

Advancing rural connectivity in South Africa

A case for community-owned networks

POLICY BRIEF



Authors

Shaun Pather and Carlos Rey-Moreno



science
& technology

Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA



technology innovation
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ZENZELENI



Note: Throughout this document, important points are indicated in this format to highlight key issues that underpin policy recommendations made in the final two sections.

Contents

Abbreviations.....	2
1. Introduction.....	3
1.1 Access to affordable communications in Africa and South Africa	3
1.1 What are community networks?	4
1.3 Zenzeleni Networks: A South African rural community network.....	4
2. Policy and regulatory frameworks.....	5
2.1 Rural digital divide.....	5
2.2 ICT SMME growth	6
2.3 Advancing the objects of the ECA	6
2.4 Universal service and access and the true access gap	7
3. Bottlenecks and challenges in the current policy regime	7
3.1 Licensing framework	7
(a) Licensing fees and compliance	7
(b) Licence exemptions.....	8
(c) Licence exemptions: The Zenzeleni case.....	8
3.2 Spectrum regulations	8
(a) Licence-exempt for access and backhaul.....	9
(b) Licenced spectrum for mobile network services.....	11
3.3 Increase transparency and visibility of data related to telecommunication infrastructure	15
3.4 Telecommunications infrastructure as a common-pool resource	16
3.5 Public funding for community networks (SMMEs) targeting universal access	17
3.6 Infrastructure sharing: Implications for state-owned entities	18
4. Context of grassroots innovation	18
5. Regional and global policy	19
6. Advancing a community networks model: What we have learnt.....	19
6.1 Facilitation and coordination	20
6.2 Bottom-up community-driven processes	20
6.3 Integrated intervention that is beyond the access layer	20
6.4 Seed-funding to ensure the sustainability of start-ups.....	20
6.5 Community technology public access centres	21
7. Policy recommendations	21
7.1 Licensing community networks.....	21
7.2 Spectrum	21
7.3 Licenced spectrum for mobile services.....	22
7.4 Increase the transparency and visibility of telecommunication infrastructure	22
7.5 Telecommunications infrastructure in “commons”	22
7.6 Development of community co-operatives as SMMEs	22
7.7 Public funding for SMMEs targeting universal access.....	22
7.8 Lowering of data costs without the need for universal service obligations	22
7.9 Monitoring of the access gap	22
7.10 Universal service and access definitions	23
7.11 Obligations revisited: Synergies with state-owned companies and others in the Internet ecosystem..	23
.....	23
7.12 Regional and global policy.....	23
7.13 Grassroots innovation	23
Acknowledgements	24

Abbreviations

CN	community network
CSIR	Council for Scientific and Industrial Research
CSTD	Commission on Science and Technology for Development
ECA	Electronic Communications Act
ECNS	electronic communications network service
ECS	electronic communications service
EIRP	Effective Isotropic Radiated Power
ICASA	Independent Communications Authority of South Africa
IEEE	Institute of Electrical and Electronics Engineers
ITU	International Telecommunication Union
PECN	private electronic communications network
PtMP	point-to-multipoint
PtP	point-to-point
SMMES	small, medium and micro-enterprises
TVWS	TV white spaces
USAF	Universal Service and Access Fund
USAL	underserviced area licensee
UWC	University of the Western Cape
WOAN	wireless open access network

1. Introduction

Fifteen years after the first World Summit on the Information Society, open, affordable and free Internet access remains a critical challenge. Significant digital divides between and within countries still exist and are, in some cases, widening, hindering the achievement of the African Telecommunications Union's mission "to achieve universal service and access to broadband". This has a negative effect on the cross-cutting contribution that information and communication technologies (ICTs) can make to the achievement of the Sustainable Development Goals, including and poverty eradication.

Historically, rural South Africa has been underserved in terms of telecommunication services. This situation has prevailed into the era of broadband connectivity for various reasons. Notwithstanding the National Development Plan's vision of a "dynamic and connected vibrant information society and a knowledge economy that is more inclusive, equitable and prosperous", market failure, the slow pace of implementing SA Connect (the national broadband policy adopted by Cabinet in 2013), the splitting of the old Department of Communications, and a period of changes in political leadership may also be attributed to the problem. Meanwhile, poverty, inequality and unemployment remain a stark reality for the rural poor. Decisive and holistic interventions are needed to address all elements of the digital ecosystem, not only in respect of access.

The situation requires stakeholders to take a fresh look at how the digital divide can be addressed. It requires innovative approaches and creative thinking from a policy and regulatory perspective.

This policy brief therefore makes a case for how a community networks model may be harnessed to address the rural digital divide.

1.1 Access to affordable communications in South Africa and Africa

According to the International Telecommunication Union (ITU), in 2017 Africa was at the tail of ICT usage in the world, with just above 20% of the population having access to the Internet, and over 20% without access even to basic voice communications¹. Even if they have access, many people face cultural, economic and social barriers to communicating through ICTs. In 2015, the ITU concluded, "a monthly fixed broadband package cost 1,7% of average income in developed countries, compared with 64% of average income in Africa". Similarly, "mobile broadband cost 1-2% of monthly income in developed countries, compared with 11-25% of monthly average income in developing countries"². According to a 2016 study published in Information Technology and Development, in rural areas the problem of affordability is even more pronounced, with communication costs being as high as 22% of monthly income³.

South Africa fares slightly better in terms of Internet penetration; 53% of the population has access to it. This may appear to be positive, but a recent study indicates "increasing Internet connections suggests a bridging of the digital divide yet, as more people are connected, digital inequality paradoxically increases. Inequality exists not only between people online and offline, but also between those who have the skills and financial resources to use the Internet optimally, and those who do not."⁴

Studies indicate that most Internet and basic telephony usage in Africa occurs via mobile phones, but that "after steady growth in the decade to 2015, the level of uptake for Africa has been relatively stable during the past two years"⁵. This trend is not expected to change as the mobile network operators currently struggle to find economic viability in markets with subsistence level incomes and/or in sparsely populated regions with high infrastructure costs. The GSMA, an association of mobile network operators worldwide, acknowledges that with their current model it will take at least seven years (until 2025) to connect the next billion people to the Internet, leaving many more (30% of the world population) still unconnected⁶. Various attempts to address this problem

¹ https://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2017/MISR2017_Volume1.pdf

² <https://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2015/MISR2015-w5.pdf>

³ <https://www.tandfonline.com/doi/full/10.1080/02681102.2016.1155145>

⁴ https://researchictafrica.net/wp/wp-content/uploads/2018/09/after-access-south-africa-state-of-ict-2017-south-africa-report_04.pdf

⁵ https://www.itu.int/dms_pub/itu-s/opb/pol/S-POL-BROADBAND.17-2016-PDF-E.pdf

⁶ <https://www.gsma.com/mobileeconomy/>

through universal service strategies, universal service funds, private sector initiatives or philanthropy have met with limited success.

1.1 What are community networks?

Telecommunications infrastructure installed, maintained and operated by the community (or some of its members) to meet their own communication needs are referred to as community networks (CNs). The model is similar to Catalonia's guifi.net (a free, open and mostly wireless telecommunications community network), which describes itself as a “bottom-up, citizenship-driven technological, social and economic project with the objective of creating a free, open and neutral telecommunications network based on a commons model. The development of this common-pool infrastructure eases the access to quality, fair-priced telecommunications in general and broadband Internet connections in particular, for everybody. Moreover, it generates a model for collaborative economic activity based on proximity and sustainability”⁷.



Community networks enable historically disadvantaged communities, many of which are in rural areas, to obtain the technical and related skills, including support, to install, manage and operate their own electronic communications services and infrastructure. Of all the available options, bottom-up locally developed communications infrastructure and alternative local access infrastructure models like CNs are proving to be particularly effective in realising the goal of universal and affordable access to ICTs.

In addition to providing affordable connectivity in places where there was none, or where it was not affordable, CNs contribute to the empowerment of marginalised populations by fostering the local economy, creating local employment, developing technical and entrepreneurial skills, and contributing to the social cohesion of the communities they serve.

There are instances of CNs all over the world, in both urban and rural environments, and in developed and developing countries. In Africa, a recent survey was able to identify 37 CN initiatives in 12 African countries, of which 25 are considered active⁸. Representatives from these communities have been meeting since 2016 to share experiences and learn from one other and from other stakeholders. The Third Summit on Community Networks in Africa was hosted by Zenzeleni Networks in the Eastern Cape in September 2018. The event was attended by more than 100 people from 20 different countries (13 from Africa)⁹.

In South Africa, more than 20 community networks were identified in 2016¹⁰. However, this number has increased; representatives of 15 new South African communities attended the 2018 Summit. Zenzeleni Networks is one of the new CNs, and a good example of how a typical rural community can provide digital connectivity for the village.

1.3 Zenzeleni Networks: A South African rural community network

Zenzeleni is a social innovation ecosystem through which rural communities have ownership of their telecommunication businesses, allowing them to maximise value and benefits. Based on postgraduate research at the University of the Western Cape (UWC), the spin-off is a partnership with the Mankosi community, in one of the most disadvantaged areas of the Eastern Cape.

A non-profit company, Zenzeleni Networks, serves as a facilitator to ensure that the needs of the community are met. The first Internet service provider in this ecosystem, Zenzeleni Networks Mankosi Co-op Ltd, has connected more than 13 000 people and 10 institutions, offering prices as much as 20 times lower than those offered by existing operators. In addition, it is able to provide a network service of significantly better quality than the large network operators. Zenzeleni Networks Mankosi is a 100% black-owned, 40% women-owned telecommunications co-operative, which has been legally sanctioned by the Independent Communications Authority of South Africa (ICASA) and holds electronic communications service (ECS) and electronic

⁷ https://guifi.net/en/what_is_guifinet

⁸ <https://www.internetsociety.org/doc/cnafrica>

⁹ <https://www.internetsociety.org/events/summit-community-networks-africa/2018/>

¹⁰ <https://www.internetsociety.org/doc/cnafrica>

communications network service (ECNS) exemptions. Currently, ways of scaling up the model are being investigated, and the incorporation process for a new co-operative, Zenzeleni Networks Zithulele, is under way.

Zenzeleni Networks, with its founding partner the UWC, has also taken an active role in advocacy. It has made submissions¹¹ and presentations¹² at the Telecommunications and Postal Services Portfolio Committee's 2016 public hearings on the "Cost to Communicate in South Africa", showing that historically disadvantaged people are promoting the universal provision of electronic communications networks and electronic communications services and connectivity for all. More recently, together with Association for Progressive Communications and UWC, it made a submission at the public consultations on the Electronic Communications Amendment Bill¹³, and participated in the workshop in Pretoria in March 2018¹⁴.

The South African government, in particular the Department of Telecommunications and Postal Services (DTPS) and the Department of Science and Technology (DST), have indicated support for the CN model. During her speech at the DTPS Budget Vote to Parliament on 17 May 2018, the Deputy Minister of Telecommunications and Postal Services, Ms Stella Ndabeni-Abrahams, stressed the importance of CNs. Her statement¹⁵ highlighted that the community ownership model advances components of the ITU's ICT Development Index and the development goals set out in South Africa's National Integrated ICT Policy White Paper¹⁶. She stated, "The [CN] model further addresses the key barriers for universal access which the department's Internet for All project seeks to address." The DTPS has established a steering committee involving the relevant state-owned entities to pursue further development of CN co-operatives as one element of operationalising its 2017 ICT Small, Medium and Micro-enterprise (SMME) Development Strategy. Since March 2018, the DST, through the Technology Innovation Agency (TIA), has funded Zenzeleni Networks to investigate how a CN model could be expanded to other South African communities.

2. Policy and regulatory frameworks

South Africa has several policy and legislative elements pertinent to the CN model, including the following:

- National Development Plan (11 November 2011, the Presidency).
- Electronic Communications Act, 2005 (Act No. 36 of 2005).
- Electronic Communications Amendment Bill (*Government Gazette* No. 41880, 31 August 2018).
- National Integrated ICT Policy White Paper (*Government Gazette* No. 40325, 3 October 2016).
- ICT SMME Development Strategy (*Government Gazette* No. 41243, 10 November 2017).
- National e-Strategy (*Government Gazette* No. 41242, 10 November 2017).
- National Small Enterprise Act, 1996 (Act No. 102 of 1996).
- South Africa Connect: Creating opportunities, Ensuring Inclusion: South Africa's Broadband Policy (*Government Gazette* No. 37119, 6 December 2013).

This section demonstrates how the implementation of a CN model will advance specific aspects of this policy and legislation.

2.1 Rural digital divide

The inadequate connectivity in rural South Africa is acknowledged in the National Development Plan, South Africa Connect, and the 2015 National ICT Advisory Review Panel Report. The National Integrated ICT Policy White Paper (p 66) reads as follows:

The National Development Plan (2012) ("NDP"), South Africa Connect: the National Broadband Policy and Strategy (2013) ("SA Connect") and the recommendations captured in the National ICT Advisory Review Panel Report (2015) ("ICT Panel Report") have identified that, despite the policy and regulatory framework, network roll-out is skewed towards

¹¹ https://www.apc.org/sites/default/files/Policy%20brief%20Cost%20to%20Communicate_13092016_FOR%20SUBMISSION.pdf

¹² <https://pmg.org.za/committee-meeting/23322/>

¹³ https://www.apc.org/sites/default/files/Zenzeleni_APC_UWC_Submission_ECAA_2017.pdf

¹⁴ https://www.apc.org/sites/default/files/Zenzeleni_APC_UWC_-_ECA_A_Workshop_1.pdf

¹⁵ <https://africanewswire.za.com/deputy-minister-stella-ndabeni-abrahams-telecommunications-and-postal-services-dept-budget-vote-2018-19/>

¹⁶ https://www.dtps.gov.za/images/phocagallery/Popular_Topic_Pictures/National_Integrated_ICT_Policy_White.pdf

urban areas – and the prospects of providers rolling out modern broadband services in rural and less affluent areas without government intervention are minimal.

 According to the National Integrated ICT Policy White Paper, the main challenges that have underpinned the rural digital divide include an ineffective policy regime, the concentrated broadband infrastructure market and the high cost to communicate. There have been some endeavours in the past to address the rural divide. Chapter 14 of the Electronic Communications Act was specifically designed to address universal service and access in South Africa. However, the failure of the Chapter 14 regulatory mechanisms is well known and acknowledged in the White Paper.

This situation of failure requires innovative models to address lack of access in rural areas. According to SA Connect, a community network ecosystem like that demonstrated by Zenzeleni is one of the options for closing the digital divide. A model like this also addresses the important matter of affordability, as was demonstrated at the "Cost to Communicate" public hearings held by the Parliamentary Portfolio Committee on Telecommunications and Postal Services¹⁷. This is in line with Recommendation 19 of the Final Report of the World Telecommunication Development Conference in Dubai in 2014, which includes the statement that “business models which can achieve financial and operational sustainability can be operated by local entrepreneurs supported by a variety of initiatives”¹⁸.

2.2 ICT SMME growth

Another intervention proposed in the National Integrated ICT Policy White Paper (Chapter 12, ICT Industry Growth) concerns the growth of small, medium and micro-enterprises (SMME) in the ICT sector. This is taken further in the DTPS ICT SMME Strategy, which states that the SMME sector has been identified as an important strategic sector in the overall policy objectives of the Government of South Africa, and is seen as a driver of change for inclusive economic growth, national development, employment creation and poverty reduction.

 The ICT SMME Development Strategy (p 1) “focuses on accelerating the development and growth of small enterprises in the ICT sector”. The scaling of a CN model across rural South Africa can potentially contribute to the envisaged SMME growth.

Zenzeleni Networks, the umbrella support organisation, and Zenzeleni Networks Mankosi (the local co-operative that operates the network) fall into the category of micro-enterprises in terms of the definition of small business in the National Small Enterprise Act (adopted in the ICT SMME Development Strategy), i.e. “a separate and distinct business entity, including co-operative enterprises and non-governmental organisations, managed by one owner or more which, including its branches or subsidiaries, if any, is predominantly carried on in any sector or subsector of the economy mentioned in column I of the Schedule and which can be classified as a micro-, a very small, a small or a medium enterprise”.

The National Small Enterprise Act categorises SMMEs broadly as follows:

Enterprise size	Annual turnover (SA rand)	Number of employees
Medium	Up to R26 million	Up to 200 employees
Small	Up to 13 million	Up to 50 employees
Very small	Up to R3 million	Up to 20 employees
Micro	Up to R0,2 million	Up to 5 employees

2.3 Advancing the objects of the ECA

Zenzeleni is unique in its focus and ability to achieve objects of the Electronic Communications Act (ECA) that, in our opinion, have not seen sufficient progress since the inception of the Act. These objects include the following:

¹⁷ <https://pmg.org.za/committee-meeting/23322/>

¹⁸ <https://www.itu.int/en/ITU-D/Conferences/WTDC/Documents/D-TDC-WTDC-2014-PDF-E.pdf>

- To promote the universal provision of electronic communications networks and electronic communications services and connectivity for all – section 2(c).
- To promote the empowerment of historically disadvantaged persons, including black people, with particular attention to the needs of women, opportunities for youth and challenges for people with disabilities – section 2(h).
- To develop and promote SMMEs and co-operatives – section 2(p).

2.4 Universal service and access and the true access gap

The CN model also supports the National Integrated ICT Policy White Paper goals of addressing universal service and access deficits. The White Paper (p 31) states that –

Achieving [universal access] will require ... appropriate relevant targeted public intervention to address market failure which is evidenced by the true access gap and smart subsidy zones.

In this regard, we argue that a CN is an intervention with significant potential to address the access gap in rural South Africa. There is a broad consensus that the true access gap is in rural South Africa, and the Zenzeleni CN model demonstrates how a typical rural gap may be closed.

Community networks are akin to the “community innovations” promoted in the White Paper (Chapter 12, Industry Growth). Zenzeleni received an award for South Africa’s Best Innovation with Social Impact at the Technology Innovation Agency’s most recent Innovation Bridge technology matchmaking event (2017)¹⁹, and a Finalist Award in the Equal Rating Innovation Challenge by the Mozilla Foundation²⁰.

3. Bottlenecks and challenges in the current policy regime

3.1 Licensing framework

The registration, transfer and granting of service licences and licence exemptions in South Africa is performed by the Independent Communications Authority of South Africa (ICASA) in accordance with the provisions of the ECA²¹. Recent changes to the ECA were introduced by the 2014 Electronic Communications Amendment Act²². According to ICASA, applications are processed five to seven weeks after reception. In South Africa there are two categories of licences for electronic communications:

- Electronic Communications Service (ECS) licences allow the holder to provide licensed services (such as the provision of voice and data services) to customers over its own or over another licensee’s network.
- Electronic Communications Network Service (ECNS) licences allow the holder to establish and operate a network. ECNS licensees are also able to enter into commercial arrangements with other ECNS licensees in order for the former to benefit from the use of the network owned and operated by the latter.

ECS and ECNS licences can be awarded in either individual or class categories. Individual ECNS licences are national in scope, and class ECNS are regional, e.g. for a district municipality. Individual ECS licences are required from those services consisting of voice telephony using numbers from the national numbering. For other services, a class license suffices.

(a) Licensing fees and compliance

A local telecommunications operator does not intend to cover a national area, so it does not require an individual ECNS. It does not require an individual ECS either, because it is not required to use numbers from the National Numbering Plan. The registration of each class ECS and class ECNS licence has an initial registration fee of R12 187, so if both are needed then the fees total R24 374. There is also a renewal renovation fee of R6,094 after 10 years. If one builds infrastructure in two different municipal districts, then two separate class ECNS are

¹⁹ <https://www.innovationbridge.info/ibportal/?q=content/landline-cellphone-internet-plan-empowers-communities-their-terms>

²⁰ <https://equalrating.com/innovative-solutions/>

²¹ RSA. Electronic Communications Act. South African *Government Gazette*, 490(28743), 2006.

²² RSA. Electronic Communications Act (36/05): General Licence Fees Regulation, 2012. South African *Government Gazette*, 573 (36323), 2013.

required²³. Additionally, if any of the licences generate revenue, the holder needs to pay an annual fee. The amount of the contribution is based on the revenue obtained by the holder. For the lowest group (US\$0 to 5 million), which is the most likely for a local telecommunications operator, the annual fee is 0,15% of that revenue²⁴. If exempted from holding a licence, the operator is also exempt from paying registration, renewal and annual fees.

(b) Licence exemptions

The following are exempt from holding an ECS licence²⁵:

- A person or company who provides ECS on a non-profit basis.
- A reseller who provides ECS duly obtained from another licensee.
- A person who provides an ancillary service, i.e. a single retail service or a bundle of retail services which do not amount to an ECS and include necessary but incidental elements of an ECS, where such ECS elements do not constitute the major purpose, utility or value of the service, including tracking, alarm and similar services.

The following are exempt from holding an ECNS licence²⁶:

- A small electronic communications network, i.e. a network that lies within a limited area, and is used by a specific user group (and should use frequencies which are licence exempt).
- A private electronic communications network (PECN), i.e. a network used primarily for providing electronic communications for the owner's own use. Where a PECN resells, leases or otherwise makes available any spare capacity on its network to a third party, such resale, lease or other provisioning of spare capacity is subject to additional regulations.

(c) Licence exemptions: The Zenzeleni case

In the Zenzeleni case there are two layers that need to be considered in respect of licensing.

At local village level, an SMME co-operative exists, and it is deemed to be a network provider. Zenzeleni Networks Mankosi Co-op Ltd has been legally sanctioned by ICASA with licence exemptions for both the ECS (as it is not-for profit) and ECNS (as it is considered a PECN). Other co-operatives supported by Zenzeleni Networks will follow a similar approach. It is expected that they will be legally sanctioned too. However, it should be noted that the concept of the PECN is being stretched, as the citizens of a rural village do not, strictly speaking, comprise a private entity.

 A new category for community networks licences should therefore be considered. Other countries such as Argentina have passed resolutions to address similar problems²⁷.

The second layer is the facilitating entity, namely, non-profit company Zenzeleni Networks. Such a facilitating entity also requires licence exemption in order to liaise with wholesale providers and to share the bandwidth with the different co-operatives. This is critically important in order to facilitate a potential scaling up of the CN model. However, although Zenzeleni Networks applied for its licence exemption on 26 February 2018, it has not yet received an answer from ICASA.

 If we are serious about addressing the rural divide, we need an enhanced process to ensure that licence exemptions are processed more quickly.

3.2 Spectrum regulations

²³ RSA. Electronic Communications Act (36/05): General Licence Fees Regulation, 2012. South African *Government Gazette*, 573(36323), 2013.

²⁴ RSA. Electronic Communications Act (36/05): General Licence Fees Regulation, 2012. South African *Government Gazette*, 573(36323), 2013.

²⁵ RSA. Regulations Regarding Licence Exempt Electronic Communication Networks. South African *Government Gazette*, (31289), 2008.

²⁶ RSA. Regulations Regarding Licence Exempt Electronic Communication Networks. South African *Government Gazette*, (31289), 2008.

²⁷ <https://www.boletinoficial.gob.ar/#!DetalleNorma/190061/20180817>

ICASA also regulates the use of radio spectrum in South Africa²⁸. Most bands require a licence, but there are exemptions. Depending on the band, both cases are of interest for community networks, as explained below.

(a) Licence-exempt for access and backhaul

Although the use of the bands described below does not require a licence, the use and possession of all forms of radio apparatus that operate in those bands should still comply with the following requirements²⁹:

- Each radio apparatus should be type approved by ICASA.
- The technical characteristics of type approved devices (frequencies, transmission power and external high-gain antenna) may not be altered without a new type approval certificate issued by ICASA.
- The devices should be operated within, and not exceed, the technical parameters set out by ICASA. This includes the specification of the maximum power radiated in a given direction that each device can transmit in a given frequency. The latter is specified in most regulations as the effective isotropic radiated power (EIRP)³⁰, measured in decibel-milliwatts (dBm).
- The antenna should always be used at the lowest average height at which the device will still work effectively.
- The user should operate on a secondary basis, i.e. should not cause interference on another licence holder.
- The user will receive no protection from interference from ICASA.

(i) Wi-Fi bands

The leading success story of licence-exempt spectrum is its use in the 2,4 GHz and 5 GHz bands, particularly for Wi-Fi communication. Over 200 wireless Internet service providers operate in South Africa, giving access to more than 160 000 users, with an annual turnover of R5 billion. This includes most community networks. Many municipal public access initiatives use these frequencies too.

The table below provides a description of the regulated output power in the bands used by Wi-Fi in South Africa, as well as in Canada and the United States.

Country	2 400-2 483,5 MHz		5 150-5 250 MHz		5 250-5350 MHz		5 470-5 600 MHz		5 600-5650 MHz		5 650-5 725 MHz		5 725-5 850 MHz	
	EIRP	Tx power	EIRP	Tx power	EIRP	Tx power	EIRP	Tx power	EIRP	Tx power	EIRP	Tx power	EIRP	Tx power
South Africa	20 dBm		23 dBm		20 dBm		30 dBm				30 dBm		36 dBm (PIP 53 dBm)	30 dBm
United States of America	36 dBm in PIMP. PIP of 1 dBm less in Tx power per 3 dBi increase in antenna gain above 6 dBm	30 dBm	36 dBm in PIP & 53 in PIMP	30 dBm	30 dBm	24 dBm	30 dBm	24 dBm	30 dBm	24 dBm	30 dBm	24 dBm	36 dBm in PIMP and no limit in the antenna gain in PIP	30 dBm
Canada	36 dBm in PIMP and no limit in the gain in PIP	30dBm	23 dBm indoor only		30 dBm	24 dBm	30 dBm	24 dBm			30 dBm	24 dBm	36 dBm in PIMP and no gain limit in PIP	30 dBm

The table above shows a great disparity in the power levels allowed for the different bands in which Wi-Fi devices operate. This disparity is based on the bands being regulated simultaneously for fixed infrastructure, namely, point-to-point (PtP) and point-to-multipoint (PtMP) and user access (hotspot), with most countries limiting the output levels to reduce interference in user access mode. Few countries make this distinction obvious by having distinct regulation for PtP links, where the use of higher gain antennas and their narrower beam reduces the interference with adjacent devices automatically.

²⁸ RSA. Final Radio Frequency Spectrum Regulations. South African Government Gazette, 597(38641), 2015.

²⁹ RSA. Final Radio Frequency Spectrum Regulations. South African Government Gazette, 597(38641), 2015.

³⁰ When setting transmission power limits, regulatory agencies generally use equivalent isotropically radiated power (EIRP) as a measure of power. EIRP refers to the actual power radiated by the antenna element as opposed to simply the power output of the radio.

 The impact of this approach for extending connectivity in rural areas cannot be underestimated. For instance, Canada’s specific regulations for 2,4 GHz enable links above 30 km in PtP with existing hardware³¹, whereas South Africa’s regulations only allow links of about 2 km. In the 5,8 GHz band, Canada, the United States of America and South Africa make the distinction between fixed infrastructure and user access mode. Note that the lower the frequency, the further it travels, so making this allowance for 2,4 GHz has a greater impact than for 5,8 GHz.

(ii) Millimetre wave bands

In addition to the traditional Wi-Fi licence-exempt bands, there are other bands that can currently be used without a spectrum licence in many countries. Of particular interest are the extremely high frequency millimetre waves, in the 24 GHz and the 60 GHz bands. The table below shows how these bands have been regulated in South Africa as compared to Mexico and the United States.

Country	24,05-24,25 GHz		57-64 GHz		64-71 GHz		71-76 GHz		81-86 GHz	
	EIRP	Tx power	EIRP	Tx power	EIRP	Tx power	EIRP	Tx power	EIRP	Tx power
Mexico			82 dBm (if gain less than 51 dBi, 2 dBm less Tx power for each dBi below)				85 dBm	35 dBm	85 dBm	35 dBm
South Africa			55 dBm (40dBm up to 66 GHz)	10 dBm						
United States of America	Gain should be at least 33 dBi	0 dBm	82 dBm (if gain less than 51dBi, 2 dBm less Tx power for each dBi below)		82 dBm (if gain less than 51dBi, 2 dBm less Tx power per each dBi below)					

Given the regulations in Mexico and the United States, links of about 2 km are technically possible in the 60 GHz band³², which could be used by some small operators to provide “fibre-like” experience to their customers. In the 24 GHz band, the United States allows licence-exempt use of 200 MHz between 24,05 and 24,25 GHz for PtP links. This establishes another wireless alternative for fibre-like speeds for up to 6 km³³.

 With the requirement of higher gain antennas for 60 GHz (51 vs 33 dBi), higher gain antennas are expected for 24 GHz equipment too. These high gains result in extremely narrow beams that make interference with other devices very unlikely, making licensing unnecessary. In this regard, more regulators and policy makers should look at enabling the use of these bands on a licence-exempt basis.

(iii) TV white spaces

South Africa has been a global pioneer in the piloting of dynamic spectrum technologies such as TV white spaces (TVWS). South African research³⁴ in this area has directly influenced United States regulation of TVWS technologies. In addition, the Council for Scientific and Industrial Research (CSIR) has developed a Geo-location Spectrum Database³⁵ for managing the deployment of these technologies, which meets stringent international standards developed by the UK telecommunications regulator. This technology is particularly relevant for South Africa for two reasons. The first is that the frequencies used by TVWS technologies are particularly well-suited to rural access where affordable and pervasive access to broadband remains a challenge.

³¹ <https://www.ubnt.com/airmax/rocketdish-antenna/>

³² In addition to the usual link budget calculations at these frequencies, it is also necessary to consider vapour absorption, which bring losses of 20 dB/km. See <http://frankrayal.com/2013/08/12/new-fcc-rules-give-60-ghz-a-boost/>.

³³ Although longer distances are possible in dry environments, heavy rain can render the link unstable or unusable beyond the distances mentioned above: <https://help.ubnt.com/hc/en-us/articles/204977614-airFiber-Rain-fade-effects-on-AF24-24HD-links>

³⁴ TV white space for South Africa – <http://www.ee.co.za/article/tv-whitespace-south-africa.html>

³⁵ CSIR TV White Space Database http://whitespaces.meraka.csir.co.za/about_page.jsp



The second is that this technology re-uses empty television broadcast channels, which are largely unused in rural South Africa.

In March 2018, ICASA gazetted Regulations on the use of TVWS spectrum³⁶. This means that, subject to type approval and authorisation through a geo-location database, TVWS wireless communication equipment can legally be used in South Africa. While this is a big step from a regulatory perspective, it does not yet enable licenced operators to deploy TVWS technology, as the regulator also needs to sanction a geo-location database service provider.

South Africa's TVWS regulations differ slightly from regulations elsewhere in that they require all TVWS equipment to include a built-in GPS and all installations to be carried out by an installer of wireless equipment in possession of a radio dealer certificate, or by a professional radio technician, registered with the institute of Electrical Engineers

(iv) Zenzeleni's case with licence-exempt spectrum

Currently, the entire infrastructure of Zenzeleni Networks is built using licence-exempt spectrum in Wi-Fi bands. In particular, most of the bands in the 5 GHz band are used for the backhaul network, and the 2,4 GHz band is used for the access network.

(b) Licenced spectrum for mobile network services

Low-cost alternative GSM technologies have existed for some time and there are a variety of start-ups in this space, including NuRAN³⁷, Fairwaves³⁸, Facebook's OpenCellular and others. Manufacturers like NuRan Wireless are producing low-cost radio systems that can serve as robust platforms for initiatives like Osmocom,³⁹ which provide an open-source alternative to proprietary software for the management and operation of GSM networks. This makes it possible to put up a GSM base station for a few thousand dollars. We are now seeing these innovations coming to LTE (Parallel Wireless, Baicells) and as the user devices permeate rural areas, the technology presents a great opportunity for small-scale operators and community networks.



What constrains small operators and community networks from taking advantage of these innovations is the fact that the popular GSM spectrum bands have largely been assigned to existing mobile network operators.

(i) Spectrum sharing for rural mobile operators

In South Africa, the spectrum required to provide mobile phone services, especially from 900 MHz to 1 800 MHz, is fully allocated to six mobile network operators, as shown in the figure below⁴⁰.

³⁶ Regulations on the Use of Television White Spaces 2018. ICASA. <https://www.icasa.org.za/legislation-and-regulations/regulations-on-the-use-of-television-white-spaces-2018>

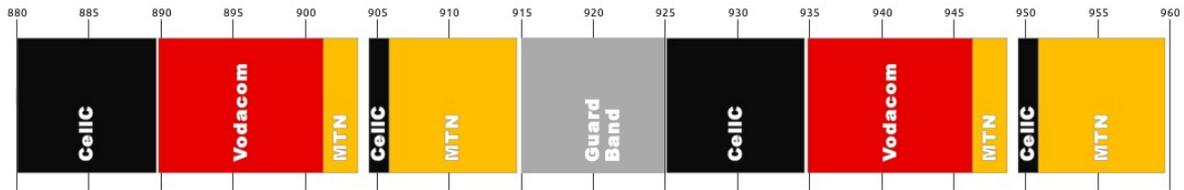
³⁷ <http://nuranwireless.com/>

³⁸ <http://fairwaves.co/wp/>

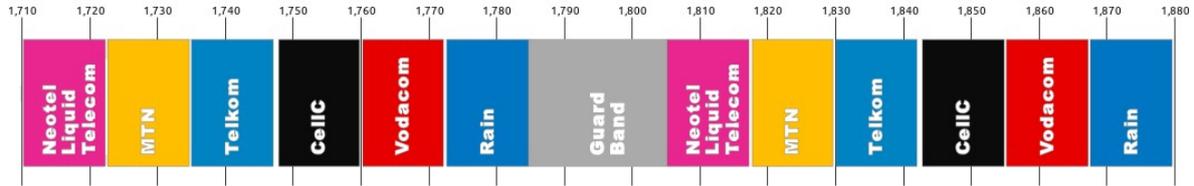
³⁹ <https://osmocom.org/>

⁴⁰ <https://opentelecomdata.org/spectrum-chart/>

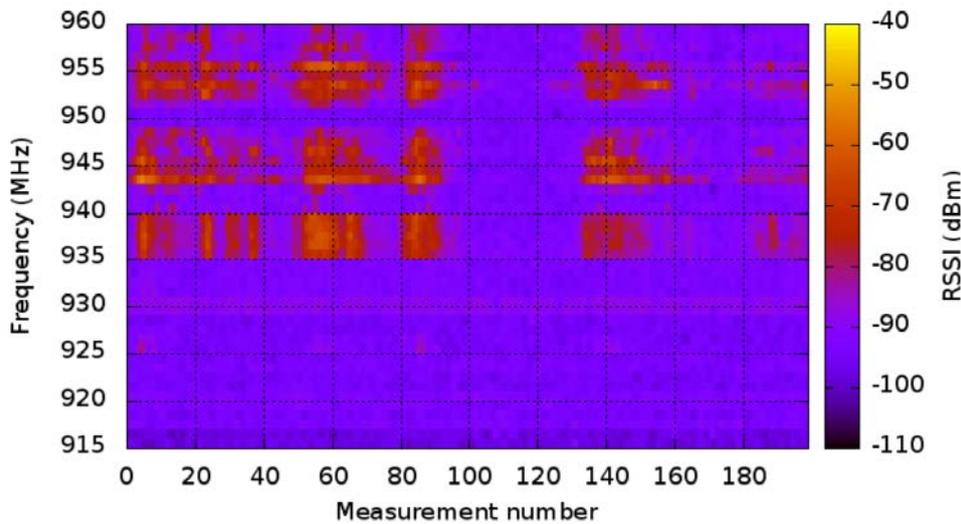
900 MHz Band



1800 MHz Band

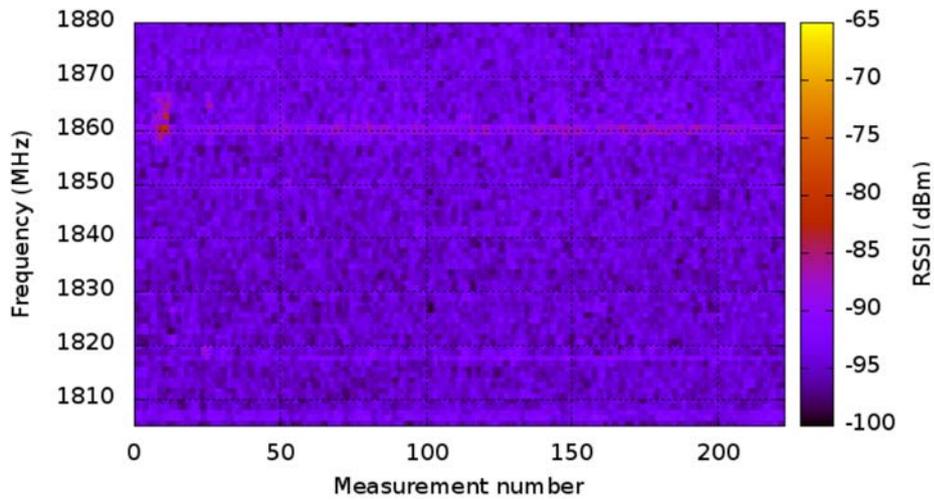


However, despite the debates around spectrum scarcity in the country, large amounts of spectrum bands dedicated to mobile communications are unoccupied in rural areas⁴¹. The figure below shows measurements of spectrum occupancy of the 900 MHz band carried out in a rural part of the Eastern Cape. Where there are no reddish marks, the band is not being used. When compared to the spectrum allocations above, one can see that the assignments to Cell C are technically unused.

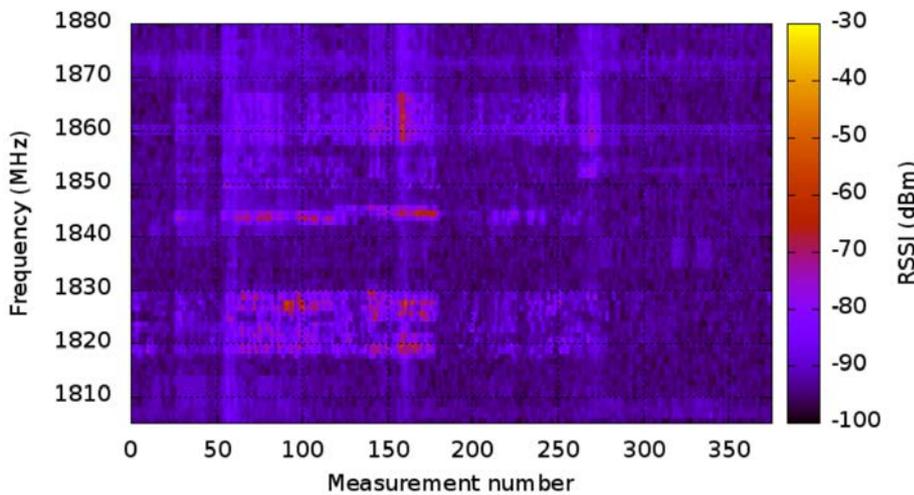
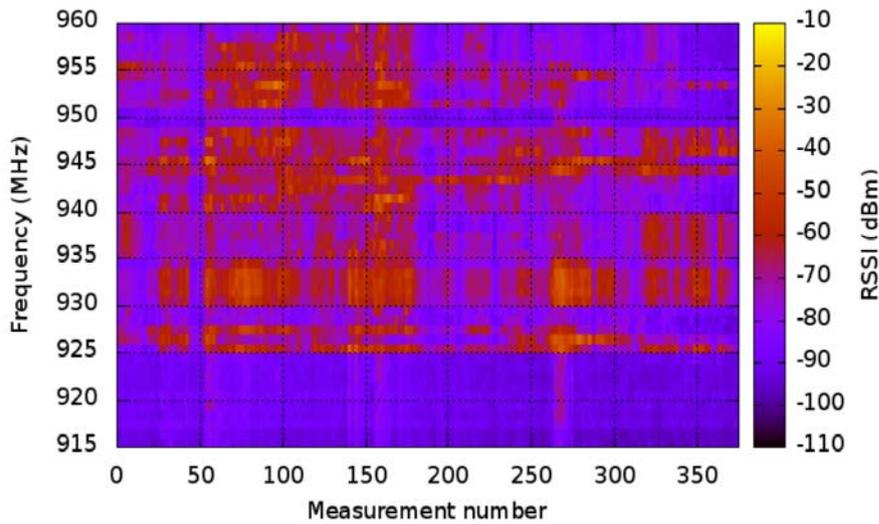


In the case of the 1 800 MHz band, it is clear that only Vodacom is using this spectrum.

⁴¹ Data collected using RF Explorer 6G Combo (<http://rfexplorer.com/models/>) and the GSM Track app (<http://wireless.ictp.it/gsm/gsmtrack/GsmTrack.apk>) created by the International Centre for Theoretical Physics, while driving in rural Eastern Cape, South Africa, between the Mthatha and Mdumbi river mouths. More information and results can be found at <http://wireless.ictp.it/gsm>.



But this lack of usage of spectrum outside urban areas does not only happen in deep rural South Africa. The figures below show the spectrum usage on the N2 between East London and Mthatha.



Cell C is hardly using the 1,4 MHz to 950 MHz band. Telkom, Rain and Neotel are not using their assignments in 1 800 MHz in the entire area, and use by Vodacom, MTN and Cell C in this band is sporadic.

 At present, for this unused spectrum to be used, a prior agreement needs to be reached with one of the licence-holders of the spectrum. Additionally, an application to ICASA is required for approval of a spectrum sharing agreement in terms of the 2015 Radio Frequency Spectrum Regulations.

(ii) A case for spectrum allocations for rural mobile operators

Mexico is the only country in the world where a fraction of the spectrum dedicated to mobile network services has been set aside specifically for the use of small operators and community networks in underserved regions. After a successful pilot by Rhizomatica in Oaxaca⁴², the Mexican communication regulator (IFETEL) analysed the assignments in the 850 MHz band and concluded that there was a small amount of spectrum that remained unassigned. The modest amount of spectrum available meant that it was of little value to commercial operators. As a result, in IFETEL's Annual Programme for the Use and Exploitation of Frequency Bands 2015⁴³, it assigned different slots per region for "social use"⁴⁴, in particular, 2 x 5 MHz of the 850 MHz spectrum in seven regions (excluding the urban areas of Guadalajara and Monterrey) and 2 x 2,54 MHz of spectrum in another region, provided that the spectrum is used in rural settlements with a population smaller than 2 500 people, and that the operator accepts that the regulator has the right to assign the spectrum for commercial use in the future.

Tecnologías Indígenas Comunitarias, a non-profit organisation based in the state of Oaxaca, Mexico, holds a concession as a social telecommunications operator, and currently serves more than 3 500 active daily users spread across 63 villages and communities in Oaxaca, with 2G voice and data services using 2 x 2 MHz. These users are served by 14 community-owned and operated cellular sites.

 The Mexico case demonstrates that it is possible to provide spectrum for small-scale rural operators such as community-owned co-operatives.

(iii) Wireless open access network

With the advent of the National Integrated ICT Policy White Paper, there has been substantive debate in South Africa on the merits of a wireless open access network (WOAN). Stakeholders who have argued against the WOAN believe that it will result in a repeat of the era which saw one provider with a monopoly first on fixed-line services, and then on the provision of ADSL for Internet connectivity.

From the perspective of a rural CN model, we would support a model of WOAN in which universal service obligations provide backhaul to rural areas at least. However, it seems unlikely that universal service obligations to provide network services at a rural community level will be successful, given that there has to date not been any success with underserved area licensees (USALs). The failure of the USAL model has been reported previously, including in a for example, by Gillwald (2006)⁴⁵ and Lewis (2013)⁴⁶. In 2016, the Institute for Race Relations also commented on the USAL saga⁴⁷.

⁴² http://www.dof.gob.mx/nota_detalle.php?codigo=5387867&fecha=06/04/2015

⁴³ <http://www.ift.org.mx/industria/espectro-radioelectrico/programa-anual-de-uso-y-aprovechamiento/programa-2015>

⁴⁴ Social use gives rights to use and exploit frequency bands in the radio-electric spectrum to provide telecommunication services for cultural, scientific, educational community services on a non-for-profit basis.

⁴⁵ Gillwald, A., 2005. A closing window of opportunity: Under-served area licensing in South Africa. *Information Technologies & International Development*, 2(4).

⁴⁶ Lewis, C., 2013. Universal access and service interventions in South Africa: best practice, poor impact: challenges in leadership of ICT policy and e-development. *The African Journal of Information and Communication*, (13), pp.95-107.

⁴⁷ See, for example, <http://www.polity.org.za/article/telecomsusal-2016-01-25>, which laments that only two of the 27 under-served area licensees were successful. It further asserts that the USAL programme failed because only a small part of the allocated funds being actually spent on building networks.

 It is important to note though that the WOAN is unlikely to focus on the least-served areas first, and complementary strategies such as those highlighted in preceding sections are therefore needed to address the rural divide in the meanwhile. When the WOAN is operating, it could serve a useful role in supporting CNs.

 It is also envisaged that the WOAN will receive priority in the assignment of high-demand spectrum. In this regard a social purpose licence for community networks to access part of the spectrum in the bands targeted by the WOAN would make it possible for communities to set up their own mobile broadband infrastructure.

It is therefore recommended that 2 x 5 MHz of spectrum in the 800 MHz band should be set aside for non-profit, black-owned, small operators when high-demand spectrum is assigned⁴⁸.

(iv) Spectrum usage fees for mobile telephony spectrum

Licensing of spectrum in the 800 MHz and 2,6 GHz bands should include “use it or share it” provisions allowing qualifying operators to access unused spectrum on a secondary basis.

Frequency bands for mobile telephony are licenced. This means that small operators and community networks wishing to provide mobile services must pay the corresponding spectrum usage fees. In most countries, these fees must be paid prior to gaining access to the spectrum.

In South Africa, there is a formula that determines the amount to be paid by the operator⁴⁹. This formula considers the centre frequency, the value of that band, geographic factors, the type of use (shared or exclusive), and the area and population covered, among other factors. This means that a national and a local operator could be charged the same fees.

(v) The case for Zenzeleni to access licenced spectrum for mobile services

Should mobile operators with assigned, yet unused spectrum in rural areas agree to share their spectrum, the annual licence fees for the slot of 1,4 MHz⁵⁰ in the 900 MHz band to cover a rural community with 2 000 potential users occupying an area of 40 km², e.g. Mankosi, would be only R700 a year. The low cost should make it feasible for a rural CN co-operative to afford this fee.

With this arrangement, sustainability modelling shows that a CN, such as Zenzeleni Networks, which provides voice rates 66% cheaper than the current main operator in the area, will only need to service half of the current outgoing calls from 500 users to make the service sustainable.

 This would reduce the cost of communicating in rural South Africa from 22% of monthly income to 3%.

Zenzeleni Networks has approached three of the four operators with assigned yet unused spectrum in rural areas, namely, Telkom, Cell C and Liquid. None of them has agreed to share their spectrum. This is an obstacle and a strong case has to be made to deal with how unused spectrum is allocated to CNs.

3.3 Increase transparency and visibility of data related to telecommunication infrastructure

As the value of being connected to communication infrastructure grows, those without access are increasingly being left behind. In order to ensure everyone has affordable access to communication, more transparency in the telecommunications sector is required so that there is a better understanding of who is unconnected and what opportunities exist to solve connectivity challenges. SMMEs, as well as policy makers and regulators, need tools and resources to create effective access strategies.

⁴⁸ Note that these recommendations were included in a written submission by Zenzeleni Networks and its partners on the Policy Directions to the Authority on Licensing of Unassigned High-Demand Spectrum, dated 8 November 2018.

⁴⁹ RSA. Amendment of the Radio Frequency Spectrum Fees, 2010 in terms of the Electronic Communications Act, 2005. South African *Government Gazette* No. 38642, 2015.

⁵⁰ A slot of this size allows for 4 non interfering channels in GSM, and it is the same size of the slot assigned but not used by Cell C in this frequency band.

 Transparency of data related to existing and planned network infrastructure (including fibre-optic network ownership, routes, technical specifications, tower heights and locations, and wireless spectrum assignments) is required. The lack of information and transparency makes it difficult for all actors, including civil society, the research community and the private sector to engage in solution-oriented dialogue with policy makers and regulators. Urgent steps are therefore needed to make provision for stakeholders to be able to access such data.

 A simple first step would be to normalise transparency regarding the assignment of spectrum frequencies. It is impossible to have a public debate on innovations in spectrum management without a clear understanding of current spectrum assignments and their terms and conditions.

The UK regulator, OFCOM, is a model of good practice⁵¹ in this regard, as is the Mexican regulator, IFETEL⁵².

 Another important step in transparency is public information regarding network towers and their occupancy. As ensuring affordable access to all the population becomes an increasingly important strategic priority, having a rigorous understanding of the limits of existing coverage becomes essential. Network operator coverage maps are useful tools, but require a mechanism for independent corroboration. Public access to information on tower location and occupancy is the simplest route to achieving that.

As with spectrum assignments, examples of good practice in this regard already exist. The Canadian regulator, ISED, publishes a downloadable database⁵³ of all towers and associated radios. In an excellent illustration of how useful open data practices can be, the data has been converted into a compelling and easy-to-use visual map by Steven Nikkel⁵⁴. In India, commercial operator Airtel has published a map⁵⁵ of all of their tower infrastructure under the slogan “Because you have a lot to say. And we have nothing to hide.” Both the Canadian and Indian instances provide potential best practice routes for South Africa.

 Transparency in the deployment of terrestrial fibre-optic infrastructure is important too.

Fibre-optic points of presence are very high capacity and very low-latency connections to the global Internet. Access to fibre for backhaul is often essential for full advantage to be taken of the innovations in spectrum management discussed in preceding sections. Yet it is rare for operators to publish detailed fibre maps. With few exceptions, governments and regulators have been slow to push for transparency in this area. Good practice in this area can be seen in operators like Dark Fibre Africa in South Africa, which has published a detailed fibre map⁵⁶ of its network since its formation over 10 years ago.

3.4 Telecommunications infrastructure as a common-pool resource

Another bottom-up spectrum management innovation comes from managing telecommunications infrastructure as a common-pool resource. The commons concept is an adaptation of the work of Nobel Prize winner Elinor Ostrom on the collective management of natural resources.

The commons model considers the backhaul infrastructure contributed by the different participants as a stock resource (like a forest) that, if nurtured properly, can sustainably provide the connectivity required by all participants. For this to work, clear mechanisms to recognise and compensate investments made by participants are needed, as are clear guidelines for conflict resolution. This would allow not only a more efficient way of managing the spectrum available for small operators and community networks, but also bring economies of

⁵¹ OFCOM Radiocommunications licences <https://www.ofcom.org.uk/manage-your-licence/radiocommunication-licences>

⁵² Instituto Federal de Telecomunicaciones: Registro Público de Concesiones <http://ucsweb.ift.org.mx/vrpc/>

⁵³ Government of Canada: Spectrum Management System Data http://sms-sgs.ic.gc.ca/eic/site/sms-sgs-prod.nsf/eng/h_00010.html

⁵⁴ Canadian Cellular Towers Map https://www.ertyu.org/steven_nikkel/cancellsites.html

⁵⁵ Airtel Open Network <https://www.airtel.in/opennetwork/>

⁵⁶ Dark Fibre Africa Coverage <http://www.dfafrica.co.za/network/coverage/>

scale to enable the reduction of costs to the final user. In many ways, this model provides a good framework for managing the proposed WOAN. Although many community networks around the world use this model, the most notable example of its implementation is guifi.net; more than 20 small operators have contributed over €8,5 million to a common-pool resource that is serving more than 100 000 users in Catalonia, Spain.

 The benefits of the commons model should be considered in the allocation of resources through universal access funds to provide affordable connectivity in areas not profitable to traditional commercial operators. The use of such funds should be premised on an economic model in which all infrastructure deployed with public funds is managed as a common pool resource, making it easy for others to contribute to and extend the resource.

However, one problem with this approach is South Africa's current regulatory framework, which does not allow collective ownership of infrastructure like the one required by the common-pool resource model.

3.5 Public funding for community networks (SMMEs) targeting universal access

Allowing a broader range of SMMEs, including those holding an ECS and an ECNS licence exemption, will certainly contribute to funding to “promote the universal provision of electronic communications networks and electronic communications services and connectivity for all” by empowering “historically disadvantaged persons, including Black people”. As included in the Recommendation 19 from the ITU Telecommunications Development Sector⁵⁷, additional mechanisms should be considered, such as making available dedicated funds from the Universal Service and Access Fund (USAF), or the digital development fund the DTPS proposes to replace USAF with, to enable SMMEs like Zenzeleni to gain market entry and remain sustainable.

 In this regard, the ECA should provide for funding to be allocated specifically for SMMEs, so that they can enter the sector and address the true access gap.

The Preferential Procurement Regulations of 2017 provide for government to set aside 30% of appropriate categories of state procurement for purchasing from SMMEs, co-operatives, and township and rural enterprises. The sustainability of community co-operatives would be greatly assisted if all state-owned facilities, e.g. clinics and schools, purchased connectivity from them.

In respect of funding, it should be acknowledged that the anticipated developmental outcomes from Internet connectivity will not emanate from the provision of infrastructure only. We have sufficient evidence of this in research conducted at UWC, and through our experience with Zenzeleni.

 We therefore advocate that future funding models take into account the ICT ecosystem, and that infrastructure, local content, and ICT uptake and adoption, is funded together. There is little or no evidence to date that funding from the Universal Service and Access Fund for infrastructure projects has led to developmental outcomes.

There seem to be other funding mechanisms, both private and public, available to fund social innovation, on which policy is largely silent. Social innovation has largely failed because innovation has been defined and largely funded under a Silicon Valley-type approach to technological innovation. Among these innovations are “futuristic” technologies (virtual and augmented reality, for instance), which require high-speed bandwidth. This seems to be at a remove from the reality in South Africa, where most people cannot access the Internet because they cannot afford to. Additionally, local mechanisms are generally restricted by the market logic that requires small-scale enterprises to scale up, which does not apply to spaces where the market has failed (most of the rural areas where the Zenzeleni model would apply).

 Thus, exploring alternative mechanisms to fund social innovations that work in and for these scenarios should be encouraged.

⁵⁷ <https://www.itu.int/md/D10-WTDC14-C-0038/es>

3.6 Infrastructure sharing: Implications for state-owned entities

Even if an SMME meets all the requirements of the regulatory framework and receives start-up funding, it is often impossible to provide sustainable affordable access in rural areas if there are no local backbones to provide backhaul connections, or if backhaul offered by existing providers is not affordable. Aside from the limited competition in this area, this is also often because infrastructure-sharing policies, which would minimise costs, are not in place or are not enforced.

Some fibre is deployed by government, but operators are often charged excessive rates for it, instead of the kind of prices that a public utility/enabler would charge.

 Similarly, access to existing passive infrastructure, such as the towers of mobile operators, the masts and poles of public broadcasters, and energy distribution grids, should be considered to extend affordable access into rural areas rather than as a revenue stream. Promoting and enforcing clear guidelines and transparent pricing models for infrastructure sharing will contribute significantly to this.

4. Context of grassroots innovation

In many other countries, grassroots and frugal innovation in the informal economy have gained ground, and in certain instances indigenous innovations have been documented. In general, in these situations, the innovation is rarely driven by formal research and development⁵⁸.

Recently, in its 2018 Draft White Paper on Science, Technology and Innovation (p 27) the Department of Science and Technology proposed adopting a broader conceptualisation of innovation, as follows:

The White Paper adopts a broader conceptualisation of innovation and its sources. This shift will recognise that the sources and nature of innovation go beyond R&D and radical innovation, and include imitative and incremental innovation, including design and engineering activities, on-the-shop-floor attempts to improve productivity, and investment in organisational learning, learning by doing, using and interacting, and observing what others are doing.

If the above policy proposition is implemented it will broaden the current definition by the National Advisory Council on Innovation (NACI), which currently defines innovation as “the process of transforming an idea, generally generated through R&D, into a new or improved service, product, process”.

We welcome a broadening of the definition. In the National Integrated ICT Policy Discussion Paper, specific mention was made of grassroots innovation. The document argued that innovation occurs in both the formal and informal sectors, and that while in the formal sector innovation generally leads to patents, design registration and related forms of intellectual property protection, there are also examples of innovation which have not followed the cycle of formal research and development, but which are realised in commercial markets.

 A community network model is an innovation in itself, but the development and extension of digital infrastructure will create a more fertile ground for other innovation, in areas which to date have not been typically viewed as places of innovative activity.

The ICT policy discussion paper notes that, in the current environment, there is little or no support for innovation in the informal economy in South Africa; further, that the growth of ICT infrastructure could provide an environment more conducive to innovation in the informal economy. We support this view, and therefore argue that the realisation of a model for community networks has the potential to create an enabling environment for grassroots innovation as communities harness the potential of broadband to find solutions for local problems.

⁵⁸ National Integrated ICT Policy Discussion Paper, November 2014.

This policy brief therefore endorses the draft White Paper on Science, Technology and Innovation (p 30) proposal that particular attention be given to supporting SMEs and co-operatives in informal settlements and rural areas, in pursuit of an inclusive innovation system.

5. Regional and global policy

The work done under the leadership of the DST and DTSP to develop community networks in South Africa could be adapted to benefit communities elsewhere in Africa. The government should therefore share South Africa's experiences in the regional and global policy forums in which it participates.

More explicit endorsement and support from governments and from communications regulatory authorities that have a track record in this area could play a much-needed catalysing role in the region. It would be particularly valuable if the DST and DTSP could contribute to the wording of regional and global policy resolutions related to community networks in order to facilitate discussions among governments, as well as with practitioners, researchers and other relevant actors.

During the course of 2018, Zenzeleni and the Association for Progressive Communications participated in two processes in order to further this goal:

1. The meeting of the United Nations Economic and Social Council's Commission on Science and Technology for Development (CSTD) in May 2018.
2. The preparatory meetings for the International Telecommunication Union (ITU) Plenipotentiary Conference in Dubai in October and November 2018.

At CSTD, thanks to the support from other member states, "community networks" are included as one of the emerging topics to consider in working to accomplish the World Summit on the Information Society goals⁵⁹. However, it is possible that, if the South African delegation had defended the text, a more favourable wording would have been included.

The 2018 ITU Plenipotentiary Conference was still to take place at the time this document was written, so its outcomes cannot be discussed. However, on 19 September 2018, the Association for Progressive Communications shared a briefing with DTSP outlining the work that other regions are doing towards the inclusion of favourable wording in the resolutions discussed there, and the positive impact that supporting such resolutions would have for the African region. With the leading role that South Africa has in the region, if its delegation champions these proposals, and the African delegation endorses them, the likelihood of them being formalised is very high.

Furthermore, civil society organisations are often included in government delegations from the Americas and Europe to advise on country positions. It would be helpful if South Africa considered a similar approach. At the time this document was written there was an open and ongoing conversation about the inclusion of a member of Zenzeleni in the South African delegation for the 2018 ITU Plenipotentiary Conference.

Other gatherings where a civil society presence in South African delegations could be useful are the ITU World Telecommunication Development Conference and the ITU World Radio Conference, as well as the study groups leading to them, or emerging from the resolutions approved in these global and regional policy spaces.

At a regional level, ICASA is member of the Communications Regulatory Authority of Southern Africa and chairs the working group on electronic communications. If the ideas in this policy brief were championed at this forum and others (e.g. the African Telecommunications Union and the African Union Commission), this would facilitate the development of CNs in Africa.

6. Advancing a community networks model: What we have learnt

⁵⁹ http://unctad.org/meetings/en/SessionalDocuments/E_res_2018_28_en.pdf

Over the period of our experience with Zenzeleni networks, the following have been identified as critical to the successful establishment of a rural community co-operative:

6.1 Facilitation and coordination

- (a) The state of the rural divide is such that communities need a catalyst to start a community network. In our experience, the notion of running an Internet service provider appears far-fetched to rural communities. An entity is therefore required to facilitate and coordinate the establishment of CNs. This should be a not-for-profit or non-governmental entity.
- (b) This organisation should comprise a board on which non-commercial stakeholders such as advocacy groups, academia and regulatory experts are represented. Community co-operatives should also be represented.
- (c) The board should provide strategic direction and oversight to the implementation arm of the organisation.
- (d) The implementation arm should undertake the following activities:
 - (i) Provide support to community co-operatives in addressing technical, legal, financial (business) and social barriers that arise.
 - (ii) Manage the overall community network as “commons”, with all infrastructure shared and owned by all.
 - (iii) Liaise with the rest of the national and international ecosystem within which the community network (CN) operates, e.g. in respect of managing government policies, working with other operators and seed funders, engaging new communities and sharing experiences with other CNs around the world.

6.2 Bottom-up community-driven processes

- (a) The “community” in a community network is central. From the outset, all processes should be bottom-up. If there is no buy-in from a community, the process cannot be foisted upon them.
- (b) Local support is critical in this regard, as represented by the tribal authority under which each village falls. In the case of Mankosi, the initial go-ahead for the establishment of the co-operative was given by the village tribal authority.
- (c) Community co-operatives should ideally be established through a democratic process. This is vital, as the co-operative plays a central role in managing the development of the digital ecosystem. For example, Zenzeleni Networks Mankosi is a locally owned co-operative based in a rural village in the Eastern Cape. It was registered with the Companies and Intellectual Property Commission in 2014. It is also a legally registered Internet service provider, with a licence exemption from ICASA to provide community-based Internet services. It focuses on providing connectivity and liaising at local level on matters such as user needs, retaining and reinvesting the network income into locally relevant development, etc.
- (d) While the co-operative plays a local management and oversight role, local champions should be trained and mentored by the facilitating not-for-profit entity. This is the first opportunity to create jobs in the community.

6.3 Integrated intervention that is beyond the access layer

Various Acts and policies, including the National Development Plan, stress the social and economic benefits of providing broadband connectivity. However, the realisation of benefits cannot be taken for granted. A rural connectivity programme requires a holistic intervention, which includes the adoption of ICTs, the development of local content, and training. For example, in Mankosi, through a skills intervention targeting rural youth, 15 students were able to register for higher education programmes. Without the benefit of affordable communication, these young people would probably not have been able to access post-school studies.

6.4 Seed-funding to ensure the sustainability of start-ups

- (a) There is consensus that rural communities will not be served by large commercial operators. If access to broadband is a human right, then government needs to intervene in the current market failure.
- (b) The current Universal Service and Access Fund, or a future digital development fund, should be used to provide start-up funding.

- (c) The costs of seed-funding connectivity start-ups are not exorbitant if one considers the approximately R5m per underserved area licensee spent in the early 2000s⁶⁰. Zenzeleni has demonstrated that a network can be established at a fraction of the cost. Once backhaul is in place, expanding the local network will be inexpensive. Current costs are approximately R8 000 per hotspot and, as technology improves, and with anticipated spectrum allocation to rural areas, few hotspots will be required to service an entire village.
- (d) A community co-operative could be sustainable within a reasonable period. The period will depend on factors such as the number of “anchor clients” in a village, but this model has more potential for sustainability than previous universal access programmes.
- (e) A sustainable, locally owned and managed co-operative will result in medium to long-term dignity and empowerment for a community that has few other development opportunities.

6.5 Community technology public access centres

- (a) A recent study indicates that there is a significant divide in the ownership of smartphones between urban and rural area dwellers. Only 33% of people in rural areas own a smartphone, compared to 54% in urban areas⁶¹. Thus, even if broadband connectivity is provided, at least two-thirds of rural people will not have a device to access the Internet.
- (b) Rural interventions will therefore also require the establishment of public centres where the community can access technology. This would give effect to the National Integrated ICT Policy White Paper's recommendation (p 152) that digital technology hubs be established.
- (c) The notion of public access centres is not a new universal access idea. The Universal Service and Access Agency of South Africa has rolled out such centres before, but they have been unsuccessful. A new community model underpinned by a local entrepreneurship business model will make a difference. Moreover, there is growing evidence of the benefits of public access centres⁶².

7. Policy recommendations

This section will summarise the key points made in the body of the document. Specific policy recommendations will be highlighted, before concluding comments.

7.1 Licensing community networks

- (a) The private electronic communications network concept is being stretched in terms of its relevance to citizens of a rural village who, strictly speaking, do not comprise a private entity. A new category for community networks licences should therefore be considered. This should include both co-operatives and the proposed not-for-profit coordinating entity.
- (b) If the rural divide is to be addressed with speed, the regulator should institute a faster process for CN licence exemptions.

7.2 Spectrum

- (a) Expand the recognition that Wi-Fi has two important but separate purposes in the 2,4 GHz band. These separate use cases can benefit from more specific regulation which recognises the need for higher power output levels for PtP links. This would amplify the impact of an already powerful access technology.
- (b) The success of Wi-Fi suggests that more spectrum should be opened up on a licence-exempt basis. In the United States and elsewhere, efforts to open the 6 GHz band for licence-exempt use show great promise.
- (c) Higher frequency bands should be considered for licence-exempt use for PtP backhaul. Other frequency bands for backhaul links such as 24 GHz and 60 GHz should be examined for their potential to offer low-cost, high-capacity wireless infrastructure to community networks and

⁶⁰ See <http://www.polity.org.za/article/telecomsusal-2016-01-25>

⁶¹ After Access State of ICT in South Africa https://researchictafrica.net/after-access-south-africa-state-of-ict-2017-south-africa-report_04/, July 2018

⁶² See, for example, Uys, C. and Pather, S. 2016. Government Public Access Centres (PACs): A beacon of hope for marginalised communities. *Journal of Community Informatics*, 12(1), 21-52.

small operators. Given their limited capacity to interfere with other links, extending the maximum power limits and reducing barriers to use should be considered.

- (d) The sanctioning of a TVWS geo-location database service provider should be expedited, and the requirement for installations to be carried out by a professional radio technician, registered with the institute of Electrical Engineers should be dropped.

7.3 Licenced spectrum for mobile services

- (a) The allocation of new spectrum for small operators and community networks to provide mobile services in rural areas should be considered.
- (b) Where all the spectrum has been assigned, but is not occupied in areas that are not profitable to big operators, regulators and policy makers should explore innovative ways of making that spectrum accessible to community networks and small operators. This could be done via a more localised approach to where they are being used, enabling new entrants in such areas. An alternative that should be explored is a variation of the “use it or lose it” principle, namely, **“use it or share it” with underserved rural areas.**

7.4 Increase the transparency and visibility of telecommunication infrastructure

All data on spectrum assignments, fibre networks, and tower locations should be publicly available as this will lead to a more informed debate on the national strategic development of telecommunications infrastructure, and to more investment, as deliberate transparency in this sector will increase trust.

7.5 Telecommunications infrastructure in “commons”

The notion of commons is alien in the South African regulatory landscape, but it is central to the way CNs work. Policy amendments are therefore required to enable the collective ownership of telecommunications infrastructure **in rural areas** so that it can be managed as a common-pool resource.

7.6 Development of community co-operatives as SMMEs

The DTSPS ICT SMME Support Strategy (p 1) “focuses on accelerating the development and growth of small enterprises in the ICT sector”. Community co-operatives providing network services should be given special consideration in the implementation of the strategy. The scaling of a CN model across rural South Africa should contribute to the envisaged SMME growth.

7.7 Public funding for SMMEs targeting universal access

- (a) Until it is replaced, USAF should be directed to support and fund the implementation of rural CNs. This should take precedence over all other non-rural interventions, i.e. expenditure should be prioritised to address the true access gap.
- (b) When the digital development fund has been established, it should be directed to continue with the rural connectivity programme of expanding CNs.
- (c) In all instances, the funding should target holistic interventions that go beyond the provision of network services, covering skills development and awareness programmes, which are vital to the development of functional universal access components.

7.8 Lowering of data costs without the need for universal service obligations

On 21 September 2018, the Presidency announced an economic stimulus and recovery plan which included a plan to lower data costs to “provide relief for poor households and increase the overall competitiveness of the South African economy”. The CN model should therefore be pursued as a preferred avenue to lower data costs for the rural poor. Previous approaches that have not worked include universal access obligations. These should be abandoned in favour of a CN model.

7.9 Monitoring of the access gap

- (a) The ECA Amendment Bill of 2018 seeks to amend the Ministerial Policies and Policy Directives section by adding a clause that empowers the Minister of Communications to make policy in relation to “universal service or universal access obligations or both, having identified any access gaps”.
- (b) The identification of the access gap requires regular collection of data and reporting. ICASA, with the DTSPS, should be required to collect and publish annual data that reflects the access

gap in the country. Such data should be available at voting district level, or at least at ward level, to enable proper planning to address prevailing gaps.

- (c) Statistics South Africa's ward demarcation should be used for the monitoring of the access gap.
- (d) Either section 3 or 4 of the ECA (Chapter 2) should be amended to compel government to ensure regular public reporting of the access gap.
- (e) The monitoring of the access gap requires universal access definitions to be published by the DTPS.

7.10 Universal service and access definitions

- (a) Section 82(3)(a)(i) of the ECA provides for the Universal Service and Access Agency of South Africa to make recommendations to enable the Minister to determine what constitutes "universal access by all areas and communities in the Republic to electronic communications services and electronic communications network services". This function should be transferred to the DTPS.
- (b) A new set of definitions for universal access and universal service should be developed urgently. The definitions in *Government Gazette* 32939 (February 2010) are outdated and should be reviewed.
- (c) There should be a specific definition of a rural area in terms of population density. This will permit the prioritisation of funding a CN regime to address the rural access gap.
- (d) The definitions of universal access should be expanded to beyond the narrow confines of access. New definitions are therefore needed to uphold the universal service and access principles for basics services as outlined in the National Integrated ICT Policy White Paper (p 32). These are as follows:
 - **Availability** of networks and coverage.
 - **Affordability** including the ability to pay for access to infrastructure, networks, devices and services.
 - **Accessibility** and the ability of all people to use and access services regardless of education, disability, age, gender etc.
 - **Awareness** by users and potential users of what is available and the benefits of these.
 - **Ability** of different groups of people and individuals to not only access services and acquire information and data but also to use the information and data to enhance the quality of their lives (i.e. digital literacy).
 - **Quality of service:** Services provided should be of good quality and acceptable standards.

7.11 Obligations revisited: Synergies with state-owned companies and others in the Internet ecosystem

The principle of infrastructure sharing should prevail in the implementation of rural CNs. In this regard, state-owned entities such as Eskom should be obliged to share high sites and other infrastructure.

7.12 Regional and global policy

The DTPS, the Department of International Relations and Cooperation, and other government departments should extend the championing of the community network model to regional and global policy spaces to influence the way the digital divide is addressed in Africa and other developing nations.

7.13 Grassroots innovation

- (a) The proposed broadening of the concept of innovation in the DST's White Paper on Science, Technology and Innovation (p 27) is supported, as is the inclusion of "grassroots innovation" in the new conceptualisation.
- (b) The DST White Paper's intent to develop a more inclusive innovation system (p 30) is welcomed, as this will advance the community network model and the associated digital ecosystem that will evolve from it. The DST is therefore urged to fast-track the interventions it seeks to make in "supporting SMEs in informal settlements, rural areas and co-operatives".

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