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## Abbreviations and acronyms

A4AI	Alliance for Affordable Internet
AfriSIG	African School on Internet Governance
ANE	Agencia Nacional de Espectro
ASEAN	Association of Southeast Asian Nations
ASORCOM	Alternative Solutions for Rural Communities
ATU	African Telecommunications Union
AUC	African Union Commission
AWS	Advanced Wireless Services
B4RN	Broadband for the Rural North
ccTLD	Country code top-level domain
CITEL	Inter-American Telecommunication Commission
CRASA	Communications Regulators Association of Southern Africa
CSTD	Commission on Science and Technology for Development
DC3	Dynamic Coalition on Community Connectivity
DFID	Department for International Development, United Kingdom
DTPS	Department of Telecommunications and Postal Services, South Africa
EACO	East African Communications Organisation
ECCAS	Economic Community of Central African States
ECOWAS	Economic Community of West African States
FGV	Fundação Getulio Vargas
GCRF	Global Challenges Research Fund
GISWatch	Global Information Society Watch
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GSMA	Global System for Mobile Communications Association
HERMES	High-frequency Emergency and Rural Multimedia Exchange System
ICASA	Independent Communications Authority of South Africa
ICT	Information and communication technology
IGAD	Intergovernmental Authority on Development
IGF	Internet Governance Forum
IIT	Indian Institute of Technology
ISOC	Internet Society
ITU	International Telecommunication Union
LCD	Least developed countries
LTE	Long-Term Evolution
OAS	Organization of American States
OFCOM	Office of Communications, United Kingdom
OTT	Over-the-top
PAPU	Pan African Postal Union
PCC.1	Permanent Consultative Committee I
RIA	Research ICT Africa
RCUK	Research Councils UK
SDGs	Sustainable Development Goals
Sida	Swedish International Development Cooperation Agency
TIC AC	Telecomunicaciones Indígenas Comunitarias
TVWS	TV white space
UCT	University of Cape Town
UFPA	Federal University of Pará, Brazil
UNHCR	United Nations High Commission for Refugees
USAASA	Universal Services and Access Authority of South Africa
USAID	United States Agency for International Development
UWC	University of Western Cape, South Africa
WATRA	West Africa Telecommunication Regulators Assembly
WSIS	World Summit on the Information Society
WTDC	World Telecommunication Development Conference

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# 1. Executive summary

APC requested support from IDRC's Networked Economies Program to provide initial funding for the first 18 months of a three-year multi-donor project focused on local access and community-based networks. The ultimate objectives of the project are to:

- Create an enabling environment for communities and local entrepreneurs to solve their own connectivity challenges.
- Ensure local connectivity initiatives are able to reach long-term sustainability, support development opportunities, and contribute to meeting the Sustainable Development Goals (SDGs) in relation to connectivity.

Historically, APC has contributed to the debate about access to telecommunications infrastructure from a rights-based approach, and this project aims at continuing this trajectory by streamlining this research on community-based networks in the organisation.

The project is divided into four activity areas, or work packages (WP) as they are called in this report: 1) In-depth case studies and analysis, 2) Open telecom data, policy and regulation, 3) Awareness raising and movement building, and 4) Support for existing and emerging initiatives.

The progress during the 18 months on all WPs has been consistent and all deliverables have been completed within the budget by the end of the project timeline. These are some highlights in each of the WPs:

- WP1. The production of a first document creating a body of knowledge of the factors that inhibit or encourage the existence, development and scaling of community networks in different contexts, including an understanding of the power relationships and dynamics in the framework of particular community networks and how they impact on women.
- WP2. Engagement with regional regulatory bodies via workshops in Africa (EACO and CRASA) and interviews in Latin America (leading to an official report presented at a CITELE meeting). Information led to the creation of a convincing narrative on the need for a more enabling regulatory framework. Open Telecom Data campaign conceptualised and started. Progress in engagements in global policy forums.
- WP3. Organisation of sessions/events about local access in major conferences (World Summit on the Information Society (WSIS) Forum, regional and global Internet Governance Forums (IGF), among others), and participation as speakers in more than 30 events. 13 editions of the monthly newsletter published, with 300 subscribers. Production of more than 35 news pieces, and contributions to longer seminal reports on the topic. The materials produced were accessed more than 1,000 times/month. The Global Information Society Watch (GISWatch) 2018 report, focused on Community Networks, was also produced and launched.
- WP4. Four new community networks deployed in Colombia and Brazil. Development of technology to backhaul GSM traffic and SMS over high frequency (HF) radio. Initial design of a distributed GSM architecture, the integration of satellite backhaul and explorations into 4G-LTE. All of the above brought an additional USD 750,000 into the technology development space for community networks from grants and awards.
- Additionally, support from project team members has been a key factor for AfChix to be selected as a finalist of the WomenConnect Challenge, with a USD 100,000 fund for building the capacity of African women to deploy and operate community networks. AfChix is just one example of the project's emphasis on contributing to capacity building of women. Five women have received grants to participate in conferences and other events, and GISWatch featured chapters written by women where possible. The columns in GenderIT.org are another example of this, including the challenges experienced by the project team while doing so. Finally, throughout the research field trips, while focusing on gender participation in the initiatives studied, a support network of women is starting to emerge.

In summary, during the period that this report covers, there has been an incredible ground-swell of groups looking to get more involved and taking inspiration from more mature networks to build their own access networks, as well as interest among donors to support them and among regulators to create the environment to enable them. In other words, these are still early days and there is a lot to be hopeful for. However, this increase in interest has not yet been matched by an increase in the financial and human resources available. This has the double negative effect of stretching those with resources to work on the topic too thin, as well as

discouraging those who compete for but do not receive the meagre additional resources available. Despite some success with other donors to fund additional work, the resources are far from enough to support the existing demand, in particular around research, where IDRC, one of the very few options to continue independent research on local access networks, is not able to continue its support. As shown through the outputs of this project, research like this is critical to understand the changes in external conditions as well as the socioeconomic benefits and implications of one of the few alternative models, especially for the global South, that holds promise for providing universal affordable access.

## 2. The research problem

According to the World Bank's World Development Report 2016: Digital Dividends [1], it is widely agreed that telecommunications services such as mobile telephony and broadband are prerequisites for human development in the 21st century. Without connectivity, individuals, communities and businesses face significant barriers for participating in the economic and social networks that comprise modern life. Universalising access and connectivity has therefore become a policy priority in many countries, and is a core pillar of the UN Sustainable Development Agenda [2]. Several of the proposed SDG targets address inequalities in access to the internet and information and communication technologies (ICTs), most significantly Target 5.b (enhance the use of enabling technologies, in particular ICT, to promote women's empowerment) and Target 9.c (significantly increase access to ICT and strive to provide universal and affordable access to internet in less developed countries [LDCs] by 2020).

Nevertheless, in spite of the massive increase in the number of people connected through mobile telephony and data networks in the past decade, over four billion people remain unconnected to the internet, including around a billion who do not have access to basic telephony services [3]. And for the majority of those that are connected, cost is considered the major barrier to meaningful use.

This digital gap is more acute for women, as it is estimated that 12% fewer women than men can benefit from internet access worldwide; this figure rises to 15% in developing countries and almost 29% in least developed countries according to statistics from the International Telecommunication Union (ITU) [4].

It has been widely assumed in the debate over how to achieve universal access to the internet that connecting the unconnected will largely take place through mobile broadband (3G and 4G/LTE). Most of the efforts to bring connectivity to the lowest income groups have assumed that by extending this business model, mobile broadband will eventually reach everyone, if necessary through government subsidies.<sup>1</sup> However, for many people in low-income groups and rural areas, this is not likely to be the case, as prevailing business models of existing network operators are not oriented toward the least profitable, low-income and rural services.

The GSMA estimates that at least 3,000 paying subscribers are necessary to justify the cost of installing a traditional GSM base station [5]. Having covered most of the population centres of this size, the uptake of traditional mobile broadband is now slowing considerably – the GSMA estimates that annual mobile revenue growth is expected to drop to 2% by 2020 [6]. Telecom economists such as Richard Thanki have concluded that to connect the next two billion people on the planet with the lowest income levels, broadband services will need to cost less than USD 4.50 per month [7].

In rural settings with dispersed populations, these revenue levels are inadequate to provide sufficient return on investment for a national mobile operator burdened by the fixed costs inherent in their technology and business models. In Brazil, for example, there are many locations where mobile base stations have been set up only to be abandoned by operators due to lack of sufficient revenue generation.

Due to growing awareness of the limitations in the national operator mobile broadband model, there is increasing interest in exploring alternative strategies for reaching the unconnected. Innovations in low-cost communication technology have created new possibilities for the development of affordable, locally owned and managed communication infrastructure. As a result, a growing number of communities and small, local and regional operators are using off-the-shelf low-cost commodity networking equipment to provide themselves and others with Wi-Fi, GSM and fibre connections. In some cases these networks are now connecting thousands of people and there are increasing indications that community-based infrastructure building models could provide a viable complement to existing national networks. For example, Rhizomatica

<sup>1</sup> Or through providing exclusivity incentives, such as in Argentina, which has just instituted a 15-year period in which national operators who build last mile broadband networks will not be forced to open them up to third parties, which acts as an incentive for incumbent telephony companies. For other examples see: <http://a4ai.org/affordability-report/report/2015/>

is helping remote communities in Mexico gain access to voice services for about USD 3.00/month [8] and a broadband connection could be supplied for little more.

But these innovative bottom-up initiatives are still relatively rare and may be dependent on a unique opportunity or special set of circumstances. They also generally face overwhelming regulatory and financial hurdles, and require technical, economic and regulatory support to meet scaling and sustainability challenges. These initiatives are mostly geographically dispersed and unconnected to one another. As a result they are hard pressed to exchange experiences and learning systematically, which makes facing these challenges even more difficult.

In addition, although there are positive signs emanating from local connectivity initiatives regarding their sustainability and social impact, very little has been documented with a sufficient level of detail to fully understand the dynamics and potential benefits. Even in the cases that are better understood, the metrics and language used may not be consistent with industry and government practice, making these projects difficult to take seriously as a viable option to help meet universal service objectives. Similarly, business strategies have developed in an ad-hoc way with few systematic procedures, constraining their ability to plan or to scale, and making it difficult for other networks to adapt them to their own contexts. Also, the availability of detailed quantitative business models which accommodate different technologies and demographics would allow the effectiveness of different strategies to be compared, and likely help existing and new networks ensure sustainability.

### **Research questions and overall objective**

It is under this digital access research problem that this project has the rationale to seek out answers for the following overall research questions around community-run local access models:

Question 1: Are local access infrastructure models a viable alternative for connecting the unconnected, and if so, what are the circumstances that make them successful?

Question 2: What are the additional benefits to the local community in terms of well-being, gender equity and social and economic development when local connectivity initiatives are locally owned and operated?

The ultimate objectives of the project are to:

- Create an enabling environment for communities and local entrepreneurs to solve their own connectivity challenges.
- Ensure local connectivity initiatives are able to reach long-term sustainability, support development opportunities, and contribute to meeting the Sustainable Development Goals (SDGs) in relation to connectivity.

The section that follows describes the efforts in answering these questions through this exploratory research project.

## **3. Progress towards milestones**

It is important to note that the proposal submitted to IDRC was initially conceptualised as a three-year multi-donor project. Thus, the real scope of the project reported here is the one contained in the budget, not in the proposal initially submitted to IDRC. This was clarified with the Program Officer in the first stages of the implementation.

### ***Personnel***

Grant funds were allocated to cover the following research team for the first 12 months, along with the publication of the Global Information Society Watch (GISWatch) report. The list includes the time originally designed to be dedicated to the project by each team member (FTE = full time equivalent):

#### **Local access project team – original budget**

Name	Title	Role	Duration
C. Rey-Moreno	APC staff	Overall project coordinator and WP3 coordinator	0.5 FTE until December 2017 and 0.8 FTE until July 2018

M. Jensen	APC staff	WP1 coordinator	0.6 FTE until July 2018
K. Diga	APC staff	Project and research support and GISWatch coordinator	1 FTE from 22 October 2017 until December 2018
S. Song	Consultant	WP2 coordinator	60 days until July 2018
P. Bloom	Consultant	WP4 coordinator	50 days until July 2018
N. Bidwell	Consultant	Gender and social impact adviser	130 days from 1 December 2017 until July 2018
E. Huerta	Consultant	Contributed to the project using a grant received by Rhizomatica from the Ford Foundation.	

The above personnel plan was decided based on the initial indications from IDRC that the grant would be renewed after the first year of the project. Before the end of 2017, the team received clarification from IDRC that this renewal would not happen until 2019, if at all.

The unexpected amount of information and data to be gathered, systematised, processed and analysed, led to the need to extend the contracts and to increase FTE. The revised personnel plan below encompasses the contract extensions.

#### Local Access project team – additional budget

Name		Role	Duration
C. Rey-Moreno	APC staff Zenzeleni	Overall project coordinator and WP3 coordinator	1.0 FTE from August until October 2018
M. Jensen	APC staff	WP1 coordinator	0.8 FTE from August until October 2018
S. Song	Consultant	WP2 coordinator	15 days from August to October 2018
P. Bloom	Consultant. Rhizomatica	WP4 coordinator	12.5 days from August to October 2018
N. Bidwell	Consultant University of Namibia	Gender and social impact adviser	32.5 days from August to October 2018
N. Aavriti	APC staff	Gender movement building support Need identified to have a more gender-focused component in WP3	0.2 FTE from April to July 2018 Involvement in the project continued as an in-kind contribution from APC.
P. Ramanujam and R. Bassi	APC staff members- parental leave cover	Additional support for the project and for GISWatch	1 August to 1 November 2018

All of the personnel changes above were made possible by mobilising external additional funds and in-kind contributions to the local access project from the different partners, as well as revising the current IDRC budget, particularly some “Items of Expenditure” inside the “Consultants” budget category.

In the implementation report below, the “Summary of Action Points” under each work package (WP) in the proposal is used as a point of departure, clarifying where necessary the action points (APs) or milestones that were not covered in the budget; some APs were not covered by the budget but the team managed to carry them out with support from other donors. In-kind contributions from project partners are also included.

Team project planning and coordination:

- Online pre-inception meeting on 7 to 9 August 2017.
- Physical inception meeting from 24 to 27 September 2017 in Oaxaca, Mexico.
- Team member attendance at the Internet Governance Forum in Geneva in December 2017 provided the opportunity for a follow-up physical meeting with reflection on the first six months of the project.
- Team member attendance at the Internet Governance Forum in Geneva in Paris in November 2018 provided the opportunity for a follow-up physical meeting with reflection on the entire project.
- The inception meeting in Quito in February 2019 of the Sida-funded project that allows continuation of this project provided another opportunity to discuss and refine the impact of this project.

- Online team teleconference meetings (using Zoom) every Wednesday since the beginning of the project, keeping minutes of the decisions and progress made.
- Regular use of a dedicated mailing list and a Slack channel provided by APC which were used to share information and make decisions between meetings.

## 3.1 WP1 – Research

Systematic research to date on understanding community networks has been limited. The purpose of this work package was to conduct exploratory research on community networks and the grassroots organisations who are developing them, and establish a starting point around the research question of their potential to address connectivity gaps and their other benefits which arise from these emergent community-led initiatives. This activity has been led by Mike Jensen as the research coordinator. Soon after the start of the project, following an extensive search for the right candidate, five candidates were shortlisted for interviews and Prof. Nicola J. Bidwell was selected, becoming part of the team as the gender and social impact adviser. This position attracted a lot of interest, with nearly 100 applicants. Both M. Jensen and Prof. Bidwell worked together on the site selection and site visits.

### AP1.1 Initial desk research, site selection, selection of local and international consultants

An initial methodology workshop was held in Cape Town from 20 to 22 November 2017 with team members as well as methodology experts. As a result of this workshop, it was agreed that the data analysis phase would comprise of two streams: a) systematising and synthesising the information gathered from the site visits to create a detailed picture of each initiative and the community in which it is situated, and b) building different economic and technical models of service provision, using data derived from the case studies and other desk research.

#### Methods for site selection

Data collection for the site selection took place initially through a desk analysis of initiatives that were already known, contact with others active in this area, such as the Internet Society (ISOC) and Fundação Getulio Vargas (FGV), and the existing literature. This research revealed potential community-based initiatives in 38 developing countries (Angola, Argentina, Benin, Brazil, Cambodia, Colombia, Costa Rica, Cuba, Democratic Republic of Congo, Georgia, Guatemala, Guinea-Bissau, Honduras, India, Indonesia, Kazakhstan, Kenya, Kyrgyzstan, Mali, Mexico, Myanmar, Nepal, Nicaragua, Nigeria, Pakistan, Peru, Philippines, Rwanda, Senegal, Seychelles, South Africa, Swaziland, Tanzania, Thailand, Uganda, Vanuatu, Zambia and Zimbabwe). In addition, as described in more detail in WP3 below, the global call for papers for the 2018 edition of GISWatch yielded accounts of local access initiatives which provided additional sources of information on potential candidates for the case studies.

The initiatives identified were then analysed for shortlisting based on the following criteria:

- An even spread of initiatives are chosen among the three global South regions (Latin America, Africa and Asia)
- A wide spread of connectivity technologies used (Wi-Fi, TVWS, GSM, fibre)
- A track record of a functional network for at least six months but ideally longer
- An assessment of the potential opportunities to gain access to in-depth data.

The last criterion had a strong weight in the initiatives selected for the research component, as there was a focus on being able to build on prior contact and relationships with the projects. The selection process resulted in the inclusion of three APC member organisations that support local networks being selected as part of the final set of 16 initiatives to be investigated. No fibre projects were identified and only one initiative had an element of TVWS use, due to regulatory restrictions on use of radio spectrum for this process.

Following the initial selection of the case study sites, contact was made with each initiative's project leader through email, face-to-face meetings (at a conference), text chat and phone. The initial contact explained the nature of the research project, the planned methodology, and requested permission and assistance to conduct field visits and research on the initiative.

All projects except for one agreed to participate in the research project. In only one case (Community GSM networks in Aurora, the Philippines initiated by the University of the Philippines) did it prove unsuccessful to request a visit. This decision was mutually agreed due to timing conflicts as a result of their own intensive baseline studies that were taking place at the proposed site at the time. Nevertheless, continued dialogue has taken place with the Philippines project partners, additional data was provided by the project, and a GISWatch chapter was requested from them and accepted.

### **Site selection**

The final community network initiatives selected for in-field site visits were:

1. Gram Marg (India)
2. AlterMundi (Argentina)
3. Rhizomatica (Mexico)
4. Taknet/Net2Home (Thailand)
5. Pamoja Net (Democratic Republic of Congo)
6. BOSCO (Uganda)
7. Zenzeleni Networks (South Africa)
8. Assadesa/RelawanTIK - 3 projects (Banda Aceh, Bandung and Pengarrit in Indonesia)
9. Coolab (Brazil)
10. Nupef (Brazil).

In addition, four further networks, in India (W4C), Indonesia (Ungu), Peru (Mayutel/Tucan3G) and the Philippines (VBTS Konekt Baranguay), were examined via desk research and direct contact with individuals associated with the initiatives.

### **Team selection**

The research team for each site visit was selected, comprising of Prof. Bidwell and M. Jensen as the international team members as well as local facilitators and translators who were selected by engaging with the representatives of the organisations visited.

## **AP1.2 10 x initial 4-day site visits with team of 2 international and 1 local members (1 project staff, 1 project consultant and 1 local consultant/translator/facilitator)**

The initial research plan was for two international team members to visit each of 10 sites for a total of four days at each site. This plan was modified based on methodological concerns that short visits would not render sufficient data in terms of social impact and gender participation. This resulted in the following revision of the research visits: M. Jensen conducted short visits to 12 sites in nine countries to assess the technical-economic sustainability of the initiatives and Prof. Bidwell conducted longer visits to prepare in-depth qualitative research at six sites. In addition, to help fill in gaps identified in the research, further cases were examined remotely through interviews and desk research, in Indonesia (Ungu), the Philippines (VBTS Konekt Baranguay) and Peru (Napo River/Tucan3G/Mayutel). In the case of the Peru project, M. Jensen went to Madrid, Spain (20-21 December 2018) to interview the project founders/managers based at EHAS/URJC.

The following field trips to community networks were completed:

1. Gram Marg (India) – M. Jensen and Prof. Bidwell (16-27 January 2018)
2. AlterMundi (Argentina) – M. Jensen and Prof. Bidwell (26 March-7 April 2018)
3. Rhizomatica (Mexico) – M. Jensen and Prof. Bidwell (9-21 April 2018)
4. Taknet (Thailand) – M. Jensen (4-7 June 2018)
5. Pamoja Net (Democratic Republic of Congo) – M. Jensen (20-26 June 2018)
6. BOSCO (Uganda) – M. Jensen and Prof. Bidwell (28 June-13 July 2018)
7. Zenzeleni Networks (South Africa) – Prof. Bidwell (6-18 August 2018)
8. Assadesa/RelawanTIK (Indonesia) – M. Jensen and Prof. Bidwell (3 sites, 16-27 October 2018)
9. Coolab and Nupef/Maranhao (related projects) (Brazil) – M. Jensen (2-7 December 2018).

In the six locations selected for Prof. Bidwell's research (Argentina, India, Indonesia, Mexico, South Africa and Uganda), over 300 people took part in interviews, observations and focus groups and by participating in

events. Over 90% of the interviews were with people inhabiting the rural areas in which community networks are deployed. In some countries most people interviewed lived in close proximity, in the same or nearby villages or very small rural towns. In Uganda and India, participants came from 6 and 8 villages, respectively, that were farther apart. To protect their identities, interviewees have been anonymised in the report to the extent that is possible.

In addition to the initiatives listed above, researchers further interacted with other community network practitioners to enrich the data collection. In particular, further one-on-one visits were conducted with:

- Redde Base and Radio Mulheres Pankaruru in Sao Paulo Brazil.
- Digital Empowerment Foundation in Delhi, India.

For more details about the data collection, please see AP1.3 and AP1.4 below.

### AP1.3 Initial data analysis and modelling

Final data analysis is completed and can be found in the field work report [9].

### AP1.4 Social impact assessment analysis

Final data analysis is completed and can be found in the field work report [9].

### AP1.5 10 x 6-month and 2-year assessments (remote)

These assessments are outside of the scope of the current IDRC funding.

### AP1.6 Final analysis and conclusions, inputs for GISWatch 2018 and toolkit production

Due to the depth and richness of the data collected, the field work report includes the results from the 10 community networks profiled in this work package [9].

Initial results from the field work appeared as thematic chapters in GISWatch [10, 11]. More information about GISWatch 2018 is provided in WP3, below.

The production of a toolkit providing options for business and technical modelling of local access initiatives based on the benchmarking from the case studies is outside the scope of the current IDRC funding.

## 3.2 WP2 – Open telecom data, policy and regulation

A combination of mass market manufacturing and technological innovation has conspired to make it possible for anyone to build meaningful affordable internet infrastructure. However, almost all policies and regulations for telecommunications are designed for large, for-profit corporations. There is a need to better understand current regulations which either enhance or deter the potential of community networks and other small network operators to deliver affordable access. This policy work package was led by Steve Song, in collaboration with Erick Huerta and other staff from Rhizomatica, including Karla Velasco and Rodrigo Huerta. Staff from APC, including Anriette Esterhuysen, Deborah Brown and Carlos Rey-Moreno, have also collaborated in the policy research work. This WP has benefited from additional funding from other sources. Steve Song was awarded a part-time fellowship from Mozilla, and Rhizomatica's work was co-funded by the Ford Foundation. Additionally, ISOC contributed funding to the "Innovations on Spectrum Management" report (see AP2.3), and helped to cover the cost of participation in some of the events listed below. All resources have been pooled together to maximise the impact in the policy and regulatory area work. Below is a summary of the activities conducted in each of the APs included in the proposal.

## AP2.1 Research in: a) good regulatory and policy practices that promote access in underserved areas as well as b) critical regulatory barriers that hold it back

Initially this action was going to take the form of a book sprint to develop a one-week training course for regulators. To this end, an organisation specialised in its facilitation was contacted, a price negotiated, sponsors contacted, and an invitation to a short list of potential participants drafted. However, it soon became evident that it would be very difficult to have all these experts together for a week due to their busy and conflicting schedules.

The revised plan for course development consisted of a series of expert interviews in the UK, South Africa and the US, to be followed by a writing retreat with Steve Song and Peter Bloom and Erick Huerta of Rhizomatica. Interviewees included:

- Prof. William Webb, Cambridge University, formerly from the Office of Communications (OFCOM), UK, on spectrum regulation.
- James Walker, Zenzu, on fibre networks.
- Pasquale Cataldi, head of Wireless Technology, Nominet, on dynamic spectrum geolocation databases and emerging priority frequency bands.
- Alison Gillwald, executive director, Research ICT Africa, on regulating for inclusion.
- Dominic Cull, Ellipsis, on South Africa regulatory hurdles and opportunities.
- Michael Calabrese, director of the Wireless Future Project, New America Foundation.
- Jerome Bezzina, senior regulatory economist, World Bank.

The interviews in the UK were done in conjunction with Russell Southwood from Balancing Act, who in turn provided a report about the interviews that was also used as part of the research.

The retreat was held for a week in April 2018 in Toronto and resulted in a solid framework for the course. This course formed the basis for workshops with regional regulatory authorities described in AP2.9 below.

In addition, the team participated in 15 events [12-26], either as attendees or speakers, to further their insights on the topic.

## AP2.2 Regulator and policy maker survey and interviews

Activities in this action point have been framed within the decision CCP.I/DEC. 274 (XXXI-17) from CITELE which resolved to send member states a survey about “The implementation of Recommendation 19 from ITU-D for the Americas Region”. Karla Velasco was appointed in charge of carrying out this task.

This project has supported Ms. Velasco and her team to attend three CITELE Permanent Consultative Committee 1 (PCC1) meetings [15], and conduct regulator interviews at the same meetings. The results of the survey were presented at the meeting in Washington DC in August 2018 [27]. More details can be found elsewhere [28].

In addition to administering the survey, several informal interviews have been conducted with members of country delegations in order to assess the opportunities for the implementation of ITU Recommendation 19 in their countries. Some delegations showed their interest in developing pilot projects within the framework of the Memorandum of Understanding signed between ISOC and CITELE to explore further how these initiatives fit in their respective policy and regulatory frameworks [29].

## AP2.3 Production of model regulations and a local licensing framework/toolkit

The final creation of model regulations and a local licensing framework/toolkit was outside of the scope of this initial round of IDRC funding. The following steps towards this goal have been carried out:

- Worked with Zenzeleni and the University of the Western Cape to develop submissions to the South African government public consultations on proposed changes to the Electronic Communications Bill [30] and the Wireless Open Access Network [31]. Additionally, contributed to a policy brief outlining

the policy and regulatory steps that South Africa must take to have a policy and regulatory framework more conducive for community networks [32].

- Proposed and drafted a submission to the Canadian government on TV white spaces on behalf of ISOC and APC [33].
- Wrote the paper titled “Innovations in Spectrum Management”, co-branded by ISOC, Mozilla and APC [34]. It includes a detailed survey of the current status of spectrum management in frequency bands used to provide connectivity in a selection of representative countries around the world (Argentina, Brazil, Canada, India, Mexico, South Africa and the United States) and outlines the basis for an evolving spectrum management ecosystem where complementary approaches can be used to remove barriers and provide support to community networks and small operators.

## AP2.4 Economics of spectrum research

This research is outside of the scope of the current IDRC funding.

## AP2.5 Development of open telecom data standards for fibre, towers and spectrum

The goal of this action point was to establish standards for the open sharing of data regarding telecommunications infrastructure. Towards this end, standards for fibre and spectrum were developed and published for feedback.

- A standard for capturing data on terrestrial fibre optic networks was developed and shared for feedback with a variety of stakeholders [35].
- Data structures for spectrum licensing, operator identity and ownership were developed [36]. These structures were then populated with data on spectrum assignments from African communication regulators.

## AP2.6 Development of online open telecom data resource for spectrum

Little work has been done to visualise in a comparative manner the assignment of international mobile telephony spectrum, revealing commonalities and gaps across countries. This action point sought to develop a visually appealing tool to understand spectrum assignments across African countries.

- Developed prototype spectrum assignment visualisation tool and populated it with data from 17 African countries, which are now publicly available [37].
- In addition, a tool to easily update the complex spectrum data structures was developed by former CSIR researcher David Johnson [38].

## AP2.7 Design of local campaign materials to advocate for open telecom data

The goal of this action point was to develop public awareness of the need for transparency in the telecom sector.

- Developed several presentations on open telecom data [39].
- Developed framing/discussion document intended to underpin the development of an organisational coalition around open telecom data [40].
- Wrote a chapter for forthcoming IDRC-funded publication on open data [41].
- Captured examples of good practice in transparency in the telecom sector through a series of examples listed on the Open Telecom Data wiki [42].
- Worked with Research ICT Africa to bid on a contract with the British High Commission in South Africa to profile the state of open telecom data in South Africa. Sufficiently socialised the concept of open data in the telecom sector to have the British High Commission issue a tender for research on it.
- Commissioned ARTICLE 19 East Africa to profile open telecom data in four East African countries by soliciting public information on telecom infrastructure through the use of freedom of access to

information requests in Ethiopia, Kenya, Rwanda and Uganda. Work in progress, outputs are pending.

## AP2.8 Implementation of open telecom data campaign with APC partners

Advocating for and promoting open telecom data has become an integral part of the policy advocacy by the project team and APC more broadly. As a result, the issue of open telecom data has been incorporated in a number of policy submissions [30, 32] and the materials developed have been presented at a number of events [22, 24, 25], used in interactions with civil society and governments at other events [19, 43], and used in a dedicated session to present them at rp:Accra [44]. Finally, there is a section devoted to open telecom data in the paper on “Innovations in Spectrum Management” [34].

Additionally, targeted meetings with civil society organisations have taken place to form a broader coalition on open telecom data. This includes:

- Online presentation to the Web Foundation team including both Web Foundation and Alliance for Affordable Internet (A4AI) staff (September 2017).
- Meeting with Access Now, A4AI and Public Knowledge in Washington, DC, 23 and 24 April, 2018.
- Meeting with different stakeholder organisations, including the World Bank, Open Knowledge Foundation, Open Streetmaps, the French regulator (ARCEP), Mozilla, Facebook, UC Berkeley, Internet Sans Frontières, APC and Rhizomatica, at the Mozilla premises in Paris during the 2018 Internet Governance Forum (November 2018) [45].
- Presentation on open telecom data at the A4AI broadband stakeholder meeting in Lagos [39].

Finally, a mailing list has been created to keep people updated on the evolution of the campaign [46].

## AP2.9 Up to 6 regional workshops with regulators to discuss local telco regulations and open data

In the scope of the current project, only one of these regional workshops was expected to take place. A one-day workshop was organised on 17 May 2018 in Mauritius, co-located during the Universal Service and Access Committee Meeting of the Communications Regulatory Authority of Southern Africa (CRASA). This workshop discussed the challenges facing communication regulators in terms of rapidly changing technologies and the need to develop regulations that empower service providers in sparsely populated, economically poor regions. It introduced regulators to innovations in low-cost rural service delivery from around the world and invited participants to discuss their relevance in the region. The opportunity of co-location reduced the cost of this workshop, opening the possibility of organising a second workshop during the time frame of the project, and a two-day workshop (24-25 September 2018) was co-located with the East African Communications Organisation (EACO) [25]. The EACO workshop followed the same lines as the CRASA event but issues were explored in more depth given the longer time frame.

The workshop with CRASA led to an invitation to present at another CRASA event, this time of their Electronic Communications Working Group. The invitation was to introduce the concept of a regional geo-location database for TV white space (TVWS) which might serve all countries in the SADC region. The event took place in Lilongwe, Malawi on 17-19 July 2018.

## AP2.10 Introducing favourable text in global policy resolutions

This action point was not initially included in the “summary of actions” in the proposal, but as the project evolved, it was considered worth investing in. In particular, these interventions have taken place at six different policy processes:

- World Telecommunication Development Conference (WTDC):
  - Workshop with civil society pre-WTDC to get resolutions passed at WTDC [47].
  - Participation in WTDC. Global resolution proposed, not passed. Progress with the process described in AP2.2.

- Commission on Science and Technology for Development (CSTD):
  - Participation in the High-Level Panel at the World Summit on the Information Society (WSIS) Forum 2018 [48].
  - Presentation at the Commission [49].
  - Managed to introduce some wording in the WSIS resolution [50].
- ITU Plenipotentiary Conference 2018 (PP18):
  - Work with Rhizomatica and ISOC, as well as other civil society organisations, to pass resolutions approved at CITELE, thanks in part to team's participation in PCC.I meetings. Despite intense lobbying work, the resolutions were not passed at PP18.
- Structures within PCC.I. The names and objectives of the Rapporteuships were modified during one of the PCC.I meetings attended. As part of this, we were successful in adding a specific term of reference on community networks in Rapporteuship 1.4., which is the Rapporteuship on "Broadband, universal access, digital inclusion and gender equality". The term of reference states as follows: "b) Encourage the study, creation, and strengthening of public policies, regulatory frameworks and incentives conducive to new service mechanisms in non-served or under-served areas, particularly in rural areas involving the participation of indigenous peoples, other peoples, community operators, non-profit operators, and small operators."
- Engagement with the African Union and other African policy and regulatory organisations. At the invitation of ISOC, APC contributed with a presentation on "Policy opportunities for community network development in Africa" in a two-day workshop with the African Union Commission (AUC) on 19-20 June 2018 in Addis Ababa, Ethiopia. Apart from the ICT unit of the AUC, there were representatives from regional economic areas (the Economic Community of West African States (ECOWAS), the Economic Community of Central African States (ECCAS) and the Intergovernmental Authority on Development (IGAD)), regional regulatory authorities (WATRA, CRASA, EACO, ARTAC), as well as other continental-wide organisations such as the Pan African Postal Union (PAPU) and the African Telecommunications Union (ATU) [22].
- Contribution to other international policy process to include wording favourable to community networks, including IGF intersectional work [51], the UN High-level Panel on Digital Cooperation [52], awareness among UN rapporteurs [53], as well as, unsuccessfully, to the UN ICT4D resolution.

### 3.3 WP3 – Movement building

This work package was led by Carlos Rey-Moreno, but it is a result of a collective effort of the whole team, with important inputs from the APC communications team. Kathleen Diga coordinated the GISWatch 2018 edition. In addition to the travel funds offered from the project for this activity, team members have received several invitations to participate in events and conferences. APC has also contributed to the travel fund for its members to promote community networks. Most importantly, a memorandum of understanding signed with ISOC for close collaboration on movement building around community networks has contributed considerably to the accomplishment of the action points in this work package. The WP was structured around 8 action points, i.e. milestones; hard evidence of progress in each of them is included below.

#### AP3.1 Assessment, assemblage and production of relevant materials

One of strategies to enhance movement building and awareness raising around community networks was to create appropriate content that could be shared and used to enhance visibility of community networks. The main activity in this action point has been the creation of a monthly newsletter, which now has almost 300 subscribers. Every month there is a crowd-sourced effort from the APC team to share news related to community networks and local access initiatives. The different sources scanned for newsletter content include relevant mailing lists, specialised publications, Twitter feeds and tags, and alerts in different media platforms. With the information selected, a new edition is shared every month. A repository of all the newsletters since December 2017 is available [54] and 13 newsletters have been completed to date.<sup>2</sup>

A considerable component of the newsletter content has been produced within the context of this project. It has been mainly along the following lines:

- Women's participation and reflections around gender and community networks. In particular, this was done through collaboration with the APC Women's Rights Programme initiative GenderIT, resulting in the publication of three "stand-alone" pieces [55-57], four GenderIT columns [58-61], and two GenderIT articles with women who were GISWatch chapter authors [62, 63]. Additionally, when

<sup>2</sup> The monthly newsletter has continued to be produced from January 2019 onwards with the additional funding received from Sida.

support to participate in conferences or events related to community networks was provided by the IDRC project or by APC's own funds, blog posts were written by the women recipients to share their experience [57,64-67].

- A series of articles and interviews on the history and importance of spectrum regulation. Initially, an existing article exploring the history of "free spectrum" was updated and translated from Portuguese [68]. Then, beginning in November 2018, APCNews released a six-part interview series titled "What's new on the spectrum", featuring experts discussing relevant issues relating to spectrum regulation and the impact of spectrum on community networks around the world [69-74]. The interview series was aimed at engaging the general public in the conversation by framing technical discussions in more accessible, "beginner's level" terms, through a partnership between project team members and APCNews.
- APCNews has produced at least 17 articles on the APC.org platform reporting on news and events related to community networks that other media were not capturing [50, 75-90]. When relevant, the APC communications team has commissioned pieces from experts on the different aspects of the topic [91-93].
- Members of the project team, collaborating with other authors and organisations, have also produced seminal materials to further the movement around community networks in Latin America [94], and Innovations in Spectrum Management [34].

Finally, the lack of capacity-building materials on the economic sustainability of community network initiatives was identified as a priority. The first elements of a training course on the topic based on the Business Model Canvas for Social Enterprises was developed and used in the training sessions of the Third Summit of Community Networks in Africa [95] and the African Summit on Women and Girls in Technology [96].

## AP3.2 Identification of and outreach to potential participants (including the Friends of the Project meeting)

An ongoing engagement with organisations and individuals that showed potential to implement or support community networks and local access initiatives has taken place. In addition to the activities already highlighted in WP1 and WP2 that led to direct engagement with these stakeholders, the following activities have been carried out:

- Members of the team have been invited to be reviewers of different competitive calls regarding community networks and local access initiatives [97-103].
- Organising sessions at different internet-related events, including sessions at the World Summit on the Information Society Forum [104], and the Global [105] and Regional Internet Governance Forums [17, 106], among others [18, 24, 25, 43, 96, 107]; as well as participating in sessions organised by others, in the same events [44, 108-110] and many other events [12-16, 19-23, 26, 111-131].
- Conference calls or face-to-face meetings/workshops with particular stakeholders, among others: collaborations/conversations with the Internet Society, AfChix, Mozilla, Research ICT Africa, ARTICLE 19, Internet Without Borders, University of Washington, International Federation of Library Associations and Institutions (IFLA), University of Cape Town, University of the Western Cape, Microsoft Research India, Alliance for Affordable Internet, Analysys Mason, United Nations High Commission for Refugees (UNHCR), United States Agency for International Development (USAID), Seed Alliance, World Economic Forum's "Internet for All", Ammbr, Partnership for Public Access, Web Foundation, Right2Know Campaign, Independent Communications Authority of South Africa (ICASA), Universal Services and Access Authority of South Africa (USAASA) and Intelicap, as well as Nokia, Parallel Wireless, Baicells, and other manufacturers of 3G/4G hardware.
- Engagement with potential donors including Swedish International Development Cooperation Agency (Sida), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Department for International Development (DFID), Global Challenges Research Fund (GCRF), Research Councils UK (RCUK) Collective Fund, USAID (via the WomenConnect fund), ITU Americas Regional Office and Ford Foundation, to name a few.

### **AP3.3 One 3-day regional workshop in Africa with 25 participants, for civil society groups and community-based entrepreneurs wishing to build community networks**

This action point refers to the Third Summit on Community Networks in Africa. APC has been involved since the beginning through being a member of the Program Committee, and assisted in other tasks related to holding the event that took place on 2-7 September 2018 in the Eastern Cape, South Africa. The event, finally co-organised by ISOC, APC and Zenzeleni Networks, gathered more than 100 people from 20 different countries [82, 95].

### **AP3.4 Facilitation support for peer exchange**

This activity falls outside the scope of the current funded project. However, APC has contributed to facilitating some initial exchanges among community network practitioners by sponsoring their participation in events related to the topic [57, 64-67]. In addition, and as part of the Third Summit on Community Networks in Africa, which was hosted by a community network and APC member, Zenzeleni Networks, APC facilitated funding for 20 practitioners from South Africa to attend the event [82, 95].

### **AP3.5 Coordination and outreach for managing the Local Access Support Consortium including hosting a face-to-face meeting of the consortium at an existing global event (IGF 2017)**

The initial idea of a face-to-face meeting at the IGF 2017 evolved into a networking event which had the purpose of allowing different stakeholders to interact with each other. The main reason for this change to a networking event was related not only to the lack of initial evidence around community networks at the time, but also the need for stakeholders to get to know each other better.

The networking event at IGF 2017 took place on 19 December in Geneva, Switzerland. Following a collaborative stakeholder mapping exercise using the Outcome Mapping methodology being followed by the project, 88 participants were invited to the networking event. In the end, the event was attended by 64 participants (29 women and 35 men) from 35 organisations including donors such as Sida, internet registries such as APNIC and LACNIC, educational institutions such as American University and University of Washington, private sector organisations such as Mozilla and Microsoft, and a wide range of civil society organisations including ISOC, AlterMundi (LAC), Pangea (Europe), Research ICT Africa, Alternatives (North America) and EMPOWER (Asia). At each table, questions were prepared to guide the conversations, and participants were asked to rotate to different tables in order to meet others in the space. Overall, the well-attended event set the basis for continuous dialogue during the year of 2018 and assisted in recruiting authors for the GISWatch 2018 report, as well as increasing the readership for our monthly newsletter.

Additionally, after the IGF 2018 in Paris, a one-day community networks event took place on 15 November 2018. This event created the opportunity for community networks and partners to reflect on and recap the community network work of 2018 and discuss the way forward for 2019, especially exploring any possible synergies. At the event, the project team was asked to organise the afternoon component, where community network practitioners were able to hear from three main groups — ISOC, the ISOC Special Interest Group on Community Networks (CNSIG) and the project team — about what had been accomplished in 2018, and engage in further discussion on the topics of the ISOC global summit, policy and regulation and inclusion, as well as helping to lay out some salient points for 2019.

### **AP.3. 6 Travel support for participation of project staff in regional and global events**

Travel support for staff, consultants and other project partners to participate in the events listed in AP3.1 and AP3.2 has been provided.

## AP3.7 Travel support for project staff meetings

The project inception meeting took place from 25 to 28 September 2017 in Oaxaca, Mexico. Consultants involved in the event (S. Song, P. Bloom, E. Huerta and N. Bidwell) as well as APC staff involved directly in the project (M. Jensen and C. Rey-Moreno), together with APC management (C. García Ramilo, V. Betancourt) and representatives from other APC programmes (E. Smith, Women's Rights Programme) met to kick off the project.

In addition, S. Song designed and facilitated the Outcome Mapping inception workshop, which set the basis for the ongoing Outcome Mapping data capture process.

## AP3.8 Publication of GISWatch 2018

The Global Information Society Watch (GISWatch) 2018 report was a research opportunity to map out community networks around the world, and particularly highlight the initiatives found in the global South. The report comprised a total of 43 country chapters and eight thematic chapters were published. The country report highlighted the heterogeneity of existing community networks self-identified by civil society organisations, and showed that mechanisms for community ownership are what truly define this bottom-up grassroots work. The policy-related thematic chapters made a compelling case for the need to lower the barriers of entry so that isolated, rural community networks can also participate in the use and production of outputs as a result of the internet.

The 2018 edition of GISWatch was launched during the lunch break (13:30-15:00) on 13 November at IGF 2018 in Paris. A video [132], a summary [133] and a press kit [134] were created to maximise the communication reach of the launch.

The final version of GISWatch 2018 is available for free download as a PDF [135] and is also available in print through Amazon. The following activities took place to support this milestone:

- An external advisory group and the APC operational team for this edition were convened.
- Countries with community networks were mapped out and potential authors of country reports were identified and contacted.
- A call for proposals was published, the selection of proposals was conducted, the terms of reference (contracts) for authors were developed, and an overall strategy for the production and dissemination of the report was developed and implemented.

## 3.4 WP4 – Support for existing and emerging initiatives

The Pathfinder work package focused on understanding how innovations in technology, policy and regulation, and sustainability models can be incorporated by community networks, making them stronger, more resilient and better able to stay relevant over time. This work package was led by Peter Bloom, with technical support from Keith Whyte. Additional co-funding to complete the activities listed below have come from different sources, including in-kind funds from Rhizomatica, the APC subgranting programme, Mozilla Foundation, and ISOC.

### AP4.1 Research and analysis of the relevance of technological trends and possibilities with respect to local connectivity initiatives

There are many interesting things happening in the field of wireless technology, making it possible to build better-functioning networks more affordably. Unfortunately, many of these advancements happen inside a telecoms sector that is highly proprietary and not focused on rural connectivity or concerned with lowering prices to consumers or to systems integrators. This aspect of the Pathfinder work package was about prying some of these technological developments loose from the telco sector and seeing how they could be useful for community networks. This meant researching and analysing trends and technologies and working with open-source developers to make it all tangible.

- Analysis of TVWS technology options for the backhaul of the GSM deployment in Colombia (more below).

- Analysis of more bandwidth-conscious technologies such as codecs, compression, and network architectures to use HF and satellite. These were compiled and included in an application to the Mozilla/WINS competition. Rhizomatica came second in the first round of the Mozilla “Off-the-Grid Internet Challenge” [136], with their HERMES (High-frequency Emergency and Rural Multimedia Exchange System) project [137, 138]. That secured funding to prototype an autonomous network infrastructure that enables local calling, SMS and basic over-the-top (OTT) messaging, all via equipment that can fit inside two suitcases, using GSM, software-defined radio and high-frequency radio technologies [139]. The prototype was presented at the Demo Day in August to compete for the final prize, and was eventually selected as the grand prize winner [140].
- Initial design, in collaboration with Sysmocom, of distributed GSM routing architecture for decentralised networks [141].
- Development work on open-source Osmocom Core Network and Data components. This led to a successful request for funding from the Mozilla Foundation to build out the data components of the 2G network software stack as well as the distributed GSM component (see above) [142].
- Development work on open-source community cellular software (Rhizomatica) [143].
- Conversations with mobile network vendors, including Parallel Wireless, BaiCells, BBT, Cognition Systems, SES, Hengxin Technology, Hilinks and Fairwaves, during the year, starting at the Mobile World Congress and following with conversations with Kuha/Nokia through ISOC, and with AT&T and Huawei in Mexico. As a result, a short guide to choose low-cost BTS for community cellular has been created [144]. Additionally, Nokia/Kuha donated two 4G base-stations and ISOC funded the purchase of a BaiCells base-station to begin field testing in 2019.
- Attended OsmoDevCom developer conference in April 2018 and presented about community networks [145]. This led to Sysmocom donating a developer team each month to work on the needs of community cellular networks.

## AP4.2 Research and analysis on innovative and successful business and organisational models that can lead to sustainability

In addition to technology, innovation and creative thinking are required to create and sustain community networks. Part of this problem is about the capital requirements of building networks. In other words, how to get the right amount of money to community networks so that they can start and grow. This also implies that networks need to, at least eventually, address how they will become financially and organisationally sustainable. These are not easy to address, as many community networks are volunteer efforts or lack strong internal organisational processes and policies.

- Worked with partner Colnodo in Colombia to define organisational possibilities for an indigenous/Afro-Colombian/peasant association. This eventually led to the installation of a new community network (see below).
- Initial research into blockchain/ICO-related mechanisms for community networks.
- Design of Telecomunicaciones Indígenas Comunitarias (TIC AC) expansion and sustainability model in conjunction with TIC AC staff at 2018 planning meeting in January and then at Sprint Design Methodology workshop in Buenos Aires. This led to TIC AC receiving funding from Google.org and UBS bank through a prize called Visionaris [146, 147].
- Multiple conversations with banks and donors, including Global Fund for Innovation, AlphaMundi, CAF, IFC, Commonwealth Development Corporation, UNHCR, UBS, WEF, World Bank and IFC, around long-term, large-scale funding for community networks. Although confirmation is forthcoming, both ISOC and CAF seem like they will commit substantial funding for community networks starting in 2019.
- In-depth research about the common-pool resource model used by guifi.net and Broadband for the Rural North (B4RN), with a workshop conducted with Zenzeleni Networks to explore its adaptation to the rural South African context [148].

## AP4.3 Research and analysis concerning the benefits and challenges of hybrid connectivity models, as in the direct interrelation among different technologies at the local level

Due to the nature of community networks (i.e. small size, lack of capital, etc.) it is necessary to be creative with how different technologies are partnered together to actually get service to users. Any network has to

figure out how to provide service locally to users, but also connect back to other networks as well. This section of the work package ended up focusing primarily on the latter — what is referred to as backhaul.

- Initial analysis of TVWS technology options, as well as accessing national fibre backbone for GSM deployment in Colombia (three technologies involved).
- See above in AP4.1 regarding new backhaul strategies. Specifically, how GSM can be backhauled over satellite using a Network-in-the-Box architecture and how OTT services, SMS and calls might be provided over HF or shortwave radio.
- Incorporation of satellite backhaul for voice networks into TIC AC network in Mexico [149].

## AP4.4 Research and analysis on the policy and regulatory implications of new network forms (technologies and business models)

In most cases, community networks need to confront policy and regulatory challenges that hinder their growth by limiting the scope of technology they can use, their access to financing and their ability to exist alongside traditional networks. This part of the work package was focused on targeted advocacy efforts, both internationally and nationally, to help create a more friendly policy and regulatory environment for community networks.

- Participated in the World Telecommunication Development Conference and advised the Mexican delegation and CITELE with regard to community cellular and community networks.
- Primary research in conjunction with Erick Huerta around using excess government satellite capacity for TIC AC expansion model. This resulted in 8 MHz of unused government satellite capacity being donated, with a commercial value of approximately USD 30,000 per month.
- Initial research into shortwave regulation internationally and within USA, Brazil and Mexico.
- Meetings with Enacom in Argentina regarding licensing of community cellular and community wireless networks in general. This helped to secure the new community network licence that ENACOM now offers.
- Multiple meetings with Agencia Nacional de Espectro (ANE) and ICT Ministry in Colombia to provide recommendations regarding existing application in conjunction with Colnodo for licensing of non-profit use of the spectrum to community operators.
- Provided advice and support to the Federal University of Pará (UFPA) and partners around Brazil regarding their experimental GSM licence application. This was successful and three projects in Brazil were granted two-year access to frequencies.
- Initial research into availability of LTE spectrum for 4G pilot in Mexico. Three bands were identified.
- Assisted Zenzeleni Networks in GSM pilot idea regarding use of spectrum in South Africa.

## AP4.5 Expand community cellular networks in Latin America and Africa

Lastly, all of the above were about eventually putting the research into action and having both a concrete impact and also test-beds in order to better understand the ideas better.

- Latin America:
  - Planned the deployment and installed four new cellular networks, three in Brazil and one in Colombia. These were deployed between 15 November and 6 December 2017. This activity took up most of the active time during the period and is by far the most important, tangible achievement.
  - Secured funding for TIC AC in Mexico to expand to 150 communities over the next three years (see above).
  - Scoping of two new community cellular networks in southern Argentina and initial network planning for TVWS network in northern Argentina, in conjunction with ISOC.
  - Raised over USD 5,000 for Brazilian network activists to support community networks that are already up and running and that provide backhaul to community GSM project.
  - Researched how to access 4G spectrum for the TIC AC network in Mexico. Requests have been placed with Mexican regulator IFT and talks are ongoing.
  - Requests from regulators to do pilots in Peru and El Salvador.
- Africa
  - Contacted the communication regulator for Mozambique and negotiated an agreement to host low-cost GSM trials in Maputo and rural areas.

- Worked with Carlos Rey-Moreno to develop advocacy strategy for request for GSM experimental licence in South Africa.
- Developed and submitted proposal to Cell C to request for Zenzeleni Networks to use a small fraction of their GSM spectrum.
- Lesotho regulator expressed interest in funding a pilot.

Other opportunities for funding Pathfinder projects in the region have been discussed with ITU Americas and OAS/CITEL at their request. ITU Americas have put rural connectivity as one of their regional priorities for 2018-2021 [150]. Finally, additional support has come through the OpenCellular granting mechanism for community cellular projects [99], the ISIF [98] and FRIDA grants [97], and the WomenConnect Challenge [101], where team members have been or are part of the reviewing panels. In one of the projects awarded a grant by the latter, team members are also part of the advisory committee for the project, which is supporting women-led community networks in Senegal, Morocco, Namibia and Kenya [151].

## 4. Synthesis of research results and development outcomes

The project's consistent progress has contributed to answering both research questions. WP1 has provided some elements to answer Q1, and provided most of the input to answer Q2. WP2, WP3 and WP4 have focused more on the circumstances that make community-run initiatives successful. Below are some research results learned from each WP related to both questions. Those results have allowed the team to come up with future research recommendations which can be found in the field work report [9].

### 4.1 Viability and circumstance for success of local access infrastructure models

*Question 1: Are local access infrastructure models a viable alternative to connecting the unconnected, and if so, what are the circumstances that make them successful?*

#### 4.1.1 WP1 - Research

Despite the growing attention being paid to them, and the relatively large number of recent initiatives, community-based networks that have built up a track record in helping the unconnected connect themselves in the global South are still actually quite rare.

In terms of technical architectures, The provision of connectivity infrastructure in the community networks we studied is little different from traditional commercial mobile networks and fixed wireless internet service providers (WISPs) operating in urban and rural areas in more developed countries. The community networks operate at a smaller scale, but the technical models are similar – wireless and wired routers or mobile phone base stations interconnect the members of the community, and backhaul links connect them to the rest of the internet or to other phone networks using fibre or copper cables, wireless or satellite links. However in contrast to national voice operators, the community networks providing mobile voice services do not operate a centralised core network for switching and routing calls. Instead they take advantage of recent advances in technology which can provide for low cost switching services at the site of the base station.

For community networks that build internet services, as with larger commercial networks, wireless routers are deployed as Wi-Fi hotspots in public areas, and/or in businesses, government offices or the residences of community members. They are either interconnected in a star-topology, where a central point provides links to each Wi-Fi hotspot, or they are deployed in a mesh topology, where Wi-Fi hotspots may obtain their connectivity via neighbouring devices. In contrast to most traditional large-scale internet providers, Wi-Fi hotspots in the community networks are often augmented with public access facilities, or in some cases, public access is the primary service, reflecting the low availability of access devices in some locations, most notably in the deep rural areas of the DRC and northern Uganda. Voice telephony gateways are also provided in some of the Wi-Fi based networks, and similarly, the mobile networks often used internet links to carry their off-net voice traffic.

While they may be small relative to traditional national networks, the community networks still varied tremendously in coverage area and size – some service just a few dozen households in a settlement, while others provide connectivity for thousands of users spread across a dozen or more villages. Of note here is that a number of the larger and more mature community networks have developed specific organisational structures which act on behalf of the individual networks. These, sometimes called umbrella organisations, include TIC AC in Mexico, AlterMundi in Argentina and Zenzeleni NPC in South Africa. They support the operation of the community networks in a number of ways:

- Operating shared network infrastructure (such as high-sites/backhaul links and voice gateways) on behalf of the individual networks.
- Centralising technical and administrative support, which reduces the need to replicate some of these often scarce resources in each local network.
- Acting on their behalf in relations with government and partners, and to support the development of community networks in the country more generally.

Deployment costs in community networks also varied considerably, depending on the nature of network. While network equipment costs have continued to drop as the technologies advance, resulting in mobile base stations costing less than USD 5,000, and carrier grade wireless routers costing around USD 100, the solar power systems that are often needed substantially increased the cost of deployment. Similarly, towers can be costly items, especially when they needed to be high enough to reach over trees, hills or distant locations, equipped with lightning protection or transported over difficult terrain from distant origins. However, in a few community networks there were opportunities to use existing telecom towers where regulations require operators to share passive infrastructure. Buildings for use as high sites and administrative premises were also often provided by the community at no cost.

Not many of the networks were in areas without any other form of connectivity. In fact, satellite beams now blanket all but a few areas, and mobile operators were present in most of the sites. However, these large-scale commercial services are evidently too costly or unavailable. Despite their small size, improved affordability over national commercial networks is evident. For example, in the community network in South Africa, data fees are between 20 and 40 times cheaper than mobile data plans. In the Mexican mobile community networks, unlimited local calls cost about USD 2.50/month, while off-network calls cost about USD 0.02 a minute.

The institutional models exhibited by community networks vary considerably. These range from networks run and/or supported by non-profit member associations, cooperatives and small businesses, NGOs, to local authorities, and partnerships between government and academic institutions. Local authorities have a significant role in many of the networks, although these institutions vary in terms of their involvement and relationship with the “grassroots” community that may own and operate the network.

Different levels of community involvement and related institutional models reflect local and national cultures and socioeconomic contexts. In particular, strategies largely result from different approaches to coping with the hostile or non-existent policy and regulatory environments which exist for community networks. Depending on the legal environment for cooperatives vs. non-profit associations and clubs, the cooperative or non-profit membership association models appear particularly well suited to these community network endeavours. Rural cooperatives in telecommunication, energy production, savings, agriculture and food distribution have already existed for decades in both developed and developing countries. So it appears these models may become more widely adopted among community networks, given the objective of providing affordable communications combined with the cultures of resilience, community involvement and resource sharing present in rural areas, or provoked by community networks. These models also fit well with network topologies comprised of wireless links between neighbouring homes which share the available capacity.

The technical strategies or institutional models adopted by the networks reflect the different conditions present at each location, which mainly result from variations in the following factors:

- Regulatory environments
- Income levels, literacy, and other “development” indicators
- Availability of supporting infrastructure – backhaul capacity, energy
- Awareness of technical options and access to technical/management skills
- Sense of community agency, local culture and traditions
- Support from local authorities and/or external organisations.

The regulatory environment has the most far-reaching impact as a “threshold factor” which affects the technology strategy of the network, the institutional model and also its longer-term impact. Most of the initiatives studied have been at a disadvantage in providing connectivity because the national policy environments have not been conducive to these networks. This is especially the case for providing mobile voice services. Access to sufficient radio spectrum is insufficient, while licensing or interconnection requirements and government fees/taxes are not adjusted for small networks, which creates relatively much higher burdens on them. For example, in Brazil, government taxes and levies on the satellite service doubles the cost of the bandwidth used by one of the community networks for the backhaul connection to the internet, the largest cost component of running the network.

Also, community networks have usually not been given the same government support that is given to national operators for extending their services into underserved areas. Of relevance here is the fact that the community networks actually generate additional traffic (and revenues) for the existing commercial networks. For example, analysis of calling patterns in the community mobile networks deployed in Mexico and the Philippines shows incoming call traffic is four to 10 times higher than the outbound traffic originating from the community networks.

As a result of inhospitable regulatory environments, most of the community networks have been confined to using unlicensed spectrum and are dependent on limited sources of funding in the start-up phase, or for expansion. The networks are thus slower to grow or replicate and few provide voice services.

#### 4.1.2 WP2 - Open telecom data, policy and regulation

Essential to the success of local access telecommunication infrastructure initiatives is the existence of an enabling policy and regulatory framework. This research has identified the following as the main elements of this enabling environment: 1) awareness and recognition of alternative models; 2) operator licensing that recognises different coverage areas and economic volume; 3) access to radio spectrum; 4) access to passive infrastructure, e.g. towers and backhaul; 5) access to network information; and 6) funding, fees and taxes associated to service provision.

In most countries, universal service strategies exist, but typically these policies are rooted in subsidising dominant operators to extend their coverage into unserved or underserved areas. These policies have had very limited success, but still no other alternatives are proposed. This is partly because of how entrenched the belief is that only large operators can connect the unconnected, and partly because of the lack of awareness of the benefits of local access models (more below). In addition, there is a general lack of understanding of the innovations in institutional models, technical solutions and regulations that are enabling local access telecommunications infrastructure in other parts of the world.

The case of Mexico is paradigmatic, as the assignment of mobile spectrum for social use has catalysed the creation of more than 16 autonomous cellular networks in a region where no large operator wanted to provide services. Experimental licences have been used to advocate for similar experiences in Brazil and Colombia. However, in many other countries, despite having available, unassigned spectrum, or assigned spectrum that is licensed to operators but is unused in rural and remote areas, access to spectrum by local access providers has not been authorised. Similar scenarios are found with other spectrum bands conducive to rural access, such as TVWS. Only Colombia, South Africa and Mozambique have embarked upon regulations for their use.

Identifying and visualising which mobile telephony spectrum bands are allocated to each provider in a number of African countries is another research result of this project. This is critical in the advocacy for access to unassigned or unused spectrum. The intangible, invisible nature of wireless spectrum can make it a difficult topic for civil society to debate with government and regulators. Tools for the visualisation of wireless spectrum assignment and use are essential to increasing public engagement. This is part of a broader strategy to advocate for transparency in the telecoms sector, which has been identified as another critical factor for smaller local access telecommunication providers to succeed. Access to information about available spectrum, the location of towers and the points of presence of the fibre infrastructure has been proven key to the planning of some of the initiatives studied.

For change towards a more enabling policy and regulatory framework to effectively take place, two things are necessary: 1) the willingness within regulatory and policy-making bodies to seek alternative solutions; and 2) the development of a compelling evidence-based narrative supporting the need for that change.

Through extensive research, the project has come up with a convincing narrative based on F. Braudel's "different layers of economy" to justify the need to regulate for both large and small, local access service providers. Additionally, the work through regional regulatory associations has proven to be a highly effective convening space to present this narrative to regulators and policy makers. Where it has been positively received, doors have opened for deeper and more personalised discussions at the country level.

The actual modification of national policy and regulation, as well as the introduction of language in global resolutions to facilitate this change, will require longer timeframes than the duration of this project phase. Fortunately, the project has been able to create resources to identify opportunities as well as mechanisms to make timely, effective contributions to national public consultations affecting the telecommunications industry. Given the critical moment around internet governance issues, with significant geopolitical implications, effecting change at the global level has proven more complicated than anticipated. Working more closely with national delegations from different regions, as well as in the ITU Study Groups, have been identified as steps that can render better results in the future.

### 4.1.3 WP3 - Awareness raising and movement building

An obvious factor for local access telecommunication infrastructures to be successful is for the people who might be interested or who are in need of them to be aware that they are a viable and possible alternative. As with the regulators and policy makers, it has come as a bit of a surprising result to the team to discover how few organisations and individuals, in the digital rights space, and elsewhere, knew about this alternative possibility. It takes time to change the well-established idea that only large top-down operators can provide reliable high-quality services, but, through participating in and fostering discussions about complementary solutions, the project has found many stakeholders willing to engage in exploring them and building the movement further. This is critical, as it also takes a large number of people to be present in all the discussions and conversations where solutions for universal affordable access are discussed.

Among the stakeholders, it was important to identify and give voice to those directly involved in community networks. The mapping exercise took place in various forms, but the Global Information Society Watch 2018 edition on community networks became a starting point to highlight community networks globally, with emphasis on the global South, in one collection. This creates a catalogue of examples that people can learn from, replicate or look at for reference and ideas on a country-by-country basis, which at the same time provides a first point of entry for collaboration and partnerships.

The lack of a centralised space to share news about the topic with those interested in engaging further in community networks was identified in the early stages of the project and was an important factor to build the movement. To this end the monthly newsletter was created. The nearly 300 subscribers to the monthly newsletter, and the increasing use of the shared resources, are a living proof of this need. An in-depth analysis of the links most used by the readers shows a higher click rate in those related to funding, followed by those related to events.

This interest in funding from the subscribers to the newsletter, and more broadly from those interested in starting a community network, points to one of the circumstances contributing to the success of these initiatives: access to initial funding (the opportunities identified for this funding are explored further below). Another circumstance identified as being related to the success of these initiatives is their capacity to remain sustainable once the initial funding is used up. Local access initiatives, especially in Africa, are very well aware of this, and expressed their needs for training materials to be developed in this regard. To this end, training materials were adapted from previous work around the Business Model Canvas for Social Enterprises, and used in different workshops. Still more work is required to build this capacity, especially for those about to start their own initiative, so its sustainability is considered from the onset, even as a precondition for receiving the initial funding. Related to this, another circumstance to make these initiatives successful is to be mindful of the different technical, social and institutional decisions that need to be considered before the start of the project. The creation of materials and discussion spaces that enable those starting to navigate these initial steps successfully are also required.

The interest in attending events could be understood as a proxy to obtain funding, as in many of those events donors are present, but also as a way to share experiences with other peers attending these conferences. A big component of solidarity between/with similar initiatives appears to be very prominent among the organisations involved in this movement. Fostering and nurturing that solidarity/collaboration as

well as creating tools and spaces to make it more effective will contribute to the success of more local access initiatives.

#### 4.1.4 WP4 - Support for existing and emerging initiatives

On the Pathfinder project, the grant period has primarily allowed us to understand the technological possibilities that exist for community networks, as well as the pieces, technologically, organisationally and in terms of regulation, that are missing. Overall, it is clear that there is an interest from both communities around the world, as well as organisations and other civil society actors, to implement bottom-up networks. However, the process by which these actors might actually get networks started, or scale existing networks, remains challenging. As part of this research project, we supported the installation of networks in Mexico and South America, and while that was very exciting, nearly a year later some of these networks are either not functioning due to limited local human capacity, or have not received regulatory approval, or some mixture of the two. Furthermore, although the technology has come down in price, there is still a major training/capacity gap for most communities to truly run their own networks. Taking all of this into account, one key takeaway is that it is hard to build and maintain networks, especially for people and organisations that have little or no experience doing so. For those of us working on strengthening this field, the research has been fundamental towards understanding these challenges and designing and implementing ways to respond so that people-led networks can blossom and grow.

Many of these difficulties stem from the economic and demographic contexts of these networks. Being focused on remote and rural areas in developing countries, along with the unfavourable market and regulatory regimes in which they must operate, has created a variety of difficulties in obtaining support for building the networks which principally relate to:

- **Scaling and replication potential:** Small networks are less attractive to traditional sources of finance or development assistance because the overheads for administering projects and funds disbursements are much the same regardless of the size of the project. As a result, the overheads in the project are proportionally higher than those for larger-scale projects, resulting in a relatively high cost of support. Also, many of the networks are purely focused on provision of connectivity in a particular location, and have little or no interest in scaling or replicating in ways that would lead them to become the larger projects that are more attractive to traditional funders seeking scale.
- **Real and perceived levels of risk:** There are higher actual and perceived levels of risk because the distant locations are unfamiliar, the initiatives are based on novel sustainability strategies, may be run by people with limited management skills, or use new technologies in unfamiliar contexts. Many community network initiatives may also lack land or other assets to provide collateral as guarantees for loans. Even if collateral is available, the cost of commercial bank finance is usually too expensive as it is priced at levels which reflect high perceived risk.
- **Low surplus revenue potential:** Serving rural areas in developing countries, community networks have members with very low income levels, and operating costs are substantially higher in comparison to urban areas. So the ability to service a loan or provide a return on an investment may be quite limited. Furthermore, many of the networks a) do not aim to make a profit and/or b) try to ensure that any fees for service are as low as possible. This may also disincentivise traditional investors in the telecommunication sector looking for higher returns.

The combination of these factors indicates that community networks face considerable difficulties in gaining start-up financial support from traditional investors or lenders. Instead they are likely to need to grow organically from small beginnings (which can take much more time), or they must obtain soft finance and grant funding from development agencies, national governments and even community members themselves.

In addition to these financial challenges, community networks also must overcome high regulatory barriers. This has been addressed in other parts of the report, but it bears repeating. Community networks must be quite creative when it comes to building networks that generally inhabit a grey zone in terms of regulation. Without regulatory certainty, or simply some way to prove the network is legitimate and will not be shuttered by authorities, it is hard to seek and retain investment and buy-in, be it local or external. Furthermore, as discussed below, regulatory limitations make it hard for community networks to explore other technologies beyond those that use unlicensed frequencies.

Finally, there are substantial technological challenges related to building and operating community networks. While networking and general computing equipment continues to fall in price, many community networks are

pigeonholed with regards to the types of technology they can use, limiting their ability to reach end-users with quality services. This is not to say that community networks cannot be successful within this narrow field of technological options, and many are, simply that access to affordable equipment and software remains a critical issue. The reason other types of technologies cannot be used is partially related to regulation, particularly around spectrum and power output, but also to the cost inherent in using telecommunications equipment and software designed for use by large network operators. Sometimes it is even impossible to source equipment without making bulk orders that are outside the realm of scope for most community networks or require costly civil works (i.e. trenching fibre). There is also a knowledge and training issue in that most community network operators have cut their teeth using Wi-Fi and are unfamiliar with other more proprietary technologies and therefore struggle to configure these for use by community networks.

On a more positive note, the Pathfinder work package highlighted that people and communities are interested in connecting and in doing so in ways that are sustainable and appropriate to their contexts. During the period that this report covers, there has been an incredible ground-swell of groups looking to get more involved and taking inspiration from more mature networks to build their own access networks. In other words, these are still early days and there is a lot to be hopeful for. Although some technologies remain out of reach, others have become reasonable and realistic.

For example, Rhizomatica was able to purchase and install a 4G-LTE network for less than the cost to deploy their 2G GSM networks. This is an avenue that the community network community will continue to explore and will almost certainly be fruitful over the mid to long term. This is a welcome development as 4G is a current technology and there are many equipment vendors and now two or three viable free and open-source core network implementations to use. So the hardware is affordable and the software is free, and additionally there are plenty of people actively working on 4G technology, meaning there is ready access to people and knowledge resources.

The Pathfinder WP also confirmed the hypothesis that many communities, especially very remote ones, are looking for simpler solutions to their communications needs. The HERMES project, for example, made clear that many places do not want or need super high-velocity or expensive and complex networks in order to reap a tremendous benefit from being able to communicate at distance.

## 4.2 Local and global benefits offered by community networks

*Question 2: What are the additional benefits to the local community in terms of well-being, gender equity and social and economic development when local connectivity initiatives are locally owned and operated?*

Aside from the well-documented benefits of access to voice and internet services that connectivity offers to rural populations in the global South, as well as the commercial benefits to existing national networks from the traffic generated by the communities, the social impact research showed that community networks have many other benefits. Some 77 different benefits were articulated in studying just six cases (in Argentina, India, Indonesia, Mexico, South Africa and Uganda) and many of the positive contributions to the telecommunications ecosystem and to local social and economic development are specific to community networks.

Wider affordability of communications, direct savings made on the cost of existing communications, and the roles of community networks in the local circulation of money are the benefits that tend to attract policy makers and development agency attention. However, it is important to observe that while financial benefits are important to people in low-income community networks, these are by no means the aspects they value the most. It is equally important to appreciate that beyond the benefits to the social and economic development of rural populations, community networks also provide insights into factors within, or acting upon, the telecommunications sector that hinder access for all, whatever telecommunications model is applied. Moreover, the community networks paradigm offers unique practical ways to compensate for the effects of these factors on their populations and, thus, provide valuable lessons for stakeholders seeking to connect the unconnected.

### 4.2.1 Direct and indirect economic benefits

Key benefits to local economies are accrued from wider affordability of communications, direct savings made on the cost of existing communications, and community networks' various roles in facilitating the local

circulation of money. In the rural areas studied, where the only other means of internet access is through mobile operators, many people spoke of the importance of low-cost communications. For example, many of the frequent users of Zenzeleni in South Africa interviewed indicated spending between 10% to 40% of what they had previously spent on mobile data; and users in Mexico indicated the affordability of their community network's GSM provision, where alternative communications involve costly landline, satellite and radio phones, Wi-Fi services, and the expense of transport involved in travelling to the locations where they are available.

In addition to cost savings and affordability, cheaper services enable people to use the internet more effectively, with direct impact on income-generating activities, extending beyond retaining money within communities through cash payments to the community network, instead of to non-local telecommunications companies or financial intermediaries such as banks or credit cards. These benefits include:

- Fairer trade, by accessing market information to enable people to negotiate prices.
- Increased turnover in selling via e-market places.
- Better informed consumer decisions.
- 

Community networks also make important contributions to the local circulation of money via the social links and spin-off services they support. These include:

- New local trade within rural communities based on relationships forged through community networks.
- Direct income generation by people on-selling their connectivity in some cases.
- Ad hoc, small cost-saving arrangements between local people facilitated by the community network.
- Improved performance of local businesses, e.g. local transport services.
- Increased business for other local service providers, e.g. local printing services.
- Fostering community-oriented business attitudes locally.
- Introducing people to each other and creating new relationships.

Thus, along with cost savings and wider affordability, community networks have many other intrinsic benefits for the local circulation of money.

## 4.2.2 Other benefits from unrestricted access and better access to information

Affordability is vital for people in low-income communities in order to benefit from the wider economic and social value of national networks in enabling links beyond the local communities, such as for personal contact, education and business activities. However, the traffic-based usage charges of national mobile networks, especially as these charges occur irrespective of whether the traffic is local or not, can have a chilling effect on the extent of use. In contrast, the lack of charges associated with the traffic generated by the user of a community network means that community networks are more likely to encourage greater use generally, and enable activities that were not economically justifiable (affordable) with a traditional mobile network. Participants, for instance, not only referred to using the internet in informal and formal education,, but also how they learned better using resources when they did not have to worry about the cost of their data consumption, for instance to learn using bandwidth-consuming video.

The research data illustrates many different benefits to individuals and public institutions, particularly local authorities, of using a community network to access information frequently, for extended periods, in a timely manner and/or in social situations. These encompass benefits in formal and livelihood-relevant contexts including, for instance, access to up-to-date healthcare and agriculture information; support for teachers and students at all educational levels, for classes, assignments and research projects; opportunities to search for employment; research about professional or higher education opportunities; and informal remote peer exchange of information across social media platforms. These benefits are further extended by increased numbers of communication channels to disseminate information locally, most frequently through WhatsApp groups.

The affordability of community networks not only offers the many benefits of frequent, extended or timely communication with people and institutions who would not otherwise enjoy them, but in doing so greatly enriches the local communication ecology. The data gathered shows benefits such as sending applications for jobs and tertiary education, working from home, providing proof of remote work to employers, coordination for administration and governance, online financial transactions and reducing travel costs for

employment and local administration. These benefits combine with the particular social qualities of community networks. Thus, the data also illustrates that community networks significantly contribute to:

- Disseminating information using broadcast SMS over GSM Linking local information channels, such as local radio, drama groups and printing services.
- Information sharing and intermediating communication for people with accessibility constraints.

### 4.2.3 Rural community empowerment

Rural communities in the global South are particularly vulnerable to outmigration, especially of young men and skilled workers, a sense of disempowerment, and helplessness about their ability to improve their lives. Community networks can help empower rural people in using, deploying and innovating technologies. All six of the cases studied for social impact illustrate considerable capacity building, including women, children and older people. For instance, people with little prior exposure learned about technology by relating it to their everyday experience because the community network emerged in their own local environments.

While there are many barriers to women's technical involvement in technology projects in general, some of the cases studied are starting to specifically support women's involvement in set-up and operations. Women in these networks explained that they had gained confidence by learning about technology together, being inspired by women role models, and had new opportunities for meeting other women beyond their own villages.

Also, for some participants, gaining skills in building and operating their networks enabled them, or people they know, to establish their own small businesses or gain employment. Some of the cases also illustrate that community networks afford opportunities for local creative industries that innovate software or hardware solutions suited to particular rural contexts.

Because building, operating and using a community network involve more than just the technical aspects of telecommunications, benefits extend deep into the fabric of local society. Like traditional networks, community networks provide communication channels that people can use to, say, help avert loneliness. Additionally, most of the cases studied also showed that community networks offer avenues to address the social fragmentation that can accompany increased use of digital communications. For instance, community networks have acted to bridge different parts of society, such as between newcomers and migrants; supported people's cultural identity; improved local security and safety; provoked and informed local discussion about privacy; and supported intergenerational cooperation.

Strikingly, the research data on the social impact in just six cases shows that the success of community networks has also amplified people's sense of their individual and collective capability and their confidence to set new objectives for themselves and/or their communities. Local coordinators, and often users, spoke of considerable pride and satisfaction in their achievements in establishing their own network. Their descriptions of their endeavours showed that local networks contribute to, and can extend, self and collective efficacy and agency. People expressed a sense of empowerment and self-sufficiency in being able to make decisions about telecommunications and undertaking operations.

### 4.2.4 Addressing exclusion

The research data for most cases shows that the community networks paradigm fosters local commitments to ongoing learning, continuous improvement and readiness to change their operations. While community networks provide more affordable access than traditional telecommunications networks, at this early stage in their evolution there also remain barriers to access for some people. However, three unique benefits of community networks suggest they will resolve this situation in the months and years to come:

- Unlike commercial telecommunications, the local nature of community networks makes the specific factors that contribute to exclusion easier to identify.
- The incentive to address the factors is far greater than for commercial telecommunications that operate at a distance from their users and value-price their services only for populations that can afford them.
- The collaborative, rather than competitive, approach between different community networks around the world, and the dramatic recent increase in channels of communication between them, promotes sharing experiences and co-creating practical ways to address factors contributing to exclusion.

Indeed, our research shows that these unique characteristics of community networks will provide valuable lessons for many different stakeholders seeking to better serve rural populations, including commercial providers.

### 4.3 Impediments to the benefits of community networks

The detailed research on social impact shows unequivocally that community networks provide specific social and economic benefits along with the broader benefits of connectivity to people whose needs are unmet by national networks. However, community networks also encounter problems in achieving their goals to provide access to connectivity to the most excluded people in society. These problems are caused by an absence of wider recognition of the special benefits of community networks, and lack of enabling policy, regulatory and investment environments, along with different types of discrimination embedded in the global culture of the telecommunications ecosystem.

The research illustrated that community networks can provide affordable access to many people who are excluded by national telecommunications networks; however, in the cases studied, not everyone in the community networks' constituencies had access. Most barriers to people's access are also included in the much larger set of barriers presented by traditional telecommunications networks, rather than being intrinsic to the community network paradigm. Nevertheless, these encompass exclusion because potential users cannot afford phone handsets or other devices to use the network, do not have written and/or technological literacies, or have needs and interests that are not targeted when designing services, for instance, because of their age.

All telecommunications systems amplify existing gaps between people and, because community networks provide benefits to people in their rural constituencies, they also advantage those that have access in varied ways. For instance, people who already have basic technological literacy are more able to gain skills in operating community networks and consequently to participate in decision making about community networks and/or generating income by applying the skills they gained.

The research data shows that challenges to inclusive decision making that were evident in some cases studied result from broader problems in technology. For instance, technical manuals and interfaces focus on certain languages which exclude many people from understanding networks. This exclusion, of course, characterises telecommunications networks as a whole, but the problem becomes more visible in community networks precisely because they are situated within communities that are residential, rather than specifically technical, and involve the skills of local residents.

Other examples of the ways that community networks reveal conventions and practices in telecommunications that exclude diverse people relate to age and gender. For instance, the research data shows that prioritising the technical skills of younger people can be incompatible with the age profile of rural populations, where people tend to be older. Further, the global culture of telecommunications only ascribes higher value to certain sorts of work, and associates this work with men, not women. This contributes to situations where the work of social coordination, which is fundamental and vital to community networks and often undertaken by women, is not valued as much as the work of software and network engineering; thus, women are under-remunerated. In contrast to commercial telecommunications providers, however, community networks are often highly motivated to include diverse people in operations.

Unfortunately, despite their motivation and capacity to identify and address exclusion, community networks are impeded by factors related to enabling policy, regulatory and investment environments. Some challenges that community networks face in achieving inclusivity are the direct result of the current absence of enabling policy and regulations, others are more indirect. For example, exclusions relating to geographic dispersion of people occur less frequently for mobile networks than for the Wi-Fi networks that most community networks are forced to use.

The limited spatial coverage of a particular Wi-Fi hotspot can restrict connectivity to certain places, and these places may not be accessible to some people with social, cultural or bodily constraints. Sometimes this means that community networks reinforce local power structures because access points are located at authority premises, where only privileged people are permitted to use their modest amounts of bandwidth. Further, if the location of public Wi-Fi hotspots in a network is not gender-sensitive, then girls and women encounter specific barriers to access.

It is imperative to appreciate, however, that at the root of this problem are national policies and regulatory frameworks that preclude community networks from using technologies that have greater spatial coverage or

lower costs. The relationship between policy, regulation and the exclusion of women and girls from access, which in turn amplifies gender differentials in freedom to access information, is a clear example of the way that community networks expose issues that are hidden, and in fact caused by, established telecommunications infrastructures.

Other challenges arise because community networks that are situated in economically deprived, remote rural areas and are also based on less familiar telecommunications paradigms are unable to access capital from traditional investors or lenders. All the cases studied show that community networks emerge from small beginnings and operate with meagre resources, including limited access to training, vehicles and printed material, and this, in turn, constrains their ability to maintain their networks and publicise their services as well as they would like. Thus, although many of the community networks in the study respond conceptually and organisationally to the needs of their constituencies, financial limits on their operations mean their growth and changes emerge slowly.

Lack of access to capital results from a combination of factors that are all, ultimately, attributable to comparing community networks with the traditional telecommunications model and discounting their unique value:

- Compared with traditional telecommunications, community networks are seen as having higher actual or perceived levels of risk. This is because their distant rural locations are unfamiliar, they involve new technologies in apparently alien social contexts with novel sustainability strategies, and they may be run by people with limited management experience. The community network initiatives may also lack land or other assets to provide collateral as guarantees for loans. Even if collateral is available, the cost of commercial bank finance is usually too expensive as it is priced at levels which reflect high perceived risk.
- When it comes to investment, community networks are judged according to specific measures of potential, specifically scale and replicability. Small networks are less attractive to traditional sources of finance or development assistance because the overheads for administering projects and funds disbursements are much the same, regardless of the size of the project. Thus, the proportion of overheads in the project is higher than for larger-scale projects, resulting in a relatively high cost of support. Also, many of the networks focus on providing connectivity in a particular location, with little or no interest in growing and replicating in ways that would create the larger projects that attract traditional funders seeking scale.
- Community networks offer low surplus revenue. This is a disincentive for lenders and investors looking for higher returns in the telecommunications sector and limits community networks' ability to service loans. The members and customers of community networks in rural areas of developing countries have very low incomes, and operating costs can be substantially higher compared with urban areas. This is commercial telecommunications providers' key justification for not covering these areas. Further, unlike traditional telecommunications that value-price services for wealthier markets, many of the networks a) do not aim to make a profit and/or b) try to ensure that any fees for service are as low as possible.
- Community networks often need to obtain soft finance and grant funding from development agencies and national governments, because of their difficulties in gaining start-up financial support. Again, however, they can encounter problems. Firstly, until recently there were very few specific global development funding streams for community networks, and to our knowledge no national ones. Now, while there are more funding streams, there are also more community networks competing for those streams. Secondly, project proposals are evaluated and monitored against the better-known connectivity strategies of commercial telecommunications provision. These tend to emphasise the technical aspects of implementation, which do not account for community networks' inherent social qualities. Thirdly, outcomes are also evaluated against the connectivity strategies of commercial telecommunications provision, which do not account for the wide array of unique benefits offered by community networks.

## 5. Methodology

The project has used Action Research (AR) as the main research methodology, which follows cycles of Plan-Do-Observe-Reflect. We consider the proposal funded by IDRC as one AR cycle, with its initial proposal as the planning phase, its implementation as the doing and observing phase, and this report containing the

results of the reflection phase. Additionally, smaller cycles took place constantly at both the action point (AP) level as well as the work package (WP) level.<sup>3</sup>

The Observe and Reflect components of this project were articulated using an Outcome Mapping methodology [152] in order to systematically capture the project's contribution to knowledge and the overall changes that take place as a result of the project. At the project's inception meeting, the Boundary Partners (BP) were identified, Outcome Challenges (OC) were defined for each BP, and Progress Markers (PM) were developed for each OC. In subsequent meetings, actions taken in relation to each PM have been recorded on an online platform (Trello) adapted to that purpose.

It is important to note that the main elements of this reflection exercise informed the proposal sent to Sida, whose "doing" phase started in January 2019 [186]. This can be considered as the second AR cycle of this intervention.

Besides the broader AR methodological framework used for the overarching project, different methods have been used at the WP and AP level. As the ones that contributed the most to answer the research questions included in this project are those used in WP1, a summary is provided below. The detailed methods are included in the report produced as the main output of WP1 [9].

The research applied a multiple case methodology to scope community networks in the global South. The cases studied were selected based on criteria that aimed to provide insights about a variety of different connectivity technologies, services provided, institutional models and sustainability strategies, as well as a roughly even spread across countries in three regions of the global South – Latin America, Africa and Asia. In addition, the networks needed to have been established for sufficient time to be able to derive useful learning from them.

The initial desk-based research identified 16 initiatives for further study, most of which had been in operation for more than two years. During 2018, in-country research visits took place, which provided a snapshot of the technical and operational aspects of cases in Argentina, Brazil, the Democratic Republic of Congo (DRC), India, Indonesia, Mexico, South Africa, Thailand and Uganda. This data was gathered by interviewing champions, managers and technicians in networks and examining documents they provided and equipment used at different sites. Three further networks, in Indonesia, Peru and the Philippines, were later examined via desk research and direct contact with individuals associated with the initiatives.

The social impact of six cases (in Argentina, India, Indonesia, Mexico, South Africa and Uganda) was studied in more detail. Over 300 people participated in interviews, observations, focus groups and other data gathering events, which accumulated over 200 hours of recorded data across 60 days. Some 90% of participants in interviews and focus groups were people who inhabit the rural areas in which community networks are deployed. Many of the interviews relied on translation from local languages which included Hindi, Marathi, Luo and Nilotic dialects, Mexican and Argentine Spanish, isiXhosa, and central Javanese. In most countries participants live in close proximity, in the same or nearby villages or very small rural towns; however, in Uganda and India, participants came from villages that were farther apart. Participants' identities have been anonymised to the extent that is possible, and all data is stored securely. The social impact research sought to ensure a wide range of perspectives were represented, including many users of the networks as well as operators and managers, and additionally people in the community networks' footprint who did not use the network directly themselves. Women were actively recruited to participate in data gathering.

The social impact research produced mostly qualitative descriptions about how and why people coordinate, interact with and are affected by their local community networks. These descriptions are not statistically generalisable to entire populations of community network organisers, users and non-users. Nor should the cases be considered typical or atypical, since the cases studied are diverse, relatively few, and many are still at early stages of maturity and are rapidly evolving. Rather, the research provides portraits of some of the initiatives at the frontier in the communications revolution, situated in their specific contexts of management, access and use, and uncovers some common characteristics.

<sup>3</sup> Note that the project is structured around four activity areas, called work packages (WP) in this document for clarity.

## 6. Project outputs

### 6.1 Information sharing and dissemination

Below is a list of the outputs of the project in terms of information sharing and dissemination. They have been arranged in line with each WP for ease of reference.

- In Work Package 1 – Research, the main output has been the report containing the results from the field visits [9]. Additionally, one chapter has been accepted for publication, [153], one extended abstract has been accepted [154], and two others have been submitted [155, 156].
- In Work Package 2 – Policy and Regulation, three submissions were made to public consultations in South Africa [30, 31] and Canada [33]. Additionally, submissions have been made to other public consultations for WSIS and IGF processes, among others [51]. The project also contributed to a report to CITELE PCC1 [27], as well as to a policy brief for the Technology Innovation Agency in South Africa [32]. Finally, one chapter about Open Telecom Data has been accepted for publication [41], and a report funded by ISOC on Innovations in Spectrum Management has been produced [34].
- In Work Package 3 – Movement Building, 13 editions of the community networks monthly newsletter were produced [54],<sup>4</sup> together with at least 42 news articles [50, 55-94], and nine external blog pieces, including a position paper on open telecoms data, and the rationale for a regional TVWS database.<sup>5</sup> Additionally, the project contributed to several publications, including the production, together with APC core funds, of the GISWatch 2018 report dedicated to community networks [135]; collaboration on a review of community networks in Latin America produced with ISOC, FGV and REDES AC [94], and two position papers on the topic [91, 158]. Finally, a complete list of the conferences and other events where the team members participated is included in AP3.2.
- In Work Package 4 – Pathfinder, a short guide to choose low-cost BTS for community cellular [144]; a video and webpage introducing the INC network in Colombia [159], and a web page for the CELCOM project in northern Brazil [160], both established as part of WP4; and a video and press coverage about HERMES [139, 140].

In addition to the information sharing and dissemination materials created by the project, members of the project team have been interviewed by media organisations regarding their work in community networks and local access initiatives [161-169]. Additionally, other community-based initiatives supported by the project have been featured by different international media: TIC AC by German broadcaster ARD [170] and multiple times in the Mexican press, and Zenzeleni Networks by Deutsche Welle [171] and the BBC [172].

### 6.2 Knowledge creation

As described throughout section 4, this project has contributed to the creation of considerable new knowledge, especially around the viability of local access networks, the circumstances that lead to their success, and the benefits to the local community in terms of well-being, gender equity and social and economic development. In most cases, this new knowledge creates a landmark in the studies about community owned-networks. The following is expected to be very influential in the field:

- A set of 77 benefits that community owned networks provide to local communities included in [9].
- A different set of abstractions included in [34] to understand spectrum and its abundance, especially in rural areas.
- A narrative based on F. Braudel “different layers of economy” to justify the need to regulate for both large and small, local access, service providers, included in the regulatory training courses developed.
- A comprehensive and up-to-date review of the status of community networks, including its legislation, in Latin America [94].
- A compendium of descriptions of community-owned initiatives in 43 countries [135].

<sup>4</sup> The monthly newsletter has continued to be produced from January 2019 onwards with the additional funding received from Sida.

<sup>5</sup> Steve Song’s blog (<https://manypossibilities.net>). These resources have been created in collaboration with funding from Mozilla and the Network Research Startup Centre.

## 6.3 Training

Training by the project team has been focused around three main topics:

- Creating an enabling policy and regulatory environment for community networks and other local access initiatives. To this end, several training workshops were organised with policy makers and regulators [23, 26, 90, 173]. Of particular relevance were the two co-organised with the regional regulatory associations for East Africa [25] and Southern Africa [24]. Additionally, the team participated in the African ISOC Chapter Advocacy meeting at the African Union Commission (AUC), where members from the AUC itself, but also from regional economic areas (the Economic Community of West African States (ECOWAS), the Economic Community of Central African States (ECCAS) and the Intergovernmental Authority on Development (IGAD)), regional regulatory authorities (WATRA, CRASA, EACO, ARTAC), as well as other continental-wide organisations such as the Pan African Postal Union (PAPU) and the African Telecommunications Union (ATU) were present [22].
- Introductory training on different aspects of community networks and other local access initiatives were provided throughout the project to many civil society and academic partners [130, 174, 177].
- Building capacity within existing community network initiatives, especially around sustainability models [178, 179], but also around policy advocacy [47].

## 6.4 Impact

The major impacts based on an analysis of the Progress Markers created as part of the Outcome Mapping methodology of this project are summarised below. Note that the report containing the research results from the field visits was released around the time of finalising this report, so it is not possible to include its impact in this document. However, one can anticipate it will be high, given its depth, scope and seminal nature, as this is the first document creating a body of knowledge of the factors that inhibit or encourage the existence, development and scaling of community networks in different contexts, including an understanding of the power relationships and dynamics in the framework of particular community networks and how they impact on women. This is particularly relevant at a moment when community networks are being discussed in many academic, activist, policy and financing forums. Impact highlights from the other three WPs are included here.

### **Policy and regulation**

- Participation in policy and regulatory events as well as training provided through regional regulatory authorities have opened up opportunities to affect national regulatory frameworks. Although not yet concrete, there is progress towards more enabling policy and regulation for local access initiatives in Colombia, South Africa, Ecuador, Kenya and Ghana.
- The engagement at the global level has contributed to increased interest from the development sector within the ITU, which has commissioned the development of a set of guidelines for its member states to better understand the benefits and the needs of community networks. Additionally, it is already engaging in panels on community networks at the WSIS Forum 2019 [180, 181], as well as opening spaces at its own events to talk about them [182].
- The campaign on Open Telecom Data has been appealing enough for the British High Commission in South Africa to fund further research on its implementation in South Africa.
- Community networks were referenced in the CSTD's annual WSIS resolution [50]. Additionally, the importance of community networks was recognised in the stocktaking documents on the implementation of the WSIS action lines in 2018 [183], which will facilitate further discussion of the issue at the CSTD and other relevant UN spaces dealing with science, technology and development issues.
- The Alliance for Affordable Internet Access (A4AI) has embraced both community networks and open telecom data as strategic elements of their advocacy.

### **Awareness raising and movement building**

- Although it is difficult to directly attribute it to the project activities, it is positive to see how organisations not previously very involved in promoting community networks are engaging in movement building activities, and there are sessions about the topic in different conferences [184],

including around spectrum regulation [185]. This is just one sign of impact around the increased awareness of the potential of local access initiatives to connect the unconnected.

- Another area of impact has been around direct collaboration among stakeholders. In this sense, the Memorandum of Understanding with the Internet Society (ISOC) has been the highlight, as the relationship has served to create many synergies to reach those who are interested in either creating their own network or in supporting others already busy doing so, as well as to collectively advocate for regulatory change. Similarly, another large organisation like Mozilla has become more involved on the topic, and is advocating for similar change. The Partnership for Public Access, where community networks are profiled high among the solutions they promote, is another example of this.
- Relationships with donors have also translated into direct funding for community networks and similar initiatives. Notably, an agreement between APC and Sida was signed in December 2018 to expand the work of this project during 2019 [186], in addition to making funding directly available to community networks to learn from each other and reach the next level in terms of sustainability, among other goals.
- Although difficult to quantify, this project has had an impact in contributing to opening up the space for more women to participate in community network-related activities. There is a long way to go to redress the gender imbalance in the movement, but there is certainly a broader awareness about the need for more women participating in the movement as well as more women collaborating to make this happen and to make their work more visible in different spaces.

### Pathfinder

- The deployment of new community-owned networks in remote communities in Brazil and Colombia. This means concrete service provision for people with no other or very limited connectivity options.
- The establishment of four new women-led community networks in Namibia, Senegal, Morocco and Kenya [151].
- Expansion of existing community networks in Mexico. The Telecomunicaciones Indigenas Comunitarias (TIC AC) network was grown and strengthened. Coverage was added to 15 new villages and around 1,000 users. New services like GPRS data were added. Substantial money was raised for this network, providing it a pathway to grow and scale over the coming years. Additionally, the network received a satellite capacity donation from the Mexican government, valued at USD 30,000 per month.
- The development of the HERMES technology for very rural/remote areas. This project was the crown-jewel of the Pathfinder process as it truly created a totally new, hybrid solution for connectivity and was recognised as such by being named the winner of the Mozilla-WINS competition. HERMES has been identified for deployment in the Brazilian Amazon and DRC in 2019.
- Ongoing development of community-centred tools for managing and operating GSM networks. This means software that projects are already using and others may use to set up and manage community-based GSM networks. As it is free/libre and open-source software, anyone is free to use it, and we know of at least four community networks using it (TIC AC-Mexico, INC-Colombia, various-Brazil, SayCel-Nicaragua). Others, such as in the DRC, have expressed interest as well.

## 7. Problems and challenges

Historically, APC has contributed to the debate about access to telecommunications infrastructure from a rights-based approach, and this project aims at continuing this trajectory by streamlining this research on community-based networks in the organisation. As a result of APC's ability to reach out to its member civil society organisations for support as well as prior experience in reaching rural communities, no significant problems or challenges were faced during the implementation of this project, and as shown in the sections above, it has outdone itself in terms of outputs, outcomes and impact. However, a critical look at the work done makes it possible to identify challenges that this or similar projects may face in the future.

- The scope of the project, aiming to reach Africa, Latin America and Asia, was too broad to cover with the resources available. When choosing where to focus, the team was opportunistic in using existing relationships and opportunities available, as well as leveraging options to maximise impact. This has been particularly relevant in the policy and regulatory work, where interventions in Latin America and Africa have been prioritised over work in Asia. In the new phase of the project, similar work will be done in those regions and an additional effort is being made in engaging in regulatory events in the Asia region to establish new relationships and opportunities to engage [182].

- Similarly, the project has not been very effective at engaging with some specific actors, both government and civil society, in Francophone and Arab-speaking countries. There are some exceptions, such as the AfChix projects in Senegal and Morocco [151], and the arrangement of a regulatory training workshop with WATRA in 2019 [187]. The mapping exercise done through GISWatch shows that these regions host the lowest number of community-owned initiatives. To modify that trend, a more targeted effort would be required.
- The project has provided a unique opportunity to build APC's capacity around the logistics and costing of research field trips, as well as managing the sheer amount of data coming from them. The areas where most community networks are located are very remote, and it was not always easy to find facilitators to enable field visits. Additionally, while trying to assess the impact of these initiatives on gender participation, as well as on marginalised populations, additional lessons are being documented for similar processes in the future to overcome challenges identified in this process. Finally, the process for data analysis, given the sheer amount of data produced, was clearly under resourced, which required adapting the budget as much as possible to compensate for this.
- The relation between the scope of the project and the human resources available also brought additional challenges in terms of the physical capacity to attend to requests for engaging further in events and supporting organisations willing to start or scale their community-based initiatives. There is a clear and substantive increase in the interest around these initiatives, but this increase has not yet been matched by an increase in the financial and human resources available. This has the double negative effect of stretching those with resources to work in the topic too thin, as well as discouraging those who compete for but do not receive the meagre additional resources available. The project has engaged with several donors to reverse this trend, and despite having been successful with one [186], the resources are far from enough to support the existing demand.
- This very same uneven relation between the scope and the resources available for the project to meet its goals has made it difficult to find mechanisms to be more inclusive in the discussions and decisions made inside the project team. Whereas this is normal in most projects, if sustained over the long term, this may jeopardise the horizontality of the movement. In the new phase of the project [186], clear mechanisms have been established to prevent this from happening again.
- Finally, given the critical moment around internet governance issues, with significant geopolitical implications, effecting change at the global level has proven more complicated than anticipated. Working more closely with national delegations from different regions, as well as in the ITU Study Groups, have been identified as steps that can render better results in the future. More thought and a strategy are also needed in the future to identify and prioritise relevant policy processes and spaces in which advocacy could have more positive medium- and long-term impact.

## 8. Administrative reflections and recommendations

During the period that this report covers, there has been an incredible ground-swell of groups looking to get more involved and taking inspiration from more mature networks to build their own local access networks, as well as interest among donors to support them and among regulators to create the environment to enable them. In other words, these are still early days and there is a lot to be hopeful for.

It is important to highlight how critical the initial support from IDRC has been to make this happen. The different synergies that it is generating would have been impossible without the funding received for this exploratory research. Hence, it is recommended to analyse the elements of this project proposal and the implementation team/partners to identify proposals that can contribute to a similar domino effect.

The interaction with the program officer has been quite satisfactory as well, introducing a low overhead in the implementation, so the project could maximise its impact, but being very responsive when administrative queries were made to him. The flexibility with budget reallocation in this kind of exploratory research is also commendable, as was the ease with which the project was granted an extension in order to improve the quality of its final outputs.

It should be noted that the project would have considerably benefited from a longer duration and extended funding, as it was initially designed based on indications from IDRC that this would be possible. That the actual budget received was smaller, and its duration shorter, entailed having to dedicate time and effort to fundraise additional resources by the team. The reasons for not having been able to renew the project are outside IDRC's responsibilities, but it is important to note that without, one of the very few options to continue independent research on local access networks has disappeared. This is a similar case to when IDRC

supported the early work of the First Mile First Inch and Wireless Africa projects 10 years ago, which were among the initial research projects to explore the extension of telecommunication by rural communities in the global South. As shown through the outputs of this project, research like this is critical to understand the changes in external conditions, as well as the socioeconomic benefits and implications of one of the few alternative models, especially for the global South, that holds promise for providing universal affordable access.

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[176] Webinars for APC members and Alternatives interns. The first took place 10 August 2018, with around 35 participants. The second was on 27 August 2018. The project team hosted one intern from the international solidarity organisation, Alternatives (Canada), beginning September 2018 for a six-month period. The intern prepared meeting reports and other informational materials related to community networks and rural connectivity initiatives, and provided support for awareness-raising and movement-building activities.

[177] Facilitated a workshop about spectrum basics and basics of communications at Research ICT Africa, 22 August 2018.

[178] Training webinar about financial sustainability for the collective of community networks in Africa, 28 March 2018.

[179] Facilitator of “Sustainability and Governance” training at [95].

[180] Internet Society, “Community Networks and Connecting the Last Billion”, World Summit on the Information Society Forum 2019, 8 April 2019. See:

<https://www.itu.int/net4/wsis/forum/2019/Agenda/ViewSession/143#>

[181] APC, “Benefits of local connectivity initiatives for gender equity, social and economic development and viability of community networks as an alternative to connect the unconnected”, World Summit on the Information Society Forum 2019, 11 April 2019. See:

<https://www.itu.int/net4/wsis/forum/2019/Agenda/ViewSession/253#>

[182] ITU Global Symposium for Regulators (GSR-19). See: <https://www.itu.int/en/ITU-D/Conferences/GSR/2019/Pages/default.aspx>

[183] United Nations General Assembly, Economic and Social Council, “Progress made in the implementation of and follow-up to the outcomes of the World Summit on the Information Society at the regional and international levels”, 4 March, 2019. Available at:

[https://unctad.org/en/PublicationsLibrary/a74d62\\_en.pdf](https://unctad.org/en/PublicationsLibrary/a74d62_en.pdf)

[184] Digital Rights and Inclusion Forum, 2019 Agenda. Available at:

<https://drif.paradigmhq.org/download/2019-agenda/>

[185] RightsCon 2019, RightsCon Tunis Draft Programme Session List. Available at:

<https://www.rightscon.org/program/>

[186] “Connecting the unconnected: Supporting community networks and other community-based connectivity initiatives”. See: <https://www.apc.org/en/project/connecting-unconnected-supporting-community-networks-and-other-community-based-connectivity>

[187] WATRA, “Summary table meetings and workshops in 2019”. See: <https://watra.org/wp-content/uploads/2019/02/WATRA-Agenda-for-2019-.pdf>