

A COMPARATIVE ANALYSIS OF URBAN AND RURAL BROADBAND PENETRATION AND ACCESS TRENDS IN SOUTH AFRICA

Sicelokuhle Oscar Ngwenya¹, Reolyn Heymann², Theo G. Swart² and Albert Lysko³

¹*Postgraduate School of Engineering Management*

²*Department of Electrical and Electronic Engineering Science*

University of Johannesburg, South Africa

³*Department of Electrical Engineering*

University of Cape Town, South Africa

ABSTRACT

Various studies have suggested that broadband connectivity is an enabler of rapid development in the socio-economic landscape, in countries where it is readily accessible. Consequently, the demand for Information and Communication Technology (ICT) has risen sharply, as countries continually recognize the benefits and potential of ICT as a tool for social and economic development. However, while this adaptation is seen globally, the observed trend is that it is mainly readily accessible in urban areas, while in rural communities the ICT services, including internet access, is not widely seen. This paper verifies these assertions and findings through non-intrusive research methodologies that are deemed effective in obtaining the relevant information required to that end, in an effort to ascertain the cause of this disparity. It is further asserted that the slow pace of internet penetration and access in rural areas is attributed primarily to the fact that rural areas are commonly characterized by low income, poverty, underdeveloped infrastructure, illiteracy, and unemployment. These are demonstrated in this paper using results obtained from a broadband survey conducted by the authors. This paper further aims to highlight the extent of the digital divide, in South Africa (SA) through the same survey, which has been conducted in both rural and urban areas. This comparative study was done to highlight the disparity in broadband access and penetration statistics between the rural and urban communities in South Africa observed in recent years, with the aim to better understand the extent of the digital divide, as it persists today. The parameters that are used to achieve this is employment trends, availability of enabling infrastructure and broadband services, and technology availability trends, including the broadband data rates thereof. These results will clearly demonstrate the status of the ICT sector, particularly highlighting the discrepancy between rural and urban communities in SA, and these will be unpacked in this paper.

KEYWORDS

Broadband, Digital Divide, Wireless, Rural, South Africa, Urban, Wi-Fi, Cellular

1. INTRODUCTION

According to statistics from the world bank (2021) ('World Bank', 2021), it is estimated that, on average, 39.4% of the global population is residing in rural areas. In South Africa (SA), the rural population was estimated at 31.4% at the beginning of 2023, according to Datareportal (*Datareportal*, 2023). It has also been reported that 31.8% of the South African population remained offline at the beginning of the same year. With the large dependence of advanced economies on modern ICTs, broadband internet access has become an essential tool for establishing the modern knowledge-based economy and information society (Stork, Calandro and Gamage, 2014). Inadequate, or a complete lack of access to ICT services, is therefore viewed as hugely regressive in today's economic landscape.

The International Telecommunications Union (ITU) in collaboration with the United Nations (UN), with their report titled "Partnership on Measuring ICT for Development" (ITU, 2012), have called on countries to develop their National Broadband Policies, with the purpose of outlining targets on their respective country's broadband access and penetration. In South Africa, this National Broadband Policy is known as the South Africa Connect (Communications, 2013), and this policy aligns to goals set in the National Development

Plan (NDP) Vision 2030 (National Planning Commission, 2011). This policy also emphasizes the aspiration of “a seamless information infrastructure by 2030 that will underpin a dynamic and connected, vibrant information society and knowledge economy that is more inclusive, equitable and prosperous.” These two policy documents, and the objectives outlined therein, serves as guidelines with respect to targets and timelines set, and progress in achieving them. The main aim of this paper is to attempt to understand the pertinent contributing factors of the so-called digital divide, in order to formulate frameworks that will assist in averting it or minimizing its impact. The formal definition of the digital divide given in (Souter *et al.*, 2009) is “the gap which has arisen between those that make use of ICTs and those that do not”.

In the second section of this paper, we discuss the problem statement in relation to the current global landscape and position on broadband, with respect to access and penetration. This includes the research conducted by the ITU and Independent Communications Authority of South Africa (ICASA), where the findings from the resulting reports are summarized. This section then briefly discusses the research that was conducted by the authors. In the third section we discuss the research methodology that was employed for this study, which entails the objective as well as the research design. The fourth section discusses the results, and the analysis thereof. Here, the data is presented together with the results and a qualitative comparative analysis is provided. The fifth section then discusses the findings drawn from the results obtained, followed by a section to finally conclude on the findings of the research study.

2. URBAN VS RURAL BROADBAND

2.1 Problem Statement

ICT has become a great enabler of advancement in modern economies, with broadband access being an essential tool. However, broadband is not readily available in rural areas, which impedes the economic growth of a country. Although rural areas are not considered as economic hubs, a simple example of how broadband connectivity can assist in rural areas is by providing access to information to informal businesses, which are prevalent in rural, remote, and isolated areas. This information can include, weather reports, related market prices and provision the ability to do research on their products, as well as other better income-earning opportunities, which they currently lack. However, without access to ICT, these services are a pipeline dream for the rural population, and the social ills experienced by the inhabitants of those communities persists unabated, while their urban counterparts improve. Should this observation persist, it would be a misalignment with the targets stipulated in the NDP Vision 2030 and SA Connect Policy and may potentially further exacerbate the gross inequality experienced in a developing country such as South Africa.

This paper attempts to highlight this inconsistency and ascertain its severity. To achieve this, it is prudent to highlight the targets set in the SA Connect Policy, shown in Figure 1. These will be used as a point of reference to findings from an online and physical survey performed by the authors, discussed in a later section. Reference will also be made to findings made by telecommunications bodies like the ITU as well as the South African Telecommunications Regulator, the ICASA, for comparison purposes.

Broadband Policy Target	Penetration/ Measure	Baseline (2013)	By 2016	By 2020	By 2030
Broadband access in Mbps user experience	% of population	33.7% Internet access	50% at 5Mbps	90% at 5Mbps 50% at 100Mbps	100% at 10Mbps 80% at 100Mbps
Schools	% of schools	25% connected	50% at 10Mbps	100% at 10Mbps 80% at 100Mbps	100% at 1Gbps
Health Facilities	% of health facilities	13% connected	50% at 10Mbps	100% at 10Mbps 80% at 100Mbps	100% at 1Gbps
Public sector facilities	% of government offices		50% at 5Mbps	100% at 100Mbps	100% at 100Mbps

Figure 1. Key SA Connect Policy targets (Communications, 2013)

2.2 Current State of ICT

Entities such as the ITU and ICASA conduct research to ascertain the current state of the ICT sector, both globally and locally. Internationally, the ITU has released statistics in their report titled “Measuring the Information Society Report (International Telecommunication Union (ITU), 2018)”. Locally, ICASA has undertaken to issue an annual report that provides information on the state of the ICT sector in South Africa. The first annual report was released in 2016 and was made available to the public. They have since released follow up reports annually from 2017 with the latest one released in March of 2023 (‘The State of the ICT Sector Report in South Africa’, 2023).

The authors have, in addition, undertaken a survey to obtain more insight on the demographics of those affected, and the extent to which they are affected. The results, as well as the methodology used to conduct the survey, are discussed in Section 4.

2.2.1 ITU and ICASA

From their recent reports (International Telecommunication Union (ITU), 2018)(‘The State of the ICT Sector Report in South Africa’, 2023), both the ITU and ICASA have emphasized notable upward trends, and key findings, in the global ICT sector such as the availability of communication services, growth in broadband, growing predominance of mobile over fixed services, increase in revenue in the telecommunications sector, the increase in usage of mobile and fixed data over mobile and fixed voice respectively, the significant annual increase in mobile subscriptions over fixed subscriptions, and cellular population coverage for 3G is recorded at 100%, while 4G/LTE stood at over 98% in SA, as of 2022.

2.2.2 Public Survey

The public survey is essentially a questionnaire that was formulated by the authors, for the purposes of distribution to ordinary South African citizens. The survey aims to elicit qualitative data that is indicative of the state of the ICT in urban and rural areas in SA, and draw a distinction, if any, between the two.

3. RESEARCH METHODOLOGY

3.1 Purpose of the Survey

The survey aims to ascertain the extent of the digital divide between urban and rural dwellers in South Africa. The survey targets both these areas in order to provide a comparison between the two “communities”.

3.2 Research Design

The technique that has been employed by the researcher to collect relevant data for this research is public surveys. The authors conducted the survey in the form of a questionnaire. These questionnaires have been made available to participants using various methods. The questionnaire is driven at collecting information about the respondent that pertains to demographics, location, internet access and penetration trends. The questionnaire consists of non-intrusive, concise questions, presented in multiple-choice format. The same questionnaire was made available both in electronic (online survey) and physical copies. The online copy was envisioned to be available nationwide (all provinces), and reach mainly the urban population, who were the target group for this part (online) of the survey, while the physical copies were intended to reach mainly the rural dwellers (restricted to the communities visited) as they are expected to have challenges accessing the online survey. This assumption was informed by the very objective of this research study. The physical copies were therefore distributed physically in the rural areas of Vryheid and Mbazwana, two rural communities in the province of KwaZulu-Natal (KZN), South Africa. The samples that were targeted were randomly selected, and not limited by race, gender or even sample size, however, it only excluded minors (below ages of 18), in compliance to the University ethical clearance approvals. As such, the results and analysis thereof would be qualitative, due to limitations relating to pre-organization of the participants. All participants were required to complete consent forms prior to completing the questionnaire.

4. RESULTS AND COMPARATIVE ANALYSIS

The online survey closed as of the 30th of May 2019, and received 295 responses, with one individual opting not to give consent to participate. The online data captured, therefore, includes that of 294 consenting respondents.

The physical walkdown survey was concluded as of the 07th of June 2019, and received 103 responses from two separate rural areas, where it was conducted. The first survey was conducted on the 20th of April 2019 in the small town of Vryheid, where 21 individuals gave consent to participate and completed the survey. The second survey was conducted on the 13th of May 2019 in the village of Mbazwana, where 44 individuals gave consent to participate and completed the survey. The third and final survey was conducted again in the village of Mbazwana, in the weeks from the 27th of May 2019 to the 06th of June 2019, where a further 38 individuals completed the questionnaire. In total, 82 respondents from Mbazwana provided completed surveys.

The results for both the online and physical walkdown surveys were as follows:

4.1 Employment Status

From the online survey, the majority of the respondents are employed (71.1%) compared to the physical walkdown survey, where the majority of the respondents are students (43.7%) and unemployed (36.9%), respectively, as depicted in Figure 2. In addition, those who reported to be employed in rural areas, are in the lowest salary bracket, as depicted in Figure 3.

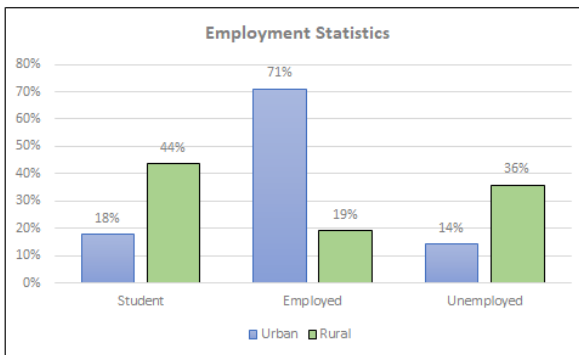


Figure 2. Employment Statistics

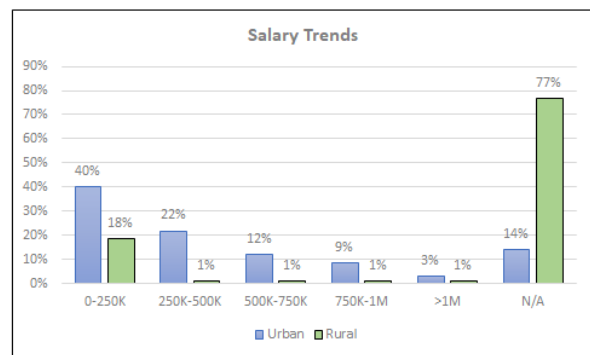


Figure 3. Salary Trends

4.2 Energy/Power Infrastructure

From the online survey, almost all the urban respondents (99.3%) have electricity at their place of residence, compared to 81.5% in the physical walkdown survey. From the online survey, the majority of respondents (75%) do not have a telephone line installed at their residence, compared to 93.2% in the physical walkdown survey. This is depicted in Figure 4, and can be viewed as a positive statistic, as it shows that South Africa generally has good availability in terms of electrical power infrastructure nationally and is also in line with global technology advancements and trends, with the move from fixed telephony to mobile.

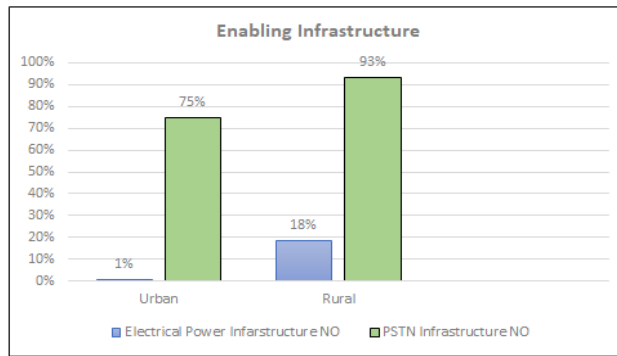


Figure 4. Broadband Enabling Infrastructure

4.3 Broadband Access Terminals

From the online survey, the overwhelming majority of the respondents' own smartphones (96.2%), as is the case in the physical walkdown survey (85.4%). The ownership of laptops and tablets follows as the most popular access terminals, in both surveys, respectively. This is shown in Figure 5. Additionally, in the online survey, 95.5% participants stated that they have access to the internet compared to 85.4% in the physical walkdown survey.

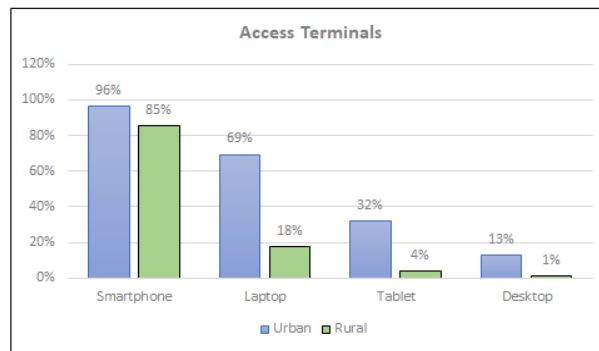


Figure 5. Internet Access Terminal

4.4 Broadband Access Location

From the online survey, 79.5% of the respondents stated that they could access the internet at home compared to 35.9% from the physical walkdown survey. The next popular point of access is the workplace and schools in both surveys, respectively, as depicted in Figure 6. The key difference between these two results is the significant number of respondents from the physical walkdown survey who claimed that they access the internet from the local community center and library, and those who do not have access at all, represented by those who picked the "Other" and "Not Applicable" options respectively.

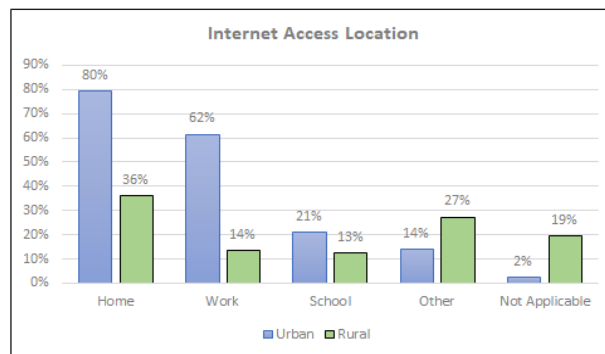


Figure 6. Broadband Internet Access Points

4.5 Broadband Access Technology

From the online survey, the majority of the respondents stated that they use Wi-Fi (63.9%) as the broadband access technology, compared to 44.7% from the physical walkdown survey. This is followed by cellular technologies in both surveys, as shown in Figure 7. This shows that wireless access is more readily available in both urban and rural communities.

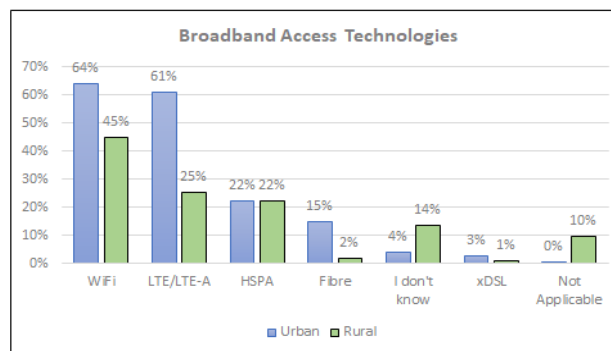


Figure 7. Broadband Access Technologies

4.6 Data Usage

From the online survey, over half of the respondents (51.4%) stated that they use 1-10GB of data per month compared to a quarter of the respondents (25.2%) in the physical walkdown survey. In the physical walkdown survey, the majority stated that they use 100MB-1GB (32%) of data per month, as shown in Figure 8. This translates to the majority of the respondents (52.1%) in the online survey spending between R100-500 per month on data costs, in comparison to 33% of the physical walkdown survey respondents, who spend less than R100. This data is depicted in Figure 9 and collaborates with the one found in Figure 2 and 3 above, where it is shown that many urban respondents are employed and, as a result, can afford to spend more money on data, and hence access more ICT services.

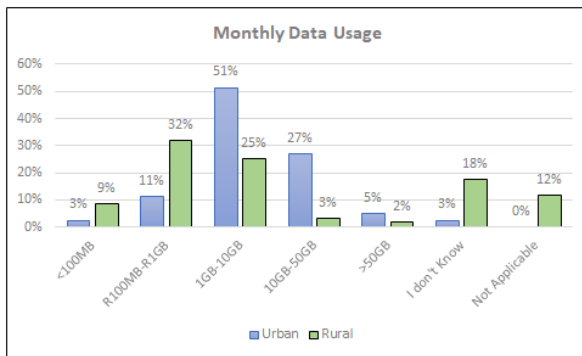


Figure 8. Monthly Data Usage

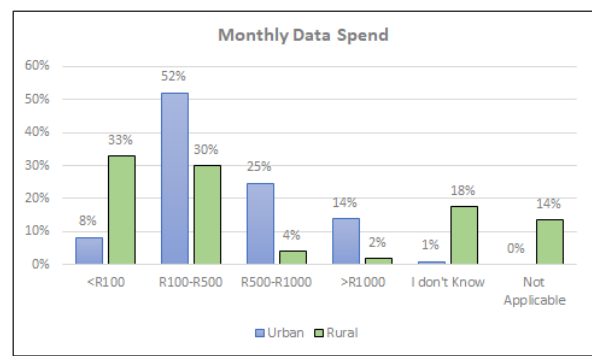


Figure 9. Monthly Data Spend

4.7 Broadband Speeds

When asked what their current broadband speeds were, the response for both the online survey and physical survey showed similar trends. That is, the majority of the respondents in both samples stated that they are not aware of the speeds that they currently have access to. However, for those who claimed to know this information, the majority asserted to have access to 10 Mbps or more, followed by between 5-10 Mbps, in both surveys, respectively. This result is depicted in Figure 10.

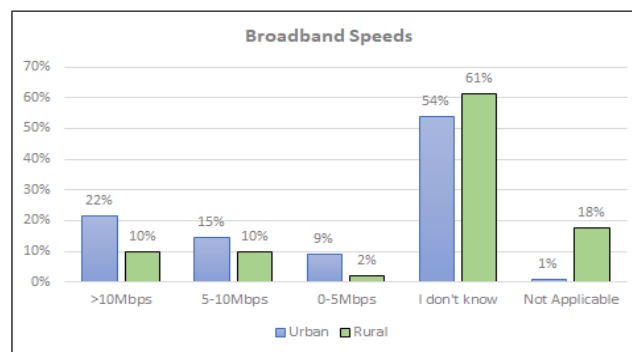


Figure 10. Broadband Data Rates/Speeds

5. DISCUSSION OF RESULTS

From both the surveys, the pattern that emerges is that the online respondents comprise of mostly employed individuals, some of which are also still enrolled in academic institutions, possibly pursuing postgraduate qualifications. An assumption was made that the majority of this sample resides in the urban and suburban areas. From the physical walkdown survey, it is clear that most of the respondents are in fact unemployed. A positive statistic in both surveys is the availability of power infrastructure, and the obvious apparent shift from fixed telephony to mobile telephony, in line with the ITU and ICASA findings. Another positive statistic is the overwhelming majority of respondents who have reported that they own a smartphone, which is also in line with global trends. As expected, a larger number of respondents from the physical walkdown survey reported to have no access to the internet at all, compared to the online survey. This implies that internet access, particularly in the samples and areas considered in this paper, is indeed often readily available in urban areas compared to rural areas. In addition, the internet access in urban areas is, for the most part, available in the convenience of the respondents' homes, while some of the rural respondents depend solely on community facilities, like for example the local library in this survey. Wireless broadband

technology has emerged as the most abundantly available technology for connectivity, which is also in line with the findings from the telecommunications bodies.

The majority of the urban respondents have also reported to utilizing and spending more money on data, as compared to their rural counterparts. This collaborates with the data collected, which reflects that most of the rural respondents are unemployed, and many other factors, including availability of broadband infrastructure, and low-income levels. Global statistics show that SA had access to speeds of up to 55 Mbps in 2021, according to studies done by Speed Test Global Index. The respondents from both surveys have reported that they indeed do have access to speeds in excess of 10 Mbps. This response cannot be confirmed, especially in light of the number of respondents who have responded that they are not aware of their broadband speeds. However, 55 Mbps is still not in line with the stipulated target of 50% population having access to speeds of 100 Mbps, as per the SA Connect Policy objectives stipulated in Figure 1.

6. CONCLUSION

The surveys done by the authors were issued in two formats, i.e. the online version as well as one conducted physically, using physical copies of the same questionnaire. The respondents that completed the online survey came from all parts of South Africa, with all nine provinces represented. The respondents from the rural areas came from two small communities in KZN, which had representation from various surrounding villages. The assumption made is that rural areas nationwide have similar characteristics, more or less, with the exception of minor and negligible deviations, for the purposes of this research study. The samples from both surveys were from respondents between the ages of 18 and 65 years.

From the results obtained in both the online and physical surveys, the discrepancy between the urban and rural respondents is observed. Although in both surveys, the majority own smart devices, the access patterns are not the same. It is seen that the urban respondents can readily access the internet from the comfort of their homes, workplace and schools, whereas that is not the case with the rural respondents. This can be attributed to a barrier that will be labelled as “Accessibility”. Additionally, the consumption pattern for those in the rural areas who do have access to internet connectivity is not the same as the respondents from the rural areas i.e. the amount of data consumed and the amount of money spent. This can be attributed to a second barrier, which will be labeled as “Affordability”. Furthermore, the reasons cited for this are visible from the results. That is, the high poverty and unemployment levels in the rural areas in South Africa, which are highlighted by respondents who have indicated that they obtain little to no income. This despite the fact that most of the survey respondents reported that they own smartphones, more than any other communication device and are able to receive 3G cellular broadband signal, at minimum. Notably, this statistic collaborates with both ITU and ICASA’s finding of the growing predominance of mobile over fixed telecommunications services as well as ICASA’s estimate of in excess of 90% 3G and LTE coverage, nationwide.

With indicative evidence of the status quo, it is the authors’ view that broadband access is indeed one of the key drivers of economic participation and development in a society and country as indicated by the state of and discrepancy in socioeconomic situations between rural and urban areas in SA. The analysis of the data from the SA Connect, ITU and Global Index, backed up by the surveys conducted by the authors, indicate that the goals set in the SA Connect for 2020 has not been fulfilled at the time of this publication, and would need to be prioritized and expedited if economic inclusion is to be achieved. To this end, it is proposed that community-based broadband systems are implemented in rural areas, which would be bespoke to the community in question, and particularly address the key barriers, which will be posed as research questions, i.e. “Accessibility” and “Affordability”. In addition, this system must be sustainable, in order to facilitate preservation and long-term profitability thereof, which should impact the community in a positive way, and facilitate growth and prosperity in rural areas. These three barriers (Accessibility, Affordability and Sustainability) are the key research questions for future work.

REFERENCES

- Communications, M. of (2013) 'South Africa's Broadband Policy', *Government Gazette* [Preprint], (November).
- Datareportal* (2023). Available at: <https://datareportal.com/reports/digital-2023-south-africa#:~:text=51.3 percent of South Africa%27s, percent lived in rural areas>
- International Telecommunication Union (ITU) (2018) *Measuring the Information Society Report 2018 - Volume 1. Geneva, Switzerland., ITU Publications.*
- ITU (2012) 'Partnership on Measuring ICT For Development'.
- National Planning Commission (2011) *Our future - make it work.* Available at: <https://doi.org/ISBN: 978-0-621-41180-5>.
- Souter, D. *et al.* (2009) *The apc icT policy Handbook Editor David Souter With contributions from.* Available at: www.apc.org.
- Stork, C., Calandro, E. and Gamage, R. (2014) 'The future of broadband in Africa', *info*, 16(1). Available at: <https://doi.org/10.1108/info-10-2013-0055>.
- 'The State of the ICT Sector Report in South Africa' (2023), (March).
- 'World Bank' (2021). Available at: <https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS>.