the roll out of the Starlink Low Earth Orbital (LEO) initiative which aimed to reach the African continent in late 2021, beginning of 2022. The latency in LEO is reduced to 15 milliseconds and the cost for 100 Mbps bandwidth is around 90 USD per month. Installation costs are also significantly lower. This option would simplify network costs and operational complexities, but it is currently unavailable in the African continent. To date in many countries, the policy framework under which Starlink can operate has also not been clarified.

Wired Backhaul (Fiber Optic)

Wired backhaul technologies use cables to deliver high-speed reliable bandwidth capacity. We focus here on fiber optic technology which is used in community networks such as in the Soweto Wireless User Group (SOWUG) in South Africa, and GuifiNet in Spain. Fiber optic cable provides the most stable connection between points in the network. Cables require less maintenance as they are protected from the elements and exposure and do not depend on alignment between two points. Stability and low maintenance bring down the cost of operations. However, there are high initial costs, and the tools required to lay the fiber optic cable are difficult to use and procure. This can be a challenge when first installing these cables and during maintenance. That said, the cost of fiber optic cables is fast decreasing, and the tools are becoming simpler. So, this technology option could be more accessible in the future.

Local Access Networks

As with backhaul technologies, **local access networks** can also be wireless, wired, or a combination of both. Local Access Networks are the points where the user connects to the community network. These points are fed by the network backhaul, which can be any one of the technologies mentioned before. The local access network points typically connect back to the nearest network multi-access point (base-station) wirelessly, or if they are in close proximity, through cabling. It is important to consider that although ethernet cables offer the most stable connection between network equipment, ethernet cables over 10 meters cause losses in the network signal. It is therefore best to use ethernet cables for short distances, and wireless antennas for longer distances (always considering the distance limitations of each type of antennas).

Focusing on Wi-Fi technology, we can distinguish two ways to offer access: through public access points, and through private access points. Each of these have different technical constraints (again these are designed in accordance with organizational and financial decisions by the community). There are different local access network designs (see the diagram below).
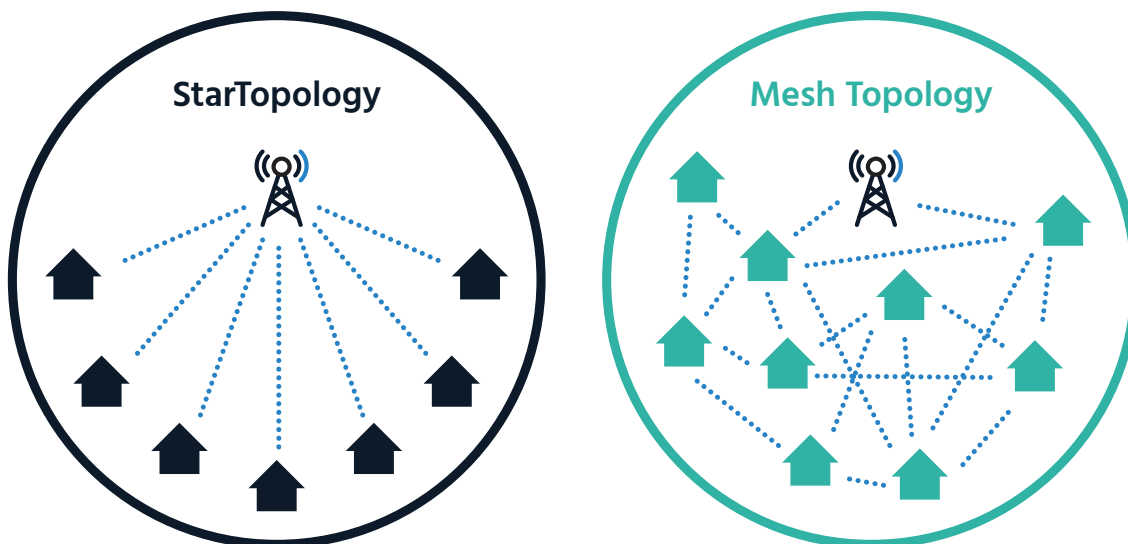
Public Wi-Fi hotspots: Here the community network deploys hotspots in designated, strategic public places in the community where residents can access the Internet. This is the lowest cost option to deploy as one hotspot can service many different users during the day. It is difficult however to plan and control how many people (or devices) connect to a public hotspot at a given time. If there are many people connecting at once and using a lot of bandwidth (for example, to stream a video) the user experience and quality of the connection will be lower for other users. The area which public hotspots cover is also not constant or clearly defined as the field of coverage will prioritize the most needy connections, limiting the range of other users. As such, technically a community network cannot ensure a certain level of quality for every user in public hotspots. In most cases however, these public hotspots are still very useful for the needs of individuals accessing key services and resources and communicating with family. It may be trickier if the users intend to run a business that relies of consistent speeds from these hotspots.

Private Access Points: Here the community network provides connectivity to homes, local businesses, and institutions such as schools, NGOs, and health centers. These connections can be set up to deliver a particular speed to a particular set of devices and a certain level of service can be predicted and maintained. In these cases, each user or client of the community network requires its own set of antennas to connect to the backbone, and one or several routers within its premises. To cover more people in the community in this way one would need more hardware and labor than with community public hotspots.

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Private access points can also use cabling to connect with one another, always considering the ethernet cable limitations or fiber optic requirements mentioned above.

Given the pros and cons of public versus private access points, how a community network decides to design its local access network is more often an organizational and financial decision than a technical one (within the technology's limitations). Technology can be adapted to the needs of the community, but it will only make sense to use it in a certain way if it can be sustained financially, and different types of users may be more willing to pay amounts for different services. Therefore, understanding the needs of the community and business model is essential to the choice of technology and the design of the network.

Cellular technology has the advantage of covering a wider area. This means it can transmit a signal from a single point (a cellular tower) over its determined coverage area and give complete coverage even through obstructions. Cellular spectrum bands are usually awarded to large operators, and inaccessible unless the mobile operator shares the band with the community network, as in the case of Rhizomatica in Mexico, Pamojanet in the Democratic Republic of Congo, and Colnodo in Colombia. There are other considerations with using cellular technology, especially regarding what would happen when users leave the community network area, including users required to swap SIM cards, meet roaming and SSID agreements with other operators, and Mobile Virtual Network Operator (MVNO) management. That said, if a community network could use cellular technology it could make operating the network far easier and more viable, as the community would need to operate 1 or 2 towers to cover everyone in a large area. Cellular base stations and technology can be costly and require advanced technical skill and training to operate.

Wired Access Technologies (Fiber Optic Cable)

As is the case for wired backhaul technologies, wired access technologies such as fiber offer reliable connectivity and maximum bandwidth. They can be used to exclusively deliver bandwidth to customers using models such as Fiber to the Home (FTTH), and models here may include fiber-to-the-premises (FTTP). This technology would typically be used to connect a private Wi-Fi hotspot. While a wireless access point mostly connects to the backhaul wirelessly, a wired access point connects to the backhaul through fiber optic cable. One of the main challenges of this model is the high cost of deployment per user.

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Challenges and Considerations

Many of the backhaul and access point technologies perform better from higher positions. There are therefore height constraints in wireless technologies. For example, wireless antennas can transmit further when they are higher and thus avoid many low obstacles (cars, houses, people etc.). High towers, can reduce the number of hops (towers or nodes) needed in the network. This will reduce costs and operational complexity. However, high towers (or sites), usually above 15 meters, are subject to environmental and health and safety regulations. These can include having to undertake a formal environmental impact assessment, which are cumbersome, costly, and lengthy processes. In other cases, technicians are required to take "working at height" courses. These assessments and courses can weigh heavily on the deployment and sustainability of a community network. Identifying the right technology, as with everything else, must consider all the requirements associated with the choice. These may include height constraints, cost, personnel safety, and mitigating any environmental impact of the community network.

Networks require power to operate, and power is therefore a key determiner in considering technologies. In many places where community networks are deployed there is low or unreliable power. The most common alternative used to power networks are photovoltaic, or solar, panels and batteries. These technologies are expensive. Zenzeleni networks recorded in 2016 that alternative power could comprise up to 80% of the cost of the network infrastructure. While the percentage of costs will vary with the number of access nodes the network has, it is important to note that power is an essential but sometimes difficult technological challenge. It can influence the choice of technological types and network designs.

Examples

For example, in the urban community network Soweto Wireless User Group (SOWUG) in Soweto, South Africa, some of their main towers and base stations are hosted by fuel stations. Soweto is an extension of Johannesburg—a city of 5.7 million people—where Soweto adds an extra 1.6 million people (2020 census data). The fuel stations were chosen because the City's extensive grid power is unstable. The fuel stations happen to be some of the few places that have backup generators. SOWUG also considered fuel stations that had favorable, high positions, but it was ultimately power (over other alternative high sites) that informed their network design options.

Another example from Zenzeleni, is that after weeks of ongoing speed fluctuations in a particular customer site, it was found that the issues stemmed from the power feeding the customer premise equipment (CPE). The business ran fully on solar and battery power (not connected to the grid). The power setup was designed to be sufficient for the business needs which coincided with the technical needs of the CPE (both requiring 48 Volts).

However, during times when the battery would not be properly charged, it would not fully deliver the 48 Volts and would cause disruptions to the signal. This deficiency did not affect any other equipment significantly but it did affect the network signal. In this case the only solution was to use a less powerful antenna that required less power and was therefore less affected by power deficiencies. In both the Soweto and the Zenzeleni examples, the network design and technology choices were guided by the challenges presented by power.

Power can also be an opportunity. In Uganda, the community network BOSCO Uganda has developed a system of access points which are all solar and battery powered. Bringing power for the network is also an opportunity for the community to address their own power issues. It would make sense for a community network deploying its own power to also consider what other functions or services the power units could offer.

Hardware certification/type approval/homologation/standardization refers to a national or international certification which is awarded to equipment that is safe and performs as it should. A community network, like any other operator, would not be able to acquire, or retain, a license if they use equipment that was not standardized in their country. Non-standardized equipment is also a risk to people operating and using it. There are many widely used network technology brands whose products are regulated in most countries. These include Ubiquiti, Mikrotik, Cambium, Mimosa, and Carlson. There are also other technologies that have been, or are being, specifically developed for community networks – such as LibreRouter. It is important to understand whether the technology you are considering is standardized in your country. These processes can be lengthy, administratively heavy, and costly, so if you want to develop or use non-standardized technology this needs to be kept in mind.

One way to assess different similar technological options is a cost comparison. Even if the initial cost of the network is covered through a grant, there will be ongoing costs to maintain the equipment. If you have top-of-the-range, costly equipment, it will always be more expensive to repair or upgrade than a more affordable option. That said, the cost comparison must be balanced with the quality and longevity of the product. If the quality is low and you have poor performance or need to replace it constantly, that too will have a bearing on overall cost.

Access to technology or equipment, both for initial deployment and for maintenance, is also an important consideration for cost and sustainability. Ideally the equipment would be accessible from a nearby supplier at a fair market rate. In community networks which operate in isolated areas, equipment needs to be ordered and couriered or fetched. Transport costs can add significantly to the cost of equipment. While the equipment may be bought from a nearby supplier in a smaller town, this cost is generally higher than ordering it from a larger city supplier as it requires additional middlemen. In this case,

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ordering in bulk is the most efficient approach. Sometimes it is attractive to import equipment, as this would cut out middlemen even more, and maybe give access to better equipment than is offered nationally. However, when importing, either on your own, or through an agent, it is important to consider the additional cost of import tax and the time (often unpredictable) that it takes to get the equipment. Consider that if the community has an unexpected breakage, and it must wait 6-12 weeks to get the replacement equipment, this can cause serious damage to the credibility and sustainability of the network.

The inability to replace costly equipment is one of the most common points of failure in technology solutions for under serviced areas. This should be included as a serious consideration in identifying the right technology.

Designing and operating a telecommunications network requires different kinds of skills and expertise. Community co-design and operations is important for sustainability and for building value. That said, it is likely that most communities will not have the skills to install and operate the equipment and software required for the network. Most communities will therefore require training and ongoing support to build up their capacity to operate their networks. Different technologies (equipment, application/software etc.) require different skills levels to operate. The technology choice should consider who will be operating it, and what it will take to build the skills to operate. The technology choice could also be guided by existing skills of someone in, or affiliated to the community, or willing to support that community network. Expertise is often developed whilst working with specific hardware and software. Choosing technology that the community network team can already operate will aid the deployment and impact sustainability.

Another element to consider when choosing technology is the safety expertise and qualifications required. Much of the equipment used by community networks is easy to use and safe. That said, elements such as power conversion and charges, working from elevated positions, or protection against lightning can be dangerous. In some cases, they require certifications to operate. Safety training for people working in community networks is important to prioritize.

In many community networks, towers, masts, and routers are hosted in private or communal areas. It is therefore essential for the community network to attain network hosting rights to host their equipment. Using the earlier example of SOWUG, they entered into a formal agreement with the fuel stations. Similarly, BOSCO Uganda entered into an agreement with a radio station who agreed to host their equipment on their masts and towers in exchange for Internet provision for their radio stations. In Kibera, Kenya, TunapandaNet's relay masts are hosted on the roof of partner schools, local municipality water tanks, and local health clinics. This hosting is provided as a community contribution. To bring down the cost of operations, community networks often work with existing

structures or build their own low-cost options. This differs from the approach used by the telecommunications industry where high towers are built with expensive base stations with power and security. Accessing very high sites, with steady power and security is optimal, but renting space from telecommunications operators is often more expensive than building one's own.

It is important to clarify the hosting arrangement in all cases, understanding the roles, responsibilities, and expectations between the host and the community network organization. Hosts may require payment or may be happy to exchange hosting for the Internet. Access and costs of power and security agreements should also be clarified in the agreements. In some cases, the host and community network may also need permission from a local authority, either from a traditional authority or government.

Environmental Considerations

As with other aspects of human social-economic activity, it is important to consider the environmental impacts of the community network. The United Nations estimated that globally in 2019 we create 53.6 million tons of electronic waste, with only 17.4 percent of this being recycled or reused[8]. As community networks we need to consider ways of reducing this over production and waste, which creates significant pollution in communities and globally. There are a number of community networks such as Portal Sem Porteiras[9] and Colab in Brazil, and the Guifi.net[10] affiliated project reuse[11] in Spain, which have found ways to lengthen the lifespan of ICTs and created opportunities for a local circular economy. Over and above this waste, using the Internet is a resource intensive activity. There is both a responsibility and an opportunity in creating ways in which our community networks reduce negative environmental impact.

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8   https://www.ewasteopeninnovation.pt/

9   https://portalsemporteiras.github.io/#quem_somos

10   https://guifi.net/

11   https://www.ereuse.org/

Key Takeaways

Technology includes all the hardware and software required for the network to carry the signal from the source to the user—from a Point of Presence (PoP) where it connects to the national backbone, to the WIFI router or device (if the device is part of the community network services).

For a sound assessment it is important to understand the technology options available to a community and the implications that this has on operations and costs.

Practical Recommendations for the Assessment

- Ensure that you have input from a person with extensive expertise in network design and operations when assessing the community network initial design and technology options. One option is to request input from a similar initiative, either another community network or a small Internet or local content service provider. This must consider the geographical and climatic conditions, the services identified by the community, and license and regulations that the community network can access.

- Request input from people with similar challenges with power supply.

- Ensure that your assessment understands the needs for reaching agreements and right to access to land and hosts. Note that in some cases people may change their minds about hosting the network nodes, so developing a good and transparent relationship with potential hosts and with relevant authorities is important.

- Take into consideration all other elements in a network before committing to a particular type of technology.

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Strategic and Sustainable Organizational Structures and Partnerships

In this section we aim to answer the following questions:

- **Why is it important to strategically consider a community network's legal registration?**

- **Is community network ownership separate from its management and operations?**

We refer to organization structure here as how a community network operates desired services within the social, technical, and legal constraints of a community. It includes the legal vehicle, governance structures, management and operational teams, services, and partnerships which contribute to the community networks, amongst others. As with the technology identification, there is no single way in which to organize a successful community network. There are community networks established as co-operatives, foundations, nonprofit organizations, social enterprises, and proprietary limited companies. However a community network is organized, it should enable the community to participate in and interact with the community network in the most mutually beneficial way possible. Mutually beneficial could be defined as the highest value for the community, with sustainable and healthy operations for the community network.

The way in which a community network is structured can affect how the community network interacts with partners, as well as its ability to access the licensing and r egulatory requirements to operate as a community network. The legal vehicle will be bound by other compliance frameworks such as requirements of companies law, labor law and revenue tax law, and other other factors.

In the readiness assessment it is important to understand the possible structures a community network can use to fulfil its objectives.

One of the greatest technical challenges throughout many community networks, perhaps more so than network technical challenges, is that of meeting the statutory obligations (administrative and bureaucratic requirements) linked to formal constituency. This includes, undertaking the required monthly, quarterly, and annual financial and fiduciary duties, applying business best practices, and working in a strategic way that meets both the community's realities and the formal sector's requirements. It is essential to sustainability that the formal duties of the community network are maintained.

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Community networks are not only required to apply good business practices, they are also asked to question these and strive to make them more inclusive and people centered. This requires a vast set of skills which are often rare in the underserved communities where community networks happen. In some cases, community networks are the first formal structure in a community, subject to legal frameworks on a national level and within a regulated space to the level of telecommunications. This presents a set of challenges over and above the many other challenges faced by successful community organizations.

One of the strategies to address these needs is to look at the organizational structure in a strategic way, drawing in partners and decoupling the various elements of structures. The aim is to simplify processes and take advantage of people's strengths. The strategy should not result in added complexities.

Some community networks have operated without formal legal structures, due largely to the fact that their national environment did not have regulatory frameworks under which they could legally operate. That said, there are many that operate as legally constituted entities. Objectively, this contributes to broadening the community network's opportunities. Without a legal vehicle one cannot attain a license or permit, as these are tied to an entity. Legal and statutory compliance is important.

A community network could be constituted under an existing community organization or could look to create its own company. Companies typically have specific objectives, mission, and vision recorded through a memorandum of incorporation, bylaws, or a charter. A new organization, or an existing entity, would need to ensure that its core documentation includes the provision of telecommunications services as part of its documented company activities.

Certain types of legal vehicles are created with the objective of creating social value, such as public benefit organizations, cooperatives, and others (these can have different names in different jurisdictions). Typically, these types of companies offer certain benefits, such as lower income revenue taxation, the ability to access government grants, and other kinds of support. It must be noted that these benefits are usually accompanied by heavier administrative and financial processes and formal submissions than other companies. It is important to weight up the benefits and burdens before committing to a legal vehicle.

In many countries, national and regional governments will publish strategies to support certain industries or activities. For example, some governments include rural development as a strategic focus area. A community network could benefit from aligning to national strategy. This can be done through the constitution of a legal vehicle that is favored by government strategy and by including wording in its constitutional documents that is clearly aligned to this strategy. This is not to say that a community network should prioritize government strategy over the community. However, choosing a legal vehicle and wording the objectives could be a strategic tool for the community network.

Ownership and Governance

There are many examples of projects aimed at addressing critical challenges and there is strong evidence that community ownership is a critical success factor. That said, it is important to consider two types of ownership:

- The legal ownership of, for example, the networks assets, business, and even the brand or IP.

- The psycho-emotional sense of ownership where, for example, the community has ways of contributing to decisions and to activities that build a sense that this network is "for us" or "ours." These two types of ownership are not necessarily related.

Legal ownership must be understood within the legal obligations and risks that are attached to it, along with its impact on operations. Often community networks are registered under the ownership of a collective of community members or established community organizations. In the best scenario the legal ownership can award the community network initiative community representation, respect, and powerful standing in the community (through its constituting members). However, there are also examples of community networks where the legal owners do not have the required understanding or capacity to meet or oversee the legal obligations that they are required to by the various legal frameworks to which they are subject. To ensure a sound and sustainable community network, it is important to ensure that legal ownership is assigned, or supported by, competent governance, management, and operations staff and processes.

The sense of ownership can be created through different strategies and mechanisms in which community members and users are actively involved in the decision-making and operations of the community network. The benefits of a sense of ownership must include authentic channels of participation and not simply be an empty term. Examples of creating sense of ownership can include the collective mapping of potential community access points, responsibilities, and benefits for caring and hosting a network node and selling network services, working to operate the network, access to financial, or other benefits of being part of the network.

Governance structures are linked to legal ownership. That said, users and partners can also be involved through the creation of a board of directors or members that meet at the annual general meetings. An important aspect to effective governance in community networks is that of navigating local politics, conflicts, and community or interpersonal dynamics. It is easy in any community to politicize activities. Small communities are no different. For example, selecting the people to host the network nodes, operate the network, and receive benefits can become a contentious and hotly contended issue. While

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leveraging trusted networks of people can be hugely beneficial to a community network, it should not be done at the expense of technical or operational health. Governance models should be assessed for both strategic and practical value.

Management and Operations Team

Management and operations, like ownership and governance, must be rooted in the community's reality. However, a community network will not succeed without a skilled, committed, and capable management and operations team. In many communities affected by the digital divide, formally skilled people are rare. We want to acknowledge that non-formally skilled people are still experts in their lives and they bring value to the community network. Here we are referring to the team responsible to operate the network and business within legal frameworks and financial sustainability principles. There are of course some skills that can be built up quickly through training, but there are others that require exposure and experience. Where the skills are not readily available in the community, partnerships are important. It is important to understand that the management and operations team will be required to bridge what are often two very different realities: the community and the telecommunications sector.

The more distant these realities are, the harder they become to harmonize. An extreme, and yet common, scenario is where an isolated community creates a community network. They speak a minority language, have limited infrastructure and services, a nd work primarily in the informal economy. In contrast, the telecommunications sector is governed by formal, legal, and often administratively cumbersome processes in an officially recognized language.

The management and operations team, like the legal owners, will need to have the ability to work in both realities effectively.

One of the most crucial aspects in sourcing and developing a good operational structure is defining the work and tasks that are required to install and operate the community network. This can then lead to defining various roles, responsibilities, and time commitments expected from each person. These are critical aspects of a functioning organization. It will also inform the recruitment process and the training needs and help define the organizational processes that need to be in place to make sure that the various people required to run the community network know how to fulfil their work and coordinate with one another.

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In this assessment, readiness is determined both by viability and the capacity of the micro and macro organizations to take the community network initiative forward. The meso organization will need to understand what it will take for the proposed organizational structures to function in terms of tasks, roles, responsibilities, and skills to provide the desired services. This will firstly inform the costs of operation (more on this in the following section). It will also show whether these skills are available in the community or through trusted partners.

Partnerships and Agreements

One of the ways to work effectively with all the areas of community networks described above is to develop partnerships with organizations that can support some of the work. Partnerships can be used for the design of the community network, the seeding and set up, mentoring, and for the operations. Types of organizations that can be valuable partners include advocacy groups (for ICT access and policy reform, for fair treatment of marginalized communities, etc.), like-minded commercial operators, other community networks, academia, and telecommunications industry associations.

For example, an organization that supports community-based projects may have useful information and templates on the organizational structures that have worked in the community. An advocacy group can be very useful in advocating for the rights of community networks to access affordable bandwidth or to give exposure to the community network initiative. A partnership with telecommunications companies can lead to invaluable knowledge and access to resources for more efficient and affordable operations.

The organizational structure should consider strategic partnerships as an answer to adding the most value to the community network. Managing partners is time consuming—partnerships should be considered in terms of what they add and what it takes to maintain the relationship.

What follows is an overview of general recommendations for partnerships and the different types of stakeholders a community network will liaise with. As a meso that supports several community networks, the most efficient way to create partners and source assistance and resources is to centralize certain activities. For example, policy advocacy which happens at a high level would make the most sense (in terms of effort and cost) if it were centralized and represented a large number of voices. This is true for many activities that do not have to be localized, and where many different communities could benefit from the same effort.

Meso-Micro Partnerships

These have been covered in the previous section, but we want to highlight that what applies to external partners is also applicable to internal partnerships and agreements.

Defining clear partnership boundaries and building strong partnerships: any partnership can develop positively or negatively, whether it is with someone new or someone you have known a long time. Defining boundaries and roles is essential. Identifying what each partner is willing to do and not do and who is responsible for what is critical. In addition, power dynamics are present in all partnerships and need to be understood. It is recommended that mesos and micros develop clear partnership agreements between themselves. This readiness assessment should be taken as an opportunity to understand one another and could be the basis for a partnership agreement in which the roles and responsibilities of each organization is defined.

Partnership agreements are most easily reached at the beginning of a partnership when goodwill is at its highest. Further into the partnership people and organizations can feel disillusioned or frustrated and it is harder then to reach consensus. This partnership burn-out can be avoided with clear partnership agreements.

Telecommunications Sector Stakeholders

A community network is part of the telecommunications sector. It is important therefore to understand the sector and develop partners in it. Industry partners can be critical to accessing spectrum and meeting the telecommunication regulatory requirements to operate the network. They can also offer valuable insight into the design and operations of quality network services and share resources. It is important to find the right partners. Below you will find some of the stakeholders in the telecommunications sector and what they can bring to the table.

State-owned telecommunications companies can offer concessions, such as the examples of Mexico or Colombia mentioned earlier. They are, however, notoriously slow in their processes, often detached from the realities of an unconnected community and not always the most cost-effective solution. There are also examples of government taking ownership of successful citizen-led projects. It is important to consider the level of alignment between your community network and government's strategies and operational realities when proposing a partnership.

Large operators may be willing to partner with a community network. Large companies however often have an established way of working and partnering and are not very flexible. Purchasing or renting from them (for example, shared use of the space in one of their towers) can be more expensive than creating one for the community network.

Large operators usually have the capacity and money to access mobile spectrum. As mentioned in the policy section, it would be interesting for a community network to have access to this unused spectrum. Another avenue to explore with large companies is to partner with them as a beneficiary of their Corporate Social Responsibility (CSR) funds. CSR funds are usually in line with defined company objectives and can be grants or development programs or technical support. These may be useful, but it is important to understand that community networks and large operator systems are very different, and the lessons from one may not be applicable to the other. It is also important to avoid negative power dynamics, such as the community network becoming a poster child for the large company.

Small commercial operators may be the most closely related sector group to community networks. They often work together, as this can be a good tactic in a sector dominated by large and powerful companies. There are many examples of small, collaborative operators. They may have agreements in place to share space in data centers or towers. Some may also call on each other to pool staff, when it is more cost effective to pay another operator to undertake a once-off job, than to mobilize or extend an in-house team. Connecting with small operators can lead to valuable partnerships and allow you to include industry best practices in your community network concept. Industry bases their advantage on best quality and maximum cost efficiency and these two elements are very valuable to a community network.

In considering partnerships, it is critical to remember that there may be very different objectives and ethical stand points between a community network and a private operator. A commercial operator is most likely driven to create maximum financial return for its owners. Community networks on the other hand are driven by maximum positive impact for its users. In a community network, financial return and sustainability must be in balance with collective benefit. This can lead to private operators and community networks being in competition or in opposition to one another. When approaching a small private operator, it is wise to understand this and communicate to them how the community network does not pose a competitive threat as it considers a different set of dynamics. It is also important to find an operator that shares your understanding of the digital divide and respects your vision of a community network.

Other Community Networks

In 2017 the Internet Society published a report on the state of community networks in Africa[12]. The study was based on a 2016 survey that mapped 37 community networks initiatives in 12 African countries. Since then, many other initiatives have emerged. Each initiative, whether currently functioning or not, will have valuable insight into the strategies they use to operate and valuable lessons of why they were or were not successful.

It could be useful to reach out to community networks in the same context as the community being assessed. It is important however to remember that challenges can vary hugely between different community network contexts. Urban community networks for example have very different challenges from rural ones. Each country and region presents different challenges and lessons. Terrain, weather patterns, and other geographical indicators also affect technology differently. The differences are nuanced and endless. Despite this, partnerships, or peering, between community networks is useful, and could happen at meso-to-meso level or micro-to-micro level.

Telecommunications Advocacy Experts and Sector Representative Groups

The Internet Society and the Associations for Progressive Communications (APC) are two of the most active international organizations supporting community networks. They have undertaken extensive policy advocacy in many African countries, at the African Union level and beyond African borders. They have also created various resources for community networks to explain the various regulatory frameworks and spectrum assignations at country level.

Some countries may have industry associations. These may be in a good position to help understand and interpret the regulatory framework (especially if the meso or micro becomes a member). There may be more than one industry association. In this case, each one should be assessed to find which is the most fitting for the community network.

There are also law firms and consulting firms that specialize in interpreting regulation for an operator, applying for licenses, and reporting. Because they are expensive, pro-bono relationships could be beneficial to the community network.

There are groups in other industries or sectors that experience similar challenges to community networks. For example, the science, innovation, education, or rural development sectors might be facing challenges relating to the fourth industrial revolution or sustainable development. Connecting with these in a thematic way may lead to effective advocacy and unexpected solutions.

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12   https://www.internetsociety.org/wp-content/uploads/2017/08/CommunityNetworkingAfrica_report_May2017_1.pdf

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Academic Institutions

Academic research can be valuable in documenting and legitimizing the case for community networks. An active academic partner can help a community network to access knowledge and resources. It can also develop work which helps the community network to better understand itself and monitor its work. Academic data is also respected (or trusted) more by public authorities than industry data, as it is considered less biased.

Academic institutions can also be partners on other fronts, such as for accessing the Research and Education Network, which has a different name in each country. In Kenya, for instance, it is KENET, while in South Africa it is the TENET. The network offers bandwidth and acts as an intranet for universities nationally. Many universities are willing to support and share resources with specific kinds of development projects. This has been a fantastic solution for community networks such as TunapandaNet, Lanet-Umoja, and Zenzeleni networks to access Internet bandwidth with non-commercial and licensing requirements.

Key Takeaways

A strategic organization structure should consider all the activities that are required for a community network to operate. These activities may be undertaken both in house and through partnerships.

In cases where the activities may benefit more than one community network it is worth considering the benefits of centralizing the activities and partnerships. Meso organizations are well positioned to play a centralizing role for several micro organizations. Both in-house and external teams require strategic and clear roles and responsibilities to ensure sustainable operations. For the readiness assessment, defining who can undertake the key activities necessary to operate a community network is essential for developing the financial viability and the capacity of the meso and micro to advance the community network initiative.

Financial Sustainability

In this section we aim to answer the following questions:

- **What are the phases of development of a community network?**

- **What are the costs associated with seeding and operating a community network?**

- **What is a community network business model?**

- **What is the role of financial projections?**

- **What is a spending ceiling?**

- **Why do we need to diversify services for different user groups?**

Financial sustainability refers to the community network being able to sustain its operations. It is the people, network, and other assets and processes required to operate over time in a healthy manner. While grant funding may be available to seed a community network, relying on grant funding indefinitely is not sustainable.

For a community network to be sustainable it is important to understand the business model. This is not to say that a community network must have the same business model as a standard operator. We understand that the reason many communities do not have access to affordable and quality connectivity is precisely because they do not present an attractive business opportunity for commercial operators. A community network business model will need to leverage existing strengths, assets, and processes within the community. It will also need to leverage collaborations and partnerships to access things like a point of presence (PoP), bandwidth, high sites, and backhaul infrastructure.

The main thing to consider is that to offer affordable services to the community users and to sustain them over time the costs of the network need to be minimized and the income needs to be consistent or grow in tandem with usage.

We know that no business is sustainable from day one. Like any business, community networks will go through different phases of development. If we look at the phases from readiness assessment to fully functioning, self-sustainable community network we can define the following phases of development:

Each phase of development requires different activities and requires a different financial model.

The readiness assessment, as well as raising partnerships and resources, would typically be funded by the meso and micro champions themselves. These initial phases are difficult to raise funds for because partnerships and financial backing require a well-developed concept and demonstrations of viability (which will only be provided through a good readiness assessment).

Seeding is the process of setting up the company, installing the initial network, and training the team. A good seeding process would end where the community network can start offering services and generating some initial income. This phase is ideally a grant-funded project, as at first the network will be only a small part of the projected size and will encounter the normal start-up issues that will limit usage.

Seeding will lead to eventual self-sustainability. The seeding stage ticks a lot of funder boxes—training, deployment, etc. That said, considering planning, deployment, and kickstarting operations, real seeding takes longer than most funding cycles, which are under 12 months' duration.

Operational mentoring is arguably the most difficult to fund. It requires both localized operations and significant external support and it has more costs than an assessment process. This stage would ideally be supported by a blended financial model where some expenses are covered by the community network income and others would probably require external sources, especially for expert knowledge which is not yet developed in house and is expensive. Few funding calls cover operational costs, which is what is needed at this time. Additionally, it is a difficult and critical time where all the new starting challenges come up: the first real organizational and network crises, as well as the first

quarterly and annual administrative processes. It is also the time where the champion groups are tired and expectant of others to share their load.

Self-sustainability is the time when the income of the community network covers the operational activities necessary to maintain the services and grow, upgrade, or improve the services in response to the demand.

The financial aspect of the readiness assessment aims to assess if, and at which point, a community network can become sustainable considering a reasonable and realistic income and growth. The projection must be contrasted constantly against the reality – though all stages of the community network deployment.

Many community network ideas focus only on the technical aspects of the network. Without skilled and dedicated management, administration, and operational teams, even the most promising financial projections will fall short (more of this in the section on organizational structures).

Financial Value of the Community Network

In our experience, people in the communities where networks are deployed tend to value financial gain more than cost savings, even if the net gain is the same. For some people the most appealing and valuable offer of the community network is the possibility for financial income or employment–either as direct employment or as resellers of the service.

If this is valued by people it must also be one of the critical success factors for financial sustainability. The financial plan must therefore include employment and other means of income generation for community network operators and not simply rely on volunteer or in-kind contributions. Income generation can act as a drawcard to retain skilled people to the area, who otherwise may leave the community in search of opportunities elsewhere. Retaining them is important to both the success of the initiative, but also to any intention to use the network as a development opportunity. The brain drain from the area helps perpetuate cycles of poverty, and thus part of the sustainability strategy must address the need to retain skilled, capable, and enthusiastic people. This requires income.

Financial Sustainability and the Community Network Business Plan

Classic for-profit business models would look to create financial sustainability and growth through large mark-ups on their services or through gaining large volumes of customers. These are limited avenues for community networks, where the need is to create low-cost services and leverage community structures that exist within limited areas and small user groups.

A community network can and should charge for its services to generate income. There will always be costs. Without income or people willing to cover costs over a long period of time the community network will collapse sooner or later.

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One of the first elements to consider in a community network model are the setup costs. This includes the capital expenditure (CAPEX) and the work required to install the network, set up the business, and train people. In a normal business, CAPEX is covered through a loan and is paid off during operations. This means that the operation's income needs to cover both the CAPEX loan as well as the operational expenditure (OPEX). This requires the business to maximize its income and charge as much as possible for their services. But this does not seem to work for community networks, as illustrated in the example below.

Examples

Zenzeleni networks developed financial calculations for deploying community networks in five different communities in South Africa in rural and urban areas. All were characterized by socioeconomic constraints, with very high unemployment rates, high levels of poverty, and a critical shortage of skills. The five communities were otherwise quite different geographically, demographically, and in relation to their land ownership patterns and community organization models. For all five communities, all scenarios where income had to cover OPEX and CAPEX repayment showed unsustainable community network models. In other words, the business sustainability rested on CAPEX being covered primarily through grant funding. This is different from community networks in areas with less of a socioeconomic challenge, for example in some parts of Latin America and Europe, where the community members can cover most of the hardware, administrative, and training costs themselves. It is also different from commercial models where, for example, a small ISP can take out a loan and repay these loans via sales profits.

Income also requires different strategies to ensure sustainability without overburdening the community network users.

One of the strategies that has worked to increase income is to diversify client groups, and services. The idea here is to be able to offer different kinds of services to different kinds of user groups. In the case of PamojaNet, in the Democratic Republic of Congo, the network operates for a cost during businesses hours, where most users, or customers, are local business and organizations. The network is free after business hours, where the community can access the network. In Zenzeleni networks, there are two services to cover two main user groups. Data vouchers are sold for a nominal price to access Wi-Fi through public community hotspots. These are affordable to all. The community network also connects homes, non-governmental organizations, and businesses with a direct line through a monthly subscription.

In both cases the community members can enjoy a service that is accessible to them, but more substantial income is generated through other kinds of users.

In calculating diverse services, understanding a spending ceiling is important. For example, a community network at first offers Wi-Fi access and later offers computers and Internet-able devices. If a user group can spend US$1.50 on Wi-Fi per month, it may not be feasible to expect them to spend US$1.50 on data and then additional amounts for accessing devices. The spending ceiling remains the same, even if more services are offered. In other words, they would reduce their data spending and still spend US$1.50 on both services. This changes if the service they are accessing allows them to either earn additional income or avoid other costs. (For example, if the community network helps people to access online banking, registrations, or other activities that would otherwise require people to travel and spend money.) A strategy to gain both financial sustainability and greater impact could be for the community network to include activities that can translate directly into savings or earnings.

In the examples above of PamojaNet and Zenzeleni networks, the common strategy is that they diversify costs by directing their services to different groups of users: one service for the community members and another service for businesses or wealthier homeowners. The businesses can afford to pay more, more regularly. They are presumably more stable, predictable customers too. Predictability and stability in income is necessary for cash-flow. Cash-flow is necessary to cover the monthly costs of the network. Predictability is important for projecting the business trajectory of the community network.

Note: Volunteer staff is common within community networks and humanitarian and development initiatives. While this can be a blessing in many crisis moments, it is not sustainable as volunteers eventually leave or require a shift to paid staff. A business model with volunteers must include a sustainable volunteer exit strategy. By the time the volunteer leaves the community network, the team should have the capacity to take on the work for itself. A volunteer, like any staff member, must have a clear role, responsibilities, and dedication. The community network must reserve the ability to guide and discipline a volunteer the same way as an employee. Not having this can lead to a very unstable operations model and create more damage than support.

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Projecting Costs and Income

Projections are a tool for testing whether an idea is financially sound. It is the exercise of defining the costs required to run the community network and offer services and defining the income expected from running the network and offering services. Projections must be grounded in research and evidence, which is gathered as the community network operates. This is one of the levels of monitoring and evaluation. It is one of the most useful tools to inform strategic decisions and essential to managing a sustainable network.

For every new idea that the community network has it should develop a costs and income impact projection for at least 24 months. As we have discussed, there is always an adoption period. There are also different periods in the month and year where there will be negative cash flow, and this needs to be considered to ensure this deficit is covered at other times. It is also important to remember that a growth in income always results in a relative growth in expenses. For example, the person doing all the administration for service A and B requires full time dedication to undertake them.

The community network wants to add a new service (service C). Service C uses the same technology. You can promote it through the same channels and it all seems like it is a great income stream with little additional costs. However, to carry the administration of service C, you must hire a new person, train them, and onboard them. The real cost of service C therefore also includes a new staff member. Human resources are one of the most expensive costs in any business. Only a projection of the work and costs over time will show whether offering the services and hiring a new person will sustain itself.

Different Value Proposition for Different User Groups

A challenge we've experienced in creating different services for different user groups is convincing users that there is a different value proposition for each service. Using the examples of PamojaNet and Zenzeleni networks, the challenge is to convince the business users, rather than the community members, to spend more. No one wants to pay more for the same service, so it is necessary to create more value to justify more cost.

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The paying business users in PamojaNet have access to the network during business hours. The benefit for using the network in business hours is that it is synchronous to working—and income or value generating—activities. Community members do not have access to the network for free at the same time. After hours everyone, whether a business owner or not, can access the network for free. One could argue that access after-hours reflects other types of uses, such as communication with family and friends, studying, or leisure. This separates people's spending attitudes. It also gives more to the people spending more.

Likewise, in Zenzeleni, community access points that were close to businesses had to be relocated, because business owners would simply pay the nominal costs for community vouchers, rather than become monthly subscribers. It wasn't enough to explain to business owners that they were heavier network users in comparison to community users. It was also not enough to show business owners that they earned between 10-50 times more than community members and the cost was proportional to earning or disposable income. Zenzeleni had to develop services that gave advantages to people that paid more. The services are now differentiated in speed and convenience. Community hotspots versus home and office connectivity are an example: people must walk to the closest hotspot to access the Internet, and when there are many community members congregated in one hotspot the connectivity is slower. Those with monthly subscriptions have a guaranteed speed and the convenience of connecting from home or their office.

Cross-Subsidizing Costs

Community networks are aligned to bridging inequalities. The tiered access described above could be seen as perpetuating inequalities. Creating different tiers of users and related services, however, allows the network services to cross-subsidize one another. We could argue that we are using inequalities to the advantage of the most marginalized, but the cost and sustainability of a community network cannot rely on the income from the people who earn the least money. It is the steady income from the more affluent users that allows a community network to maintain staff, maintain equipment, and continue to work. It is also this steady income that allows access for the community to grow.

Note: Higher paying clients are usually more demanding. This can either require more trained staff, and therefore create more costs, or it can skew the efforts of the community network away from their primarily impact focus–community members. In cross-subsidizing, this balancing act of impact and income requires careful attention and strategic planning.

Commons and Shared Services

Sharing operations services or infrastructure between community (micro) organizations, or between micro organizations and meso organizations is one operations and sustainability strategy that has emerged over the years. Shared services or infrastructure can include bandwidth, network monitoring systems, towers, servers, accounting processes, or even resources such as organizational processes and templates.

The motivation for sharing varies from case to case, but the rationale is that it is more efficient and economical to share than for each community to source, develop, and maintain everything on their own. Shared services can also include shared procurement, where buying in bulk for more than one community can bring down costs significantly. The sharing strategy is most critical when the focus of the community network is to bring down the cost of connectivity and access to resources, where the cost of maintaining each resource sustainably would likely translate into the increase of the cost of services.

Additionally, operating a telecommunications network requires skills. Some skills may be found in communities or can be developed through training, but others require many years of expertise which may not be readily available in the community. High-skilled expertise is required for the design, monitoring, and troubleshooting of the network and the organizational compliance processes, among others. While a community network's strength lies in collective and localized governance and operations, it may not always be realistic to expect a community to immediately develop all specialized skills. As the aim is to develop a high functioning, legal network, the community will have to outsource expertise not available locally. It can be beneficial for communities to collaborate collectively with a single expert or expert organization.

This collective relationship can aid the communities and micro organizations to hold a more equitable relationship with the outside experts, who could hold some advantage over the community. In collectively engaging an expert organization, communities support each other to cover the costs of expertise which is often high. Over and above the economic and logistical benefits of sharing, there is an opportunity for creating a community of communities, where community networks in a region or country, in coming together, can support each other and hold a stronger position when working with macro organizations.

The meso organization is in a good position to centralize the shared services between micro organizations, either through in-house expertise or by outsourcing them. There are also plenty of examples in Africa, and around the world, showing how community ownership and participation is key to creating valuable and relevant solutions. It is important that this strategy is considered when determining the roles of each organization and partner. How the roles and responsibilities are split between each micro and meso depends on what is agreed upon between the organizations. This should be based on

realistic capabilities, a joint understanding on which roles each organization wants to undertake in the future, and the values and parameters each bring into the partnership. It is also important to balance splitting roles between what is most efficient in the moment, what the strategic goal is, and what the social impacts are of these decisions. For example, it may be more efficient at first to centralize management of the community network at the meso level, but the goal is that the micro organization manages its network. The social impact is that people may associate the network with the meso, not the micro, and may resist contributing to the micro.

Key Takeaways

Financial sustainability is key to being able to sustain any community network. This requires careful consideration and planning to take the needs and requirements of technology, personnel, running costs, and user groups into account. Creating a solid foundation of financial sustainability is important as the network will incur costs to function properly. There are various ways to raise the capital required to seed the network, but also various models to consider in designing the networks income streams.

Part 2 - Community Network Readiness Assessment Workbook

Stage 1 – Creating The Baseline

The Community

Before undertaking these tasks read through the corresponding section in Part 1.

Tasks

- **Define the community network's parameters and position**

- **Identify the community**

- **Identify the champions**

1. **Defining the meso vision, parameters, and position:** Each meso will have its own ideas about what the community network should do and create in a community. Different people within the meso team might also have different ideas about this. In order to be able to work to a shared goal, it is important to define the position to the initiative, what the meso wants to create, and under which parameters. This is valuable to create a unified understanding internally for a team and for approaching the community and other partners with clear intentions. Being clear from the beginning on expectations can aid in finding the right partners quicker. The parameters set by the meso should not be imposed on the community or substitute the goals the community has for themselves (more on this in stage 2). This stage is about drilling down to understand conscious and unconscious expectations that the meso team has in undertaking this work.

   a. **Guiding questions:** What role does the meso expect to undertake in the development of the community network? Do they have any conditions to support a community network initiative? (This may include things that the meso feel must be in place or things that cannot be in place in support of the initiative.) What are the values or principles that guide the meso work in the community network initiative? What are the preconceptions about community networks? What does the meso believe is important about connecting the unconnected?

    b. **Suggested tools:** Brainstorming, Theory of Change/Benefit Realization Management.

    c. **Outputs:** The meso guiding principles—or a charter, a vision and mission, a scope definition, and both what is included in and what is excluded from the concept that they want to initiate. Examples: Any community network that the meso supports must offer services to all, without discrimination by gender or social or economic status. The meso will also not support a community network that is not transparent about their financial position.

2. **Identifying the community:** this is an initial step to identifying the community. At first this is done without engaging stakeholders to avoid local dynamics and raising expectations. This first step is desk research that can inform the initial technical and telecommunications research. It's important that the meso supports a community they already have knowledge of and an existing relationship with. Without this it will be difficult to undertake a realistic assessment. Identifying the community may happen first through a relationship with a local champion. The meso must assess which introduction to a community gives it the most un-biased, realistic, and positive relationship with the community.

    a. **Guiding questions:** What area does the community cover? Who are the groups and organizations that make up the community?

    b. **Suggested tools:** Desk research into national and local census data, as well as registers of different kinds (school registers, health institutions, NGO independent censuses, and surveys).

    c. **Outputs:** Initial geographical map and demographic information (population by age, gender, socioeconomic information, Internet penetration, etc.). List of initial potential user groups (populations groups, number of schools, local businesses, etc.)

3. **Identifying the champions:** Two champions, or champion groups, must be defined here: the meso champion and the micro champion. As described in the Key Considerations section, the champions, or champion groups, are pivotal in the success of the community network concept and deployment. Each community will be different, so it is up to the meso to understand what characteristics, roles, and responsibilities the micro and meso champions should have. In general, both champions need to have the time and dedication to developing the assessment. The meso champion will be required to lead this assessment process, understand all the various core elements of a community network, and be able to connect with experts who can help develop a sound community network concept. The meso champion will also need to be able to take all the data gathered and consolidate it into a cohesive concept (supported by the steps and tools in this workbook).

The micro champion will need to have insight into the community and be respected as an go-between by key stakeholders in the community. The micro champion needs to be able to guide the meso in understanding all aspects of the community that will affect the community network and that the community network aims to serve.

To continue this assessment, it will be necessary to count on the insight of the micro champion. This exercise guides the meso to determine the roles and responsibilities. The meso should also define a working agreement.

a. **Guiding questions:** Do the champions have the time and dedication to see the assessment through and take the community network further? Do the champions have the skills to analyze their macro and micro environments? Do the champions have the ability to listen and flexibility to adapt their ideas? Are the champions good communicators and team players? Are they respected people with a track record of developing work that benefits community members? What are the expectations from the champions and are they aligned with the meso principles?

b. **Suggested tools:** Interviews, peer reviews, co-defining roles and responsibilities.

c. **Outputs:** Documented roles and responsibilities of champions and a defined working agreement with each champion.

The Function and Services of the Community Network

Before undertaking these tasks read through the corresponding section in Part 1.

Tasks

• **Identify the connectivity gaps in the community.**

• **Define potential community network user groups.**

• **Develop a list of the potential functions, service, and roles for the community network.**

1. **Identify the connectivity gaps in the community:** This is an extension of mapping the community, but focused on what the digital divide looks like for the identified community. We stress that the digital divide can be physical, financial, or social. The data collection at this stage should focus on desk research and input from the local champions since "real" community data might not be recorded on an official site.

a. **Guiding questions:** What is the Internet penetration in the community (or the larger area, if statistics are not available locally)? What are the telecommunications services available in the community? For the services that are available to community members (in or out of the community) who can afford to access them? Is the access that they get sufficient for their needs? If not, why not (what are the primarily barriers)? What are the levels of digital literacy? What devices do people use and do people have access to them in the community? What devices do people access outside the community? Who is being left out or is unconnected and is the reason technical, financial, or social?

b. **Suggested tools:** Desk research, interviews, and focus groups.

c. **Outputs:** A description of the digital divide in the community.

2. **Define potential community network user groups:** This builds on the mapping exercise and focuses on the types of uses and users of the community network. User groups can be defined in any way that makes sense to the context. In this case the focus would be on understanding which types of users require a specific service or who would use the community network in a different way. (We cover the community network operators and owners in the different sections, so this exercise focuses on users.) Typical user groups would be different ages, or genders, students, professionals—but it must be emphasized that the groups must be understood in terms of how they use the telecommunications differently. In communities that do not have connectivity, it is important to understand where people access connectivity (for example, in a town that they travel to). If there are groups who do not currently use ICTs at all but that the meso feels could use them in future, it is important to include these groups and understand what they would need in order to become users.

a. **Guiding questions:** Who are the people and organizations currently using telecommunications services and digital technologies? What are their use patterns (when would they use the service—at what times of the day, week, month, and year—and what amount of traffic would they consume)? What devices do people have?

b. **Suggested tools:** Desk research, interviews, and focus groups.

c. **Outputs:** A list of the user groups and their user patterns. (Template idea: a table with current services vs. possibilities for the community network to address gaps.)

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3. **Develop a list of the potential functions, services, and roles for the community network:** This should be an expansive exercise where different options are researched and understood as potentials for the community based on the gaps and user groups. The options will then, in stage two, be presented and evaluated by the community and other stakeholders. Where the first step in this stage looks at the digital divide, this step focuses on the digital potential.

    a. **Guiding questions:** According to the demographics and what is known about the community, what functions, roles, and services could the community network play?

    b. Suggested tools: Desk research, interviews, and focus groups.

    c. **Outputs:** A list of potential functions and services.

Telecommunications Frameworks for Service, Network, and Spectrum

Before undertaking these tasks read through the corresponding section in Part 1.

> **Task**
>
> **Identify all enabling telecommunications regulatory frameworks for the community to operate different telecommunications services.**

1. **Description:** If there is another community network or community radio in the country, it is best to understand the regulatory framework under which they operate. If there is none, then a good place to start is with small operators, ideally in the community's area. The aim here is to understand the process, timeframe, and costs associated with acquiring and complying with the telecommunications frameworks under which the community network might function. Remember that the licenses that any operator requires (including a community network) are relative to what aspects of the network it operates (backhaul, services), the spectrum it uses, the bandwidth is accesses and resells, and also what kind of licenses its providers have. If there are no precedents that can guide the meso, it is probably necessary to reach out to experts in regulation.

    At this stage, while the meso is defining what information is necessary, it is best to engage with partners already involved or aligned to community networks. For example, in Africa these include the Internet Society and its local chapters, APC, and other digital rights organizations, as well as well-established institutions working to bridge the digital divide. It's also important to identify whether there are any special allocations, concessions, or exceptions for universal access telecommunications initiatives, and if so, what conditions they must fulfil (for

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example being a nonprofit organization). Note that these special conditions may not be explicit, so it is important to understand broadly what kinds of initiatives are most supported by the government and regulatory bodies. This stage is valuable for defining an initial sense of what the community network could use and would need. This will inform which stakeholders to engage and what to engage them on in stage two. It is important to understand the costs, constraints, and requirements of each possible licensing or permission.

a. Guiding questions: What spectrums are available to the community network and at what cost? What licenses are available to operate a network and offer services? For all available options, what is the associated process, cost, timeframe, and administrative burden?

b. Suggested tools: Interviews, expert assessment. The APC wiki describing national regulatory frameworks can be a useful tool[13].

c. Outputs: Cohesive description of the enabling policy frameworks or needs for community networks in the community's national (and regional if applicable) context.

Network Technical Considerations

Before undertaking these tasks read through the corresponding section in Part 1.

> **Tasks**
>
> • **Identify the technology (type and available brands) required to deliver the desired services.**
>
> • **Identify the available backhaul sources and services (PoPs, suppliers).**
>
> • **Undertake an initial design of the network (technical and deployment rights).**

1. **Identify the technology (type and available brands) required to deliver the desired services:** this is a first exercise to understand the technology that is available in the community's context. It is important to review all the main considerations in the general section above. It is no good designing a network based on backhaul or access points technology that is not available to the community affordably. Neither is it useful to settle on a technology that is difficult to source or too complex to operate.

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13 The Association for Progressive Communications (APC) has undertaken work to develop a map showing the various spectrum bands, showing which bands have been allocated and which are free. This information is openly available online (https://policy.communitynetworks.group/country-profiles).

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a. **Guiding questions:** What are all the technologies that can be used to deliver the desired services? For all technologies—what are the costs, availability, operability, performance in similar contexts to the community's, legal recognition in the country (standard type approval, frequency, etc.)?

b. **Suggested tools:** Desktop research, comparison grid.

c. **Outputs:** A comprehensive technology comparison including costs, availability, operability, shown good performance in similar contexts to the community's, legal recognition in the country (standard type approval, frequency, etc.).

2. **Identify the available backhaul sources and services (PoPs, suppliers):** This requires the meso to identify where the community network could get its bandwidth and who the supplier would be. In many cases there will be several options. It is important to understand the conditions and constraints for accessing the PoP and the service. For example, there may be a minimum contract duration commitment, such as 12 months. Some community networks use a Research and Education network as a backhaul provider. In some cases, this backhaul can only be used for education purposes and cannot be resold commercially. It is therefore essential to understand all conditions before they can be evaluated. This evaluation will influence the design.

a. **Guiding questions:** For all sources, what are the technical advantages, the legal and financial requirements, and are there any constraints for offering the desired services? For all potential backhaul service providers, what are the conditions for contracting the services, differences in pricing, and what technical response mechanisms are in place?

b. **Suggested tools:** Desk research, comparison grid.

c. **Outputs:** A comprehensive potential backhaul and provider comparison, including at least the POP—GPS coordinates, proximity and accessibility to the community, costs, power and security set up; for the service providers—cost, contractual conditions, reputation, alignment to community network vision.

3. **Undertake an initial design of the network (technical and deployment rights):**
The technical design requires an experienced person to undertake it. It should include the plotting of the backhaul nodes and the community access nodes (at this point it can include the initial priority access points). This should also identify the requirements for high standing sites (and height), which will inform whether there is a need for further requirements such as an environmental impact assessment and height training. The design will also determine the technology required in each part of the network. The expert should also be able to advise the meso on what brands and options are most suitable for the given technology.

   a. **Guiding questions:** N/A

   b. **Suggested tools:** Google Earth.

   c. **Outputs:** An initial typology of the network; a visual map over the terrain (Google Earth); a comprehensive list of all the equipment required to carry the signal from the PoP to the initial nodes and deliver the desired services to the identified user groups.

Strategic and Sustainable Organizational Structures and Partnerships

Before undertaking these tasks read through the corresponding section in Part 1.

> **Tasks**
>
> • **Identify potential types of legal vehicles.**
>
> • **Define the initial capacity and skills required to operate.**
>
> • **Undertake an external stakeholder map.**

1. **Identify potential types of legal vehicles.** This requires the meso to identify the legal vehicles most beneficial for the community. This must consider how closely the legal vehicle can adjust to the needs of the community network (services, member structures, for profit or not, etc.); benefits that it might access such as tax reductions for public benefit work; and also, the administrative burden of setting it up and operating it. It is also possible that in some jurisdictions only certain types of legal vehicles may access the telecommunication permissions or licensing. Certain types of legal vehicles are often given preference or more supported in national strategies and these could make the set up and operations of the community network easier. Legal vehicles usually have default structures, such as core roles, members, shareholders or officers as a core framework and some may be more adequate for the community network than others. Enterprise law in different jurisdictions will also define the core responsibilities

that each type of legal structure must fulfil. These default structures also describe the ownership or governance frameworks. At this stage, the meso should build an understanding the pros and cons of different legal vehicles.

a. **Guiding questions:** What types of legal vehicles can access telecommunication permissions and licensing required to operate the desired services, and which are given preference? For each of the potential legal vehicles, what is the cost of set up and operations (including quarterly and annual compliance reporting)? For each of the potential legal vehicles, what are the ownership, governance, and other structures required?

b. **Suggested tools:** Comparative grids.

c. **Outputs:** Shortlist of the most favorable legal vehicles, including the compliance requirements and costs to set up and operate each of them.

2. **Define the initial capacity and skills required to operate.** Here the meso needs to list the human resources attributes, capacities, and skills required to operate the potential services in the community. To operate the services, all technical, administrative, and compliance work will need to be undertaken, as well as managing the community sociopolitical sensitivities. The outcome of this activity aims to support the meso to discuss and assess how much of the operational work could be done by people in the community. We suggest that this exercise focuses on defining operational tasks and outcomes and basing the skills on those rather than stating roles or professional descriptions. There are a lot of things that people can do in a community network without requiring prior professional training. That said, there are other parts of the network, such as accounting, managing the telecommunication license requirements, network technical design, and monitoring that will require experienced professionals.

a. **Guiding questions:** What are the tasks that must be undertaken in order to operate the community network? What skills and capacities are necessary to undertake and deliver on these tasks effectively?

b. **Suggested tools:** Brainstorm, interview commercial and community network operators.

c. **Outputs:** An initial list of operations tasks, and the skills and capacities required to perform them.

3. **Undertake an external stakeholder map.** This activity mirrors the activity in
    section one of mapping the community. However, this aims to map the external
    stakeholders (those who are not part of the community). This task consists of
    listing all the organizations and people that might affect or support the community
    network. The groupings used in the description of this sections can be used as a
    guide (community networks, commercial operators, academics, government, etc.).
    There will be stakeholders that have close and frequent relationships with
    the community network (for example, the broadband breakout provider) and
    others with which the community network will have sporadic and limited
    interaction (for example the national regulator). The list should include how
    each stakeholder affects the community network during seeding and during
    operations. An example of a stakeholder that will be present in seeding but
    not in operations will be a funder or a trainer.

    Maintaining relationships with stakeholders requires time, skills, and resources.
    It is valuable to add the kind of tasks that will be required to maintain the
    relationships. This will differ depending on how dependent the community
    network is on the stakeholder.

    The last step of this mapping is to determine whether it is easier and more efficient
    (in terms of ease and resources) for the meso or the micro level to interact with the
    stakeholder. For example, it may be easier for the meso to manage the relationship
    with the regulator, but easier for the micro to establish and manage the interaction
    with the local municipal government. The outcome of this task is to understand the
    strategic opportunities and operational impact of each of the stakeholders.

    a. **Guiding questions:** Who are the organizations and individuals outside the community
        that can affect or support the community network? How are each of them likely to
        affect or support the community network? What will it take (time, skills, resources)
        to develop and maintain an optimal relationship with the stakeholders? Is the meso
        or the micro better positioned to manage the relationship with each stakeholder?

    b. **Suggested tools:** Brainstorm, stakeholder mapping methodologies.

    c. **Outputs:** A map of stakeholders showing the level of influence on the
        community network, the time, skills, and resources required to manage them
        and whether they would ideally be managed by the meso or micro.

Financial Sustainability

Before undertaking these tasks read through the corresponding section in Part 1.

> **Tasks**
>
> • **Undertake market research.**
>
> • **List the initial types of costs to set up and run the community network.**
>
> • **Define the initial potential income and spending ceiling.**

1. **Undertake market research.** This builds on the Community and Services sections, where the meso is asked to define the digital divide and the potential user groups in the community. What we want to understand here is the amount people currently spend on telecommunication services. If community members need to travel to access the services, it is important to include the costs of travel and how often people travel to access these services. It may be that the community does not have power and that community members need to pay for charging their phones. If this is the case, include how often and how much people spend on charging their phones, tablets, or other devices. Include any other costs that are necessary for people to access telecommunications services.

   a. **Guiding questions:** What telecommunications services do community members currently access and how much to they cost? What other costs are associated with accessing telecommunications services?

   b. **Suggested tools:** Desk research, input from champion.

   c. **Outputs:** A list of current expenditure of the community network's potential users.

2. **List the initial types of costs to set up and run the community network.** This exercise requires the meso to start defining the known costs for installing and operating the community network. This exercise is based on the work in previous sections and requires the meso to have an initial understanding of the potential services and user groups, the initial community network design and cost of technology, the operational regulatory requirements and costs, and the organizational model. In a sense, this exercise is about transcribing the previous sections into financial terms. Including the costs for infrastructure, hardware and software, permits, installation, and operations staff (including recruitment, training, and hiring).

It is recommended that the techno-economic tool provided with this handbook is used at this point to aggregate the financial data. (The tool will be used at each stage, allowing the meso to deepen, query, and test the correctness of the data.) At this point the data is based on desk research and initial feedback from stakeholders. The tool can work out the bandwidth required by the community network according to number of users and types of services. The tool will then provide the cost of bandwidth. Use it following the steps that are shown in the guide tab.

   a. **Guiding questions:** According to our initial baseline work, what are the costs associated with installing and operating the proposed community network? Have all the costs been included in the techno-economic tool? Could there be costs that are still unknown?

   b. **Suggested tools:** Community networks readiness assessment techno-economic tool.

   c. **Outputs:** Initial listing of costs to install and operate the community network, a list of the costs that are not known at this point.

3. **Define the initial potential income and spending ceiling.** The objective of this task is to understand what potential income the community network could expect based on its services in order cover its installation and operations costs. At this point other income streams are not considered, as it is important to understand how self-sustainable the network is. This work is also based on previous sections, namely the community demographics data, the potential services and user groups, the organizational model, and the market research.

The potential income (or cost of the community network services) can be understood from what it costs to provide those services and what people already spend on similar services. It must be noted that in some cases what people already spend on telecommunications services may be too much. As such it is also important to estimate the spending ceiling. The spending ceiling can be estimated from people's monthly disposable income, but will also require in depth research in stage two.

This activity also uses the techno-economic tool provided, where the tool makes the assumption that users will pay for the community network services. The tool has some pre-determined network services, data vouchers, and data monthly subscribers. The vouchers and monthly subscriptions can be adapted in terms of cost, validity period, data speeds, and use. It is not necessary that the community network include these two services, they are simply a starting point. It is also possible to add other services if necessary. Use the tool following the steps that are shown in the guide tab.

a. **Guiding questions:** According to our initial baseline work, what are people likely to pay for the community network services? Is this above the estimated spend-ing ceiling?

b. **Suggested tools:** Community networks readiness assessment techno-economic tool.

c. **Outputs:** Initial potential income for the community network services.

Completing Stage 1 – The Baseline

This stage concludes with the documenting of the initial baseline, meaning the first ideation of what the community network could be in a given community. This baseline is essential for the meso to organize itself and understand the various aspects of the community network concept.

The next step, stage two, is focused on engaging the key stakeholders both in the community and outside of it, to question the assumptions and calculations made in the baseline, and to gather more information in order to make an informed assessment.

In order for the meso to gather its own data—the outcomes of the tasks in stage one—and to engage stakeholders, it's best to document the data so that it can be presented easily. To help, this handbook includes the "Community Network Concept Template."

The techno-economic tool is also useful for communicating the concept, but it's best if the meso shares this once the information has been tested with a few experienced professionals. The techno-economic tools cover a period from installation to the first 24 months of operation. This tool is designed to give the meso an indication of the financial viability potential of the community network. The "Community Network Concept Template" and the techno-economic tool present a business plan in a sense.

Note that different stakeholders will respond differently to different kinds of presentations. The meso should adapt the template to what works best with each stakeholder. For example, the template may work to approach potential partners, but a shorter, more graphic pitch presentation could be more useful for round tables and community meetings. The documents can also be developed in the language used by stakeholders.

Every community network will have a different process to undertake the assessment and to bridge the assessment to installation and operations. Pre-installation will have a cost, and these are not part of the template and tools, which focus on understanding operational viability.

Stage 2 – Stakeholder Engagement

This stage focuses on the meso engaging with community and external stakeholders to test and complete the baseline data. Refer back to the Key Considerations of the handbook on each section for more guidelines and suggestions.

The stakeholder engagement tasks follow the structure of the sections on stage one. That way it is possible to refer back to the key considerations between the two sections. However, when engaging with stakeholders it is possible that more than one section is discussed at once. The meso should plan the engagements (and the proposed tasks) in the most practical way possible. For example, all information that needs to be discussed, developed or verified by the community stakeholders can be discussed at once and not during separate conversations. It may also be necessary to engage with the same stakeholders several times before the information required is defined.

Furthermore, we recommend that special care is taken to manage expectations and to navigate local politics with sensitivity. micro champions should always guide the level of engagement in the community.

All stakeholder communications should be recorded! These recordings will support the meso in completing the final step of stage two.

The Community

> **Tasks**
>
> - **Map the community and create buy in.**
>
> - **Develop and document the community vision and guiding principles for the community network.**

1. **Map the community and create buy in:** Engaging the community must be done through a known channel, usually led by the local champion. Before attempting any engagement, it is important to have completed all stage one activities and have a good understanding of the community. The golden rule in engagement is to listen to people and to be open and willing to look critically at preconceptions of the community. The aim of engagement, from an assessment perspective, is to ensure that the assessment is based on grounded, realistic data. This stage focuses on mapping the community further collectively, which will both provide the necessary information but also allow people to co-create the network (this is carried

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throughout all the sections that follow). A lot of the data about under-serviced communities is not captured in the national census or official records. Moreover, in all communities the data that appears on records does not include key information such as where people like to congregate or people's daily rhythms. This kind of information is only gauged well with collective mapping exercises. Collective building of information is fundamental to creating buy in and ownership from people.

Take note that engaging communities must be done with an awareness that it can create expectations and catalyze division in a community. The champions (meso and micro) must assess the healthiest way to engage at this early stage. A balance must be struck between grounding community mapping and avoiding community conflicts. In some cases, community engagement may have to be focused on a few organizations or groups at this stage with the greater community engaged later in stage four.

a. **Guiding questions:** What are the main landmarks in the community (buildings, rivers, boundaries, roads, water points, power points)? Who has electrical power? Who makes up the community (organizations; institutions; age, gender, religious, or affiliation groups of people)? What disabilities do people have? What formal and informal governance structures are there? What do people do professionally and socially? What languages do people speak? What are the levels of traditional literacy (reading and writing)? What abilities, strengths, and skills do people in the community have?

b. **Suggested tools:** Community mapping is a science. It can be done following logic or using established tools. We have found that development practices are appropriate for community networks. A good example is the Rapid Rural Appraisal and Participatory Rural Appraisal and other participatory methodology[14]. Community meetings where people create a model representation of their community can also be used[15].

c. **Outputs:** Physical 3D models, graphic, and written documentation describing the community geographically, demographically, and in terms of the activities people undertake.

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14 This is a useful reference of participatory methodologies https://www.participatorymethods.org/

15 An example of a community network's collective mapping exercise in Argentina. https://www.youtube.com/watch?v=UN9JIHwmRmo

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2. **Develop and document the community vision and guiding principles for the community network:** This point needs to be undertaken together with sections two, four, five and six. What is particular to this section is co-defining an initial vision and principles from the community describing what the community network means to them. As with the meso activity in stage one to create the vision, parameters, and position, this is about drilling down to a level of understanding what the community expects and wants. This could be done through a request to respond to the meso vision. However, this may not lead to open discussion as people may want to avoid possible conflict from disagreeing with the meso. It is up to the meso and local champions to find the best way to elicit a real sense of what is true for the community. It is also important to document this, as this will be referred back to through all stages of the assessment and the community network development.

   a. **Guiding questions:** What does connectivity mean for us? How do we want it to contribute to our lives? Who do we feel has a right to access connectivity? Who has a priority to access connectivity?

   b. **Suggested tools:** Facilitated group discussions, surveys.

   c. **Outputs:** Written or audio-visual documentation of the micro initial vision and guiding principles.

The Function and Services of the Community Network

Tasks

- **Discuss & document the connectivity needs, aspirations of the community, and the existing user groups.**

- **Present, discuss, and document the potential services, function, and role that the community network could offer (including a list of priority services and connectivity areas).**

1. **Discuss and document the connectivity needs, aspirations of the community, and the existing user groups:** This requires the meso to gather information about what the existing connectivity scenario looks like in a community. Considering that people may or may not be able to state their needs and aspirations. A good starting point is to ask people to talk about their lives, their work, and the community rhythms and lives. It is just as important to identify the strengths of people and their community as it is to identify their needs.

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    a. **Guiding questions:** Who has access to Internet and digital devices? Who is digitally literate and how? What does your (a person, group, organization in the community) work entail?

    b. **Suggested tools:** Storytelling, participatory design tools.

    c. **Outputs:** A visual, audio, or written description of the community's telecommunication user profiles.

2. **Present, discuss, and document the potential services, functions, and roles that the community network could offer (including a list of priority services and connectivity areas):** The aim here is to discuss what the future could look like. This is very difficult for most people. It is important that in stage one, after going through all six sections, the meso has gathered information about the constraints and possibilities for the community network in the specific community. This stage of co-designing the services must be preceded by the meso sharing with the community grounded information—taking care that the information presented by the meso does not restrain the community from contributing their own information. The services, functions, and roles should speak to different users as per the identified user groups. This exercise is also a learning opportunity, where different services are discussed in terms of their pros and cons for users, for operability, and for sustainability. Another aspect of this exercise is that of determining which services have a greater priority than others and which areas or groups of users are prioritized (for example schools). This is critical to designing a phased roll out of services according to community priorities.

    a. **Guiding questions:** For each potential suggested service, function, and role, what would this service offer, who would use it, and who would not be able to use it? When would it be used? What would it be used for? In order of priority, what are the most urgent services and the most urgent users who need services?

    b. **Suggested tools:** Design thinking tools, dreaming, visualizing, storytelling, participatory design tools.

    c. **Outputs:** A visual, audio, or written description of the community's desired services, functions, and roles of the community network according to different user groups and in order of priority.

Telecommunications Frameworks for Service, Network, and Spectrum

Task

Engage the telecommunications sector stakeholders and other community networks aligned groups to test the research.

1. **Description:** This stage is about digging deeper and testing whether the research in stage one is thorough or there is more information that can be added. It is also about starting to create partnership and support within the telecommunications sector for community networks. If there are no enabling community networks regulations, or no way to work around the existing regulation, the meso will need to engage in a policy advocacy campaign and the community network development will either need to be postponed or considered as a test. There are times where test licenses, which allow operations for a limited period of time, can be accessed. But a test license is difficult to manage in terms of partner expectations, it is not a secure plan, and it can be difficult to raise people's support and funds. It is also worth remembering that community networks are an innovation and they are disruptive to a sector. Many people resist disruption, and there will be a need for careful stakeholder management from the meso. The best answers can come from unlikely places. It is worth developing relationships with policymakers, regulators, government, and other operators and educating them on community networks. People will be more willing to share information when they understand that the community network does not pose a threat. (More on partnerships in the following sections).

   In doing the research here, stages one and two may be repeated several times until the meso has a cohesive understanding of all the resources the community network can use.

   Note on the role of policy advocacy: is important to educate telecommunications regulators and policymakers to make them aware of the need for equitable access to digital and telecommunications resources and the digital divide; the opportunities that community networks offer to bridge the divide equitably; and the challenges community networks have in operating within the current policy and regulatory framework. Telecommunications advocacy experts and sector representative groups often undertake policy advocacy. Advocacy is more effective when it represents a larger group of people or organizations. Many countries in Africa have policies that speak to equitable access for all, however

few have enabling policies to make this a reality. Policy advocacy requires deep knowledge of the policy and regulatory frameworks and resources. As a community network, it would be best to find like-minded organizations to partner with and collectively develop material and submit it to the relevant authorities.

a. **Guiding questions:** What white papers and other core frameworks exist nationally and regionally that support universal access and digitalization? What would be your recommendations for legally connecting the unconnected in this community?

b. **Suggested tools:** Interviews, long-term trust-building and relationship-building strategies.

c. **Outputs:** Consolidated description of the enabling policy frameworks for community networks in the community's national (and regional if applicable) context, including process, timeline, cost, and compliance with technical and administrative requirements.

Network Technical Considerations

> **Task**
>
> **Test availability, costs, and conditions of the identified backhaul services and the initial network design, including technology.**

1. **Description:** This step builds on stage one. This exercise can be guided by the stake-holder mapping, the identified technology providers, and other recommendations high-lighted in stage one. This requires the meso to verify whether the assumed partners and service providers are in fact able to partner with the community network. While this is just a community network concept, it is important to engage with the potential part-ners and understand what the process is for creating the partnership, what they will re-quire to go ahead, and what the partnership entails. This could be to update quotes or understand how long it would take to commission the bandwidth breakout.

    This can also include asking for input from aligned peers and partners to discuss the implications of the backhaul and supplier choices.

    a. **Guiding questions:** Are the conditions offered by the supplier and the Pop reasonable? Is there anything that could be a risk to the community network? Is there anything in the network design that could be carried out in a different way?

    b. **Suggested tools:** Brainstorming, Delphi technique.

c. **Outputs:** Updated typology and design of the network; a visual map over the terrain (Google Earth); and a comprehensive list of all the equipment required to carry the signal from the PoP to the initial nodes and to deliver the desired services to the identified user groups.

Strategic and Sustainable Organizational Structures & Partnerships

Tasks

- **Present and discuss the tasks, skills, responsibilities, and organizational structure required for the community network.**

- **Co-determine the potential community network organization.**

- **Define the relationship between the meso, the micro, and other potential partners.**

1. **Present and discuss the tasks, skills, responsibilities, and organizational structure required for the community network.** Guided by the initial baseline, this task requires the meso to engage with the community to discuss the tasks, skills, capabilities, roles, and responsibilities required to operate the community network. This is an important grounding exercise, which complements the ideation process of defining the desired services, potential technology, etc. The objective of this exercise is to understanding what the community is able to take on in operating the community network. As discussed, it is possible that some communities have most of the skills or in some cases some skills can be developed through training. Understanding the available skills will determine the organizational set up, perhaps the network design, and the choice of technology as well as the cost and time required for the community to be ready to seed and operate.

   Another important aspect of this tool is discussing the possible ownership and governance structures. This must be based on the operational requirements and should lead to a first proposal describing the potential ownership structures and decision-making bodies required to comply with the various relevant frameworks and meet the community network's operational and social needs. Over and above aligning these potential structures to operational needs, it is also important to align them to the guiding principles. It is important to understand the power dynamics in the community and what the ownership and governance structure is likely to enable or block.

a. **Guiding questions:** For all the tasks, who are the people in the community who have the skills and capacity (time) to take on the work required to govern, manage, and operate the community network? Who else in the community should be part of operating the network? What are the skills that they need to develop? Who are the most respected people to own the community network?

b. **Suggested tools:** Scenario building, role playing.

c. **Outputs:** Document on the skills and capacity available in the community to seed and operate the community network, the people who should be involved, and the skills gap.

2. **Co-determine the potential community network organization.** This task aims to identify whether there is an existing organization (legal vehicle) that could take over the community network or if there is a need to establish a new organization. This discussion can only happen when the tasks, skills, responsibilities, and organizational processes have been discussed.

Using an existing organization can save time and resources. It can also be a way for people to adopt the community network earlier, but that is only if the exiting organization has a good reputation in the community and it is able to take on the work required to govern and operate the community network. At this stage it is not necessary to fully commit an organization, what we want is an understanding of whether there is a need to seed a new governance structure in the community or not. If there is already an organization, it is important to contrast its structures to the requirements discovered in the previous activity.

Whether there is an existing community organization or not, it is important to discuss the pros and cons of the possible legal vehicles that could be set up. This will be valuable to also analyze the appropriateness of the existing community organization. An important consideration when defining the potential vehicle is to understand if there is anyone with experience in managing this type of organization. Prior experience will bring down the costs and time required to seed the community network.

a. **Guiding questions:** How do the existing community organizations and potential legal vehicles align with the needs and guiding principles of the community network? Who are the people in the community who have experience running the different types of vehicles?

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    b. **Suggested tools:** Open discussions, participatory rating methodologies.

    c. **Outputs:** A revised list (based on stage one) of the potential types of legal vehicles (existing and new), including the ability of the community operate each one.

3. **Define the relationship between the meso, the micro, and other potential partners.** Based on the previous tasks, this topic aims to define the role of the meso, the micro, and other partners in terms of what work and accountability each organization (or level) should take in governing and operating the network. If the micro is able to fully develop all aspects of the community network, then the role of the meso and other partners will be minimal. If the micro is not able to manage all aspects, the option is either to deem that community not ready to deploy a community network or for the meso and other partners to take on some of the operational areas.

    In places where there are other micro community networks, the role of the meso or other partners might be to create efficiencies through managing shared services between various micros. This micro-meso partner set up will influence readiness in terms of financial viability.

    It is therefore important to discuss the roles that each could realistically play. When sharing roles in a community network, community determination should not be lost. This can be created though the legal or felt sense of ownership, decision-making mechanisms, transparency, benefits, or other means.

    While it is not necessary at this point of the assessment to develop agreements, it is important to discuss what these agreements would look like and what obligations and accountability mechanisms they would need to include.

    a. **Guiding questions:** What roles can the potential micro take on? What roles could the meso and other partners take on and how will this support the micro? What areas and tasks would the micro and meso be responsible and accountable for? What would accountability look like, and to whom would each organization be accountable? What kinds of agreements would exist between the organizations?

    b. **Suggested tools:** RACI tools[16], discussion based on standard partnership agreement templates.

    c. **Outputs:** Proposal of initial partnership structure between the meso, micro, and other key partners.

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16 RACI stands for Responsible, Accountable, Consulted, Informed and it one kind of tool that can be used to list either a person's or a company's roles and responsibilities with regards to their position is an organisation or partnership.

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Financial Sustainability

> **Task**
>
> **Discuss and test the costs and income assumptions for the community network.**

1. **Description:** This requires the meso to review all the costs and income and the list of unknowns. If the activities above, such as the technology consideration tasks, have provided new costs, then these must be inserted into the techno-economic tool. Lastly, the meso should engage peers, potential partners, and potential users in the community to confirm that the costs and income assumptions are correct. The tool also requires the meso to project how many users per services there are likely to have over the 24-month period. This information should be sourced through different people and from different angles. The most common error in business financial projections is that the income is inflated. Discussing possibilities with different people and comparing data with similar projects should yield more accurate projections. Find out if there are times in the day, week, month, or year where more people will use the services or where the same people will require more from the services.

   Determine the human resources costs, based on the list developed in the organizational structures section. Compare costs to the standard income in the community as well as the commercial and nonprofit standard income for similar jobs, ideally based on responsibility levels and delivery requirement or number of hours worked.

   Consider potential shared services (for example a tower shared by more than one community network). For shared services, only the corresponding part of the cost used by the community network concept being assessed should be included in the costs.

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a. **Guiding questions:** For income, how many users would use each of the proposed services and how often? How much could people afford to pay for each service? When and why would people spend more? What are the standard salaries for the determined roles, responsibilities, and skills levels—in the community and outside the community? For shared services, how much of the initial and ongoing costs pertain to the community network concept being calculated?

b. **Suggested tools:** Scenario building, open discussions.

c. **Outputs:** Updated services specifications and price, updated human resources costs, completed list of costs and income to install and operate the network.

Completing Stage Two – Stakeholder Engagement

In order to complete stage two, the meso team and champions are required to consolidate the information that was gathered through the stakeholder engagement, by updating the baseline in the concept template and the techno-economic tool.

In doing so it is important to check if there are any discrepancies between the information in stages one and two. Question any discrepancies. It may be that further research or engagements are necessary. Information may also change over time and the concept and techno-economic tools might need to be updated as new situations arise. Some guiding questions to check if all the information is grounded, include:

- Are there discrepancies in the information from sources within the community and out of it?

- Is there a bias in the information skewing the reality?

- What can we take as the most reasonable data from the community?

Stage Three – Analyzing the Concept

Stage three is the first step to understanding whether the community is ready. In this handbook, readiness is viewed through quantitative measures, primarily through the techno-economic tool and through qualitative measures, primarily through a reflection process. The first reflection process is undertaken at this stage, and focuses on the meso's internal reflection. The second reflection process is undertaken in stage four, with all key stakeholders.

The tasks in this stage are no longer broken down into the various sections followed in stages one and two. It is an analysis of the whole instead.

We suggest a number of tasks to support the analysis. All tasks have the same output: to update the community network readiness assessment concept and techno-economic tool.

Consider that in order to update the information in all aspects, there may be a few iterations of going through each of the points to check if anything is missing.

Quantitative Analysis – Finalize the Techno-Economic Calculation for Installation and Operation

Follow the instructions provided in the techno-economic tool to complete all of its necessary items. Ensure that the data is reviewed by people with experience in similar initiatives and that it considers the research and input from stakeholders gathered in stages one and two.

Once all the data is completed, the key analysis in the tool will show either:

1. "Your business case is sustainable." If so, continue to finalize the concept note.

2. "Your business case is not sustainable." If so, consider reviewing and restructuring the design of the network, services, and organizational structures. The restructuring must remain realistic! If, after the restructuring, the result is still "not sustainable" then the community network will be deemed not viable and therefore not ready.

Whether sustainable or not, it is important to remember the following:

• Adjusting the support financial streams: These are injections of funds over and above the income generated by the community network services. As mentioned in the key considerations, viability assessments undertaken by Zenzeleni networks showed that only community networks that had grant support to cover initial seeding CAPEX and installation costs were able to reach a potential level of sustainability.

- It is best to start small, gather traction and experience, and then grow. The 24-month projection will show sustainability for a community-sized initiative—in other words, a small or medium community network. This differs from a large commercial operator model that requires huge investment, loans, and a business model based on large profit margins. Large initiatives may have a break-even period of three to five years. It is strongly recommended that the community network concept is adapted in size and income streams to show self-sustainability by month 18 or 20 at the latest.

- From day one of a community network deployment, there are costs. If there are costs and no income, the community network will start accumulating losses, which will affect the sustainability. To avoid this, all deployment aspects must be completed before the installation starts. For example, if a community network has everything ready but the permit or license to operate, it will have to maintain the network assets, organizational processes, and the people to operate them while it waits for its license. If the concept is deemed "sustainable," we recommend developing a thorough project plan with clearly defined scope, time, and costs defined. This will help ensure that when it's time to install the assumptions and calculations of the community network can become reality—and not add more costs that were not calculated.

Qualitative Analysis - Update Concept Document

The community network concept must mirror the final techno-economic results. In order for the quantitative analysis to result in a "sustainable business case," the concept data may have to be readjusted. At this point the meso must update the concept document to reflect any new information.

Financial, technical, and legal quantitative adjustment can sometimes skew the social impact objectives. Sometimes these adjustments are able to ground the objectives and make them more attainable. Other times it diverts the objectives away from the intended impact and the initial objective is lost.

In the case of this community network concept these impact objectives would be in relation to how the community network addresses the physical, economic, or social digital divide. This would be reflected in:

1. The meso's guiding principles

2. The micro's vision and guiding principles

Once the quantitative analysis is finalized, and if the outcome is sustainable, revisit the principles and intended vision to ensure these are not lost with the adjustments.

This qualitative analysis requires both objective and subjective input. Meso and champions should undertake an evaluation session, facilitated by an experienced community network practitioner, where each aspect of the network is studied to see how it supports or goes against the guiding principles and vision. From this session the group might decide to refine their principles and vision—without abandoning the core impact.

Note that the initial principles may have also guided or attracted certain kinds of partners. Make sure to evaluate how these refinements could affect partnerships.

In terms of the readiness assessment, a positive qualitative analysis should include:

- The commitment from the meso and champions to take this forward under clear conditions. These conditions should be recorded in the concept document.

- The agreement to take this forward if the micro and other key partners are willing to go ahead. (This might already be known, but should be finalized in stage four.)

If these two elements are not present, even a viable community network concept could be deemed not ready.

Completing Stage Three – Analyze the Concept

In order to complete stage three, the meso team and champions need to document the outcome of their quantitative and qualitative assessment (through the updated concept and the techno-economic tool). In preparation for stage four, the outcomes should be ready to present to the community and key stakeholders.

Stage Four – Evaluating Readiness

Stage four consists of coordinating a multistakeholder meeting. It should be undertaken whether the quantitative and qualitative analysis is positive or negative. This meeting should include all the people and organizations necessary to take the community network to the next stage of development.

There are three main objectives of this meeting:

- To inform the main stakeholders of the outcome of the assessment in stage three. Everyone should be updated, whether the assessment is viable or not. This is a key part in developing trusted relationships.

- To test the core assumptions and viability of the final assessment. Several weeks or months may have passed between stage two, when the stakeholders were first approached, and this point of the assessment. Even though research in each stage should be undertaken rigorously, it is always possible the information might have shifted. The readjustments undertaken in stage three might also have shifted core assumptions.

- To determine if the community and key stakeholders are capable and willing to take the concept forward. Without these two elements, the community network concept cannot be deemed ready.

Testing Consensus and Viability

In terms of testing consensus and viability, the following assumptions will need to be checked:

1. Are the final proposed services, roles and functions, and priorities in line with stakeholder expectations?

2. Are the costs and income assumptions realistic?

3. Do the local authorities support the development of the community network?

Testing Capacity and Willingness

Over and above the consensus and viability, it is essential to understand whether there are people able to commit to taking the community network concept forward. To determine capacity and willingness, identify these elements:

1. Who are the people in the community who are able to take on the installation, operation, management, and ownership of the community network in alignment with the guiding principles? Do the identified people have the required skills and time to undertake their work? Alternatively, if the community does not have capacity to take on some of the roles, are there partners able to support the community in undertaking the necessary roles?

2. What are the expectations from each of the key stakeholder's expectations with regard to their work, the timing, and remuneration or other benefits?

Completing Stage Four – The Readiness Assessment

Incorporate the input from the multistakeholder meeting into the concept document and the techno-economic tool (if anything needs updating based on the meeting discussions).

The document should record the people present in the meeting, the consensus reached, as well as the capacity and willingness for commitments made.

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Next Steps

If the community is assessed as "not ready," it is worth identifying the elements that affected the lack of readiness. Although each community will present unique circumstances, each assessment can provide the meso with an invaluable archive of lessons learned to help assess other communities.

If the community is assessed as "ready," the process toward deployment needs to begin. The concept document and the techno-economic tools are useful tools to understand the work ahead. It also provides information to help approach partners and funders.

To start the deployment, the champions will need to do the following:

- Acquire the permission or licensing required to operate

- Set up the company

- Develop a detailed network and business design and acquire the equipment, software, and personnel to install and operate the network

- Secure any additional funds required

- Plan the installation

- Manage stakeholders and continue to build buy in and support in and out of the com-munity

This assessment is a first approximation. Next, an experienced project manager should develop a thorough project plan. The sustainability projection shown in the techno-economic tool depends on all elements of the community network being fully ready at the time of installation.

The collaboration within the community (at the micro level), between mesos, and with the macro stakeholders is a valuable asset. The community networks movement is evolving and growing stronger!

Community Network Readiness Assessment Concept (Template)

Instructions

This is the template that accompanies the community network readiness assessment, primarily to document the outcomes of the assessment. It is complemented by the three other documents:

1. The Community Network Readiness Assessment Knowledge Areas (theory)

2. The Community Network Readiness Assessment Workbook (practical)

3. The techno-economic tool.

This template is designed to support the meso organization in consolidating data gathered for the community being assessed. The data is gathered by studying the handbook and then completing the tasks for each stage described in the workbook.

The concept document can be used for each of the four stages of the assessment. It can be used as an internal tool for the meso to record information on the community. It can also be used to communicate the concept to other stakeholders. The meso should adapt the content and presentation to suit the audience and purpose of the document.

The titles provided have been designed to account for both the scenarios described above. They can be adapted as necessary. Under each title there is a reference to the types of information that can be described in each section. All the descriptions are outputs of the handbook and should be completed by undertaking the tasks—and not simply by following the notes.

Template

The digital divide in community X

(This should include a description of the digital divide in the community being assessed).

Introduction to Community Networks and the Meso Organization and Social Impact Objectives

This is necessary when using this tool to approach potential partners.

Introduction to the Readiness Assessment

This should include the scope, both what is in scope and what is out of scope, and the purpose of the assessment.

The Meso Guiding Principles

The meso guiding principles, or a charter, a vision, and mission. Examples: Any community network that the meso supports must offer services to all, without discrimination based on gender and social and economic status. The meso will not support a community network that does not share their financial position transparently.

The Micro Vision

This can be a written or audio-visual documentation of the micro initial vision and guiding principles.

The Champions

List the meso and micro champions and define each of their roles and responsibilities.

About The Community

Community geographic and demographic data: Geographical map and demographic information; population by age, gender, socioeconomic information, Internet penetration, etc.; Physical 3D models, graphic, and written documentation describing the community geographically, demographically, and in terms of the activities people undertake.

User groups: A list of the user groups and their user patterns. List of initial potential user groups, populations groups, number of schools, local businesses etc.

Community network services: A visual, audio, or written description of the community's desired services, function, and role of the community network according to different user groups and in order of priority.

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Network Design

A comprehensive technology comparison including costs, availability, operability, demonstrated performance in similar environments to the proposed community, and legal recognition in the country (standard type approval, frequency, etc.); an initial typology of the network; a visual map over the terrain (Google Earth); a comprehensive list of all the equipment required to carry the signal from the PoP to the initial nodes and deliver the desired services to the identified user groups; and the final proposed network design.

Regulatory Framework

Cohesive and consolidated description of the enabling policy frameworks and needs for community networks in the community's national (and regional if applicable) context, including process, timeline, cost and compliance, and technical and administrative requirements.

Strategic Organizational and Operational Structure

- A revised list (based on stage one) of the potential types of legal vehicles (existing and new), including the ability of the community operate each one. Document on the skills and capacity available in the community to seed and operate the community network, the people who should be involved, and the skills gap.

- A map of stakeholders showing the level of influence on the community network, the time, skills, and resources required to manage them, and whether they would ideally be managed by the meso or micro.

- An initial list of operations tasks and the skills and capacities required to perform them.

- Shortlist of the most favorable legal vehicles, including the compliance requirements and costs to set up and operate each of them.

- Proposal of initial partnership structure between the meso, micro, and other key partners.

Financial Viability

A list of current expenditure of the community network potential users. Initial listing of costs to install and operate the community network and a list of the costs that are not know at this point. Final services specifications and price, updated human resources costs, and completed list of costs and income to install and operate the network.

Outcomes Of The Meso Analysis

Summary of the:

- Quantitative analysis - Finalize the techno-economic calculation for installation and op-eration

- Qualitative analysis - Update concept document

- The commitment from the meso and champions to take this forward under clear condi-tions. These conditions should be recorded in the concept document.

Outcomes Of The Multistakeholder Meeting

Attendance register. Document the commitment from the meso, community (micro), and external (macro) partners. Document the people responsible for taking the community network concept forward.

Annex 2: Directory of Courses and Resources on Community Networks

African Summit on Community Networks Recordings

https://www.Internetsociety.org/events/summit-community-networks-africa/

Policy and Regulation

https://www.Internetsociety.org/wp-content/uploads/2019/03/InnovationsinSpectrumManagement_March2019-EN.pdf

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

https://policy.communitynetworks.group/country-profiles

Spectrum Occupancy

https://www.researchgate.net/publication/304277518_Spectrum_Occupancy_Measurements_and_Analysis_in_the_24-27_GHz_Band_in_Urban_and_Rural_Environments

https://www.springerprofessional.de/en/towards-affordable-broadband-communication-a-quantitative-assess/15909208