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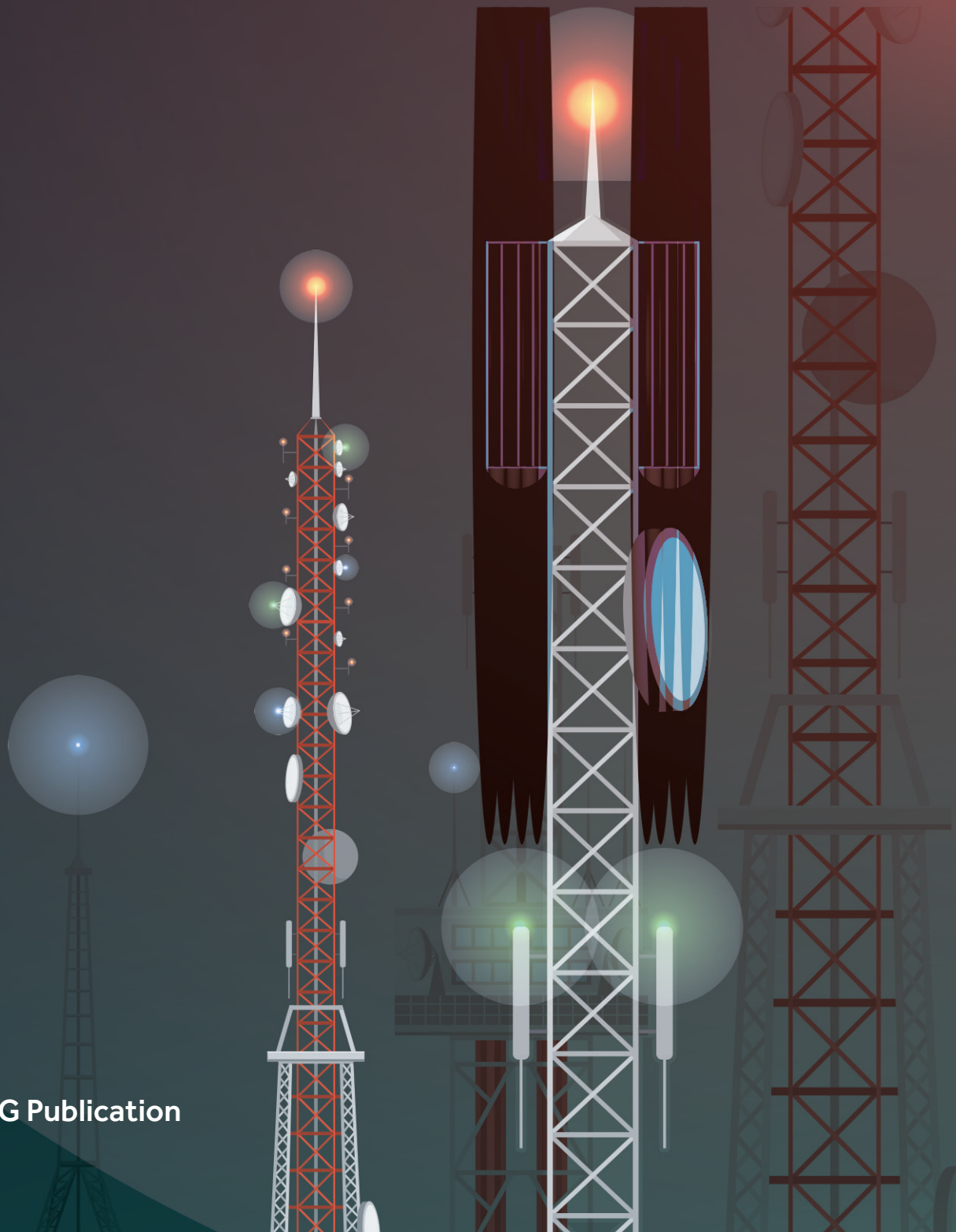
TELECOMMUNICATION & TECHNOLOGY SUSTAINABILITY WORKING GROUP

Rural Telephony and Rural Development in Nigeria:

A Case for Advancing Development



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INTRODUCTION

Telecommunications has become a crucial component of modern society, with widespread applications and systemic impact on economic and social development. Its usage ranges from radio and television broadcasts, telephone and telex communications, corporate communications, electronic communication, social media and even extends to the provision and delivery of public services to remote regions. It has become an important part of people's daily lives, providing substantial economic and social benefits since its inception.

In 1984, the Independent Commission for Worldwide Telecommunications Development of the International Telecommunications Union (ITU) released a report titled "The Missing Link."[1] The report suggests that incorporating comprehensive and relevant mobile communication functions and prioritising the development of telecommunications can play an important role in the success of a country's development program. It argues that without these components, a country's development program may face challenges in achieving its intended outcomes. This revelation effectively underpins the importance of telecommunications in economic and social development. Furthermore, the GSMA Mobile Economy 2022 report revealed that by the end of 2021, there were more than five billion people subscribed to mobile services, equivalent to 67% of the world's population, with the number of individuals who use mobile internet nearly reaching 4.2 billion.[2]

Despite the progress made, over one billion people globally reside in locations where mobile broadband networks are not available, leaving even more people without access to mobile internet coverage.[3] In sub-Saharan Africa there is a substantial access and usage gap, with 44% of those in areas covered by mobile broadband networks not yet using mobile internet services. At 40% of the adult population subscribed, there is a huge potential for growth due to the region's huge youth population. However, achieving this growth will require a collective thrust to improve ICT affordability and digital upskilling in order to meet the global mobile internet subscription average of 70% for the adult population.[4] Lack of access to information and communication technologies perpetuates socioeconomic divide, with connectivity remaining prevalent in or close to metropolitan communities. However, technical advancements, economic factors, and policy reforms are making information and communication technology more accessible and creating opportunities to bridge the digital divide.

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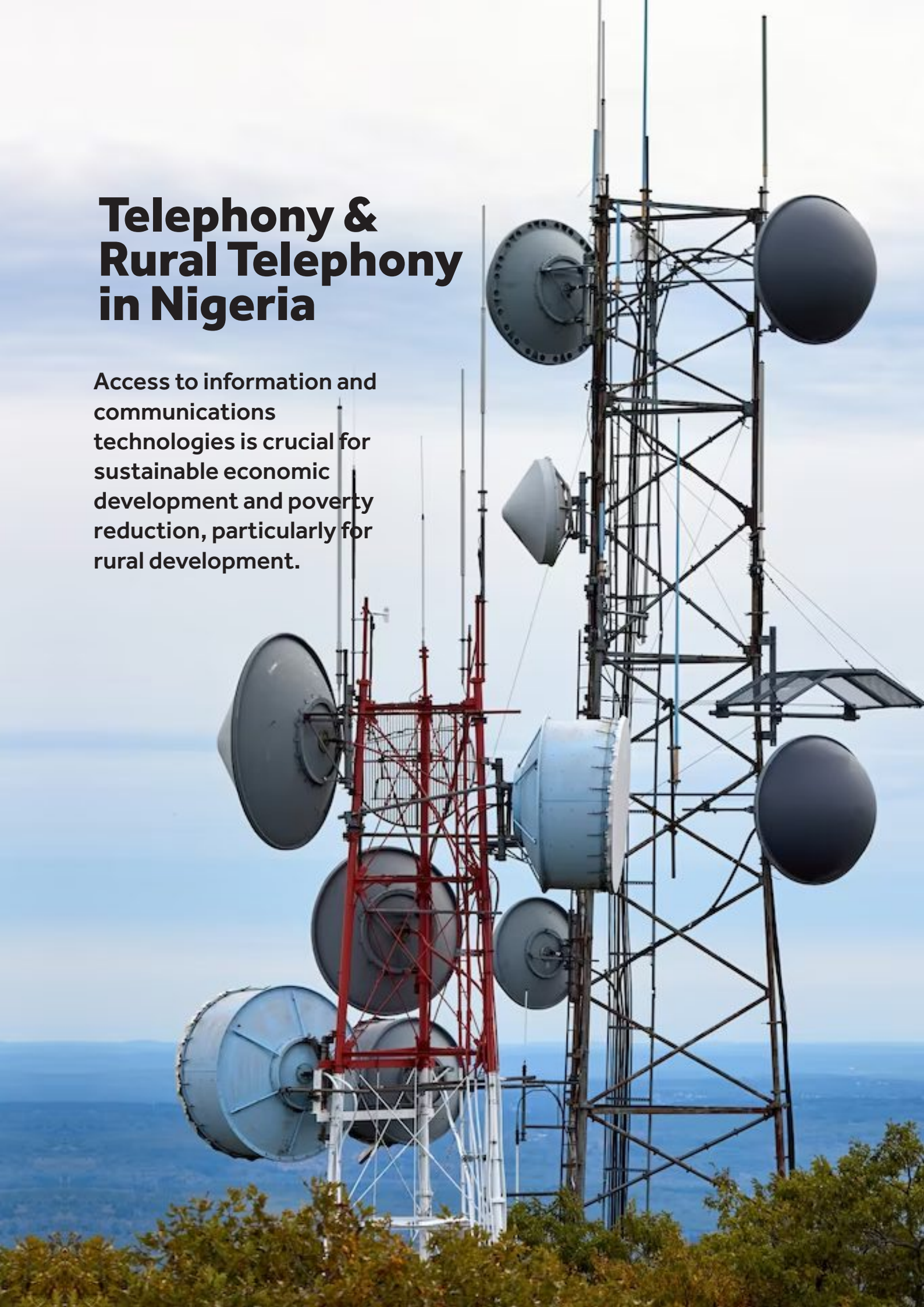
Recent research has found a strong link between ICT access and economic progress, with the relationship being found in a variety of nations and locations like Singapore, Taiwan, South Korea, and more.[5] However, the causal link between ICT availability and economic progress is complicated and diverse, with government policies, infrastructure, education, and social and cultural norms having a substantial influence. Consequently, it is vital that governments take a comprehensive approach to ensure that ICT is successfully deployed and used across all regional terrains to generate economic growth and development. In Nigeria this will entail increased ease of doing business and intensified public-private partnership to deepen telecommunications infrastructure and penetration in the country.

Joint research undertaken by Ericsson, American consultant, Arthur D Little, and Sweden's Chalmers University of Technology in 2011, concluded that doubling broadband speeds resulted in a 0.3% boost in GDP in OECD nations. This builds on a 2010 study by Ericsson and Arthur D Little, which discovered that every 10% increase in broadband penetration resulted in a 1% increase in GDP. These studies highlight the importance of investing in rural telephony infrastructure and increasing telecommunication access to promote economic growth. This informs the leadership in governments and businesses to prioritise expanding mobile network coverage and improving internet speeds in rural communities to support their economies.[6]

This research focuses on the benefits of improved rural telephony and its socioeconomic impact on rural areas. It highlights the potential of improved rural telephony in bridging the digital divide and promoting economic growth in rural areas. Addressing these issues will have significant economic rewards, as it also explores the role of public-private partnerships in expanding access to telecommunications infrastructure and services.

Telephony & Rural Telephony in Nigeria

Access to information and communications technologies is crucial for sustainable economic development and poverty reduction, particularly for rural development.



1. TELEPHONY & RURAL TELEPHONY IN NIGERIA

Rural telephony, on the other hand, refers to the provision of telecommunication services in remote and sparsely populated areas where traditional communication infrastructure may not be readily available. It is crucial for linking rural communities with the rest of the world, enabling access to critical services, education, healthcare, and economic opportunities.

Telephony is a crucial element of modern communication systems that enables the electronic transfer of speech, graphics (fax), or data between distant parties. The evolution of telephony has transformed the way people communicate, fostered business growth, and boosted economies globally. Its progress has also created job opportunities, increased business efficiency, and enhanced access to information. Rural telephony, on the other hand, refers to the provision of telecommunication services in remote and sparsely populated areas where traditional communication infrastructure may not be readily available. It is crucial for linking rural communities with the rest of the world, enabling access to critical services, education, healthcare, and economic opportunities.

In many regions of the world, including Nigeria, rural areas are densely populated and underemployed, making it difficult for telecommunication companies to construct and operate telephone networks. Consequently, these populations often lack adequate access to quality telephone services and experience severe connectivity and pricing challenges. To address this issue, rural telephony projects have evolved to improve telephone service access - deployment of landline and cellular services, rollout of internet access, etc - bridging the technology gap between urban and rural areas. The purpose of rural telephony is to provide rural residents with the same quality of telephone service access as urban residents, enabling them to participate in the digital economy, connect with friends and family, and access critical services such as healthcare and education.

Communication technologies have a significant impact on poverty reduction through three primary mechanisms: increasing the efficiency and global competitiveness of the economy as a whole with positive impacts on growth and development, enabling better delivery of public services such as health and education, and creating new sources of income and employment for poor populations. Thus, access to information and communications technologies is crucial for sustainable economic development and poverty reduction, particularly for rural development.

Despite efforts by the Nigerian government to improve rural connectivity, such as the attachment of terms to telecom licenses requiring holders to provide services to a certain percentage of the country, some individuals remain cut off. The lack of infrastructure and investment in remote regions has left many Nigerians without access to basic telecommunications services, hindering their ability to participate in the digital economy. According to Prof. Umar Danbatta, Executive Vice Chairman of the Nigerian Communications Commission (NCC), there are still about 112 clusters of access gaps and about 15 million digitally excluded Nigerians.[7] While these figures represent considerable progress made in deepening telecommunications infrastructure and access, there is still work to be done, especially in rural interiors where people do not have access to cell coverage. This lack of basic telephony service in rural areas is a significant hindrance to the development of these regions, limiting access to information, healthcare, and other essential services. While efforts are being made by the Nigerian government and private sector players to bridge this gap through initiatives such as the Universal Service Provision Fund (USPF) and investments in rural telecommunications infrastructure, it is essential for the government and private sector to invest more in rural connectivity to bridge the digital divide and ensure that all Nigerians have equal access to opportunities.[8]

2. RURAL TELEPHONY INITIATIVES

Telecom operators face significant challenges in expanding their networks into rural areas, where low population density makes it difficult to achieve a rapid return on investment. To overcome this challenge, operators need to reduce capital and operational expenditures while extending network coverage in a sustainable manner. Traditional techniques, such as establishing macro-sites, may not always be effective in rural areas with widely distributed villages and low population density, as they incur large upfront and ongoing costs. However, by combining precise demographic mapping of remote areas without cell coverage with lightweight infrastructure, operators can target isolated groups and improve the commercial case for connecting distant places, thereby increasing the return on investment of network expansion.[9]

Existing rural telephony initiatives include the use of wireless technologies, satellites, and television white space (TVWS), each with its own advantages and disadvantages. In Nigeria, the Nigerian Communications Commission (NCC) and National Broadcasting Commission (NBC) have published draft guidelines for the use of TV white space technology to improve rural broadband connectivity. TV white space is a cost-effective alternative for community-built networks due to the inexpensive cost of slots, and additional frequencies, including 2.6GHZ and 800MHZ, are also available. It is important that the NCC make these spectrums available in a timely and cost-effective way to provide network operators, both large and small, with several alternatives for growing their broadband networks in Nigeria.[10]

Studies have shown that the provision of phone and internet service is critical for an area's economic growth, and once available, traffic increases significantly. Digital satellite networks offer a more cost-effective method than equivalent land-based cable networks of comparable quality for long-distance connectivity to remote areas. When used in conjunction with Wireless Local Loops, small ground stations can offer local and long-distance service swiftly and economically, allowing the delivery of digital multimedia services on a global scale.[11]

Rural telephony initiatives must consider the population distribution of the area in question to determine the most effective approach, whether it be macro-sites or lightweight infrastructure. By adopting a strategic and cost-effective approach, operators can expand their networks into rural areas and provide vital phone and internet services to remote communities, promoting economic growth and development.

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3. RURAL TELEPHONY AND RURAL DEVELOPMENT

Bridging the digital divide between rural and urban communities is a significant challenge that can be addressed by investing in research and development. This investment is essential for fostering civic engagement, educational development, job creation, and economic progress in rural areas. Improved rural telephony is a key factor in addressing the fundamental needs of isolated rural populations in terms of safety, social needs, and convenience. Deploying telecommunications infrastructure in rural areas can lead to unforeseen positive knock-on effects, as exemplified by the potential benefits in the agriculture sector. This has been experimented on in the Nigerian agriculture sector via public-private partnerships, with varying results recorded in the past and more recently, through the Nigeria Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL) Farmers' Business School (NFBS). Spearheaded by NIRSAL, the NFBS is a mobile phone learning platform that leverages Interactive Voice Response (IVR) to train farmers on modern agricultural practices.[12]

Several other points of potential developmental impact if rural telephony deployment is deepened in rural regions of Nigeria include:

3.1 Improved Information Transfer

In Nigeria, information transfer remains a significant challenge, particularly in rural areas, where low population density and vast distances between towns hinder effective communication. The country's rural regions are typically socially and physically isolated from metropolitan areas, leading to a limited engagement in domestic and international concerns, whether economic or political.

However, rural telephony can be a game-changer in bridging this divide. With the advancements in technology, rural areas can process voice, data, and video information, which can then be transmitted to far-off destinations in a shorter time, and at a reduced cost. This improvement in communication can effectively connect rural and urban regions, allowing residents of rural communities to obtain information more quickly and apply it effectively to their needs or consumption. It can also reduce travel time, leading to increased productivity and economic growth.

A notable development in this regard is the Nigerian government's Universal Service Provision Fund (USPF) initiative. The USPF aims to provide telecommunications services to underserved and unserved communities in Nigeria, particularly those in rural areas. The initiative has resulted in the establishment of several community information centres and telecommunication hubs across the country, providing rural residents with access to affordable and reliable communication services. The USPF has also supported the establishment of e-libraries in rural areas, providing access to educational resources and information to students and teachers.[13]

3.2 Increased Business Efficiency

The challenges faced by rural communities in terms of job opportunities and ease of doing business are significant. The country's economic landscape is dominated by the urban centres like Lagos, Kano, Abuja, Ibadan and Port-Harcourt, with the rural areas lagging behind in terms of technological advancement and infrastructure development.

One major challenge is the declining job opportunities in rural towns due to the advancements in industrial technology and the trend of rural–urban migration. The rise of machinery has made it easier for manufacturing facilities to replace labourers, thereby reducing the need for manual labour. This trend has had a significant impact on rural communities, where many people rely on manual labour for their livelihood. Moreover, improvements in internet and communication technology have made it easier for businesses to outsource some services to developing countries, including Nigeria, where they can benefit from reduced costs of labour. This further reduces the job opportunities available to people living in rural areas who have limited access to the internet.

Despite these challenges, empirical data suggests that rural communities in Nigeria can compete in a wide range of service-producing industries, including farming, agro-processing, metal production, transportation, textile craft, and vocational businesses.[14] Better telecommunications can boost business productivity by lowering the time required for various activities such as procuring items, processing client orders, and invoicing customers. This can help rural businesses to operate more efficiently and reach new markets.

For instance, the agricultural sector is a significant employer in rural Nigeria. With improved telecommunications infrastructure, farmers can access information on market prices, weather forecasts, and other critical data that can help them make better decisions. They can also connect with suppliers and buyers more easily, reducing the time and cost required to source inputs and sell their products.

Improved rural telephony will also have a ripple effect on financial inclusion. According to Enhancing Financial

Innovation and Access (EFInA), financial inclusion in Nigeria has been on the rise, with the banked percentage of the adult population increasing from 38.3% in 2016 to 39.7% in 2018. However, there is still a significant gap in financial inclusion with 82% of the adult population receiving their main income in cash.[15] By 2020, financial inclusion stood at 64.1%.[16] However, the country has been experiencing an upsurge in mobile money subscriptions and traffic in the wake of the currency swap policy of the Central Bank of Nigeria effected in January 2023, and the resulting cash scarcity which placed a significant toll on mobile and internet banking channels of financial institutions.[17] The extended downtime across various digital banking platforms has brought to the fore the need to deepen telecommunications infrastructure and capacity with a view to facilitating national financial coverage.

3.3 Access to Education

Access to education is a critical issue in Nigeria, particularly in rural areas. According to Statista, in 2018, the literacy rate in rural Nigeria was 59% for males and 35% for females, compared to 86% and 74% for urban male and females respectively.[18] This disparity in literacy rates is due to several factors, including limited infrastructure, lack of access to educational materials, and insufficient funding for educational institutions in rural areas. The digital divide between rural and urban areas in Nigeria has further worsened the situation. However, increasing the access to telecommunications in rural areas has the potential to contribute to a reduction in the literacy and digital gaps. This is more so if coupled with the establishment of ICT-enabled libraries and resource centers, access to material for basic and post-basic education, and the promotion of the growth of capabilities among skilled craftsmen. With these in place, rural citizens can have access to free online materials, and it can motivate them to participate in various educational programs.[19]

Moreover, universal access to telecommunications can also benefit nomadic communities in remote and isolated places. Mobile access points and mobile devices can be used to provide nomadic educators with access to information, and informal education among rural communities can also be boosted.[20]

3.4 Improved Rural Institutional Capability and Public Services

In Nigeria, improving rural institutional capability and public services is critical to achieving the Sustainable Development Goals (SDGs) related to community healthcare services. According to the World Health Organisation 2021 Annual Country Report, Nigeria faces several challenges, including decreasing new-born and maternal mortality rates, eliminating tropical illnesses and epidemics such as malaria, cholera, polio, and containing the spread of Covid-19, Lassa Fever and other sexually transmitted infections (STIs).[21] The availability and expertise of health professionals, health infrastructure, health education, and cost of health services all contribute to meeting these objectives.

Adopting universal telecommunication access initiatives in rural regions can have a significant impact on healthcare delivery. For instance, the Grameen Foundation suggests that universal telecommunications access can reduce information latency in healthcare delivery, improve response times in emergencies, and reduce fatalities. Moreover, building a centralised repository to manage healthcare information across rural settlements is possible with the presence of rural communications infrastructure. This can be integrated into the national health insurance system, lowering the cost of maintaining information.[22]

Mobile health (m-health) programs can be used to transport data from rural healthcare institutions to central healthcare planning offices in urban regions, alert individuals to disease outbreaks, disseminate health information, and enable remote access to patient registration details.[23] Disease outbreak control is another area where ubiquitous communications connections may impact rural healthcare delivery. During epidemic outbreaks, individual movement over village and town lines is prohibited, limiting information on affected regions. Remote villages with telecommunications access can offer information on their people's health status during an epidemic outbreak and receive information on how to address the health crisis with the least risk to nearby communities.

The use of communication technologies, such as social media and SMS-based community chat platforms, has been used to tackle the Ebola outbreak in West Africa.[24] Traditional communication channels like radio and television were also used in Nigeria to reach out to people in rural areas.

Telemedicine has also been a game-changer in bridging the rural-urban divide in Nigeria's healthcare sector. Telemedicine allows healthcare professionals in urban areas to remotely diagnose and treat patients in rural areas. The COVID-19 pandemic highlighted the importance of telemedicine in rural healthcare delivery in Nigeria with the launch of a 'COVID-19 Triage Tool' to enable health workers in rural areas to identify and report suspected COVID-19 cases via mobile phones.[25]

4. CASE STUDIES OF RURAL TELEPHONY INITIATIVES

4.1 Case Study 1: IHS Towers (Nigeria)

Background:
IHS Towers, a leading telecommunications infrastructure company, has successfully implemented rural telephony solutions in Nigeria. Their initiatives focus on providing mobile connectivity to remote areas where traditional network strategies are not feasible due to high costs and low customer penetration.[26]

Initiative Details:

Rural Telephony Solutions: IHS Towers deploys individual base stations in remote locations, utilizing open-source software and satellite solutions. These "bolt-on" base stations are specifically designed to provide 2G and 3G voice and data access to communities lacking mobile connectivity.

Solar-Powered Infrastructure: To overcome the lack of reliable electricity in remote areas, IHS Towers implements solar systems with integrated lithium-ion batteries to power their base stations. By utilizing solar energy and eliminating the reliance on traditional diesel generators, IHS Towers provides a more sustainable and cost-effective solution.

Positive Impact on Communities: IHS Towers also aims to make a positive impact in the communities they serve. They actively support local schools, higher education initiatives, health clinics, and other programs. By improving rural telephony, they contribute to the growth and development of the markets they operate in.

Results:

Increased Connectivity: Through their rural telephony initiatives, IHS Towers has established 568 operational sites as at May 2023, providing mobile voice and data access to previously underserved communities in Nigeria. This expansion of communication infrastructure has enabled the Group to connect people across 11 countries throughout the emerging markets where approximately 770 million people reside.

Socioeconomic Opportunities: By bringing mobile connectivity to remote areas, IHS Towers enables communities to access socioeconomic opportunities. People can stay connected, conduct business, access mobile money services, healthcare resources, and government services. Mobile connectivity also plays a crucial role in education, providing access to online learning resources and improving digital literacy.

Efficient and Sustainable Model: IHS Towers' business model emphasizes efficiency, sustainability, and positive impact. The use of solar-powered solutions further contributes to a greener and more sustainable telecommunication network.

Community Development: By supporting local schools, higher education, and health clinics, they foster community development. Access to mobile connectivity enhances communication, trade, and knowledge sharing within the communities, leading to improved economic prospects and overall well-being.

Overview:

IHS Towers' rural telephony initiatives in Nigeria showcases the effectiveness of solar-powered solutions and community engagement in bridging the digital divide. By providing affordable and sustainable connectivity, they continue to help empower remote communities, drive socioeconomic development, and foster a more inclusive society.

4.2 Case Study 2: Mawingu Networks (Kenya)

Mawingu Networks is a successful rural telephony initiative in Kenya that focuses on providing affordable and reliable internet connectivity to underserved communities. The project was launched in 2013 with support from Microsoft.

Initiative Details:

TV White Space Technology: Mawingu Networks leveraged TV white space technology, which utilises unused portions of the television broadcast spectrum to provide internet connectivity. This technology allows for long-range wireless transmission and is well-suited for rural areas with limited infrastructure.

Community-Based Service Providers: The initiative partnered with local entrepreneurs and community-based service providers to establish and maintain the network infrastructure. These providers operated as franchisees, setting up and managing internet access points in their respective communities.

Solar-Powered Connectivity: To overcome the lack of reliable electricity in many rural areas, Mawingu Networks implemented solar-powered base stations and connectivity solutions. This approach ensured uninterrupted internet access, even in off-grid regions.

Results:
Expanded Connectivity: Mawingu Networks successfully expanded internet access to previously

underserved rural areas in Kenya, providing them with affordable and reliable internet connectivity. The initiative has now expanded coverage to 16 counties, +7,000 active users, and +300,000 hotspot customers served. It is now Kenya's largest internet service provider (ISP) dedicated exclusively to the rural and peri-urban markets in the country.

Economic Empowerment: Access to the internet enabled rural communities to engage in e-commerce, online banking, and digital entrepreneurship. Local businesses were able to reach wider markets, boosting economic opportunities and income generation.

Education and Information Access: Mawingu Networks' initiative had a significant impact on education. Students gained access to online learning resources, enabling remote learning and improving educational outcomes. The availability of information through the internet also enhanced agricultural practices and healthcare services in rural communities.

Social Development: The initiative contributed to social development by enabling communication, connecting families, and fostering social networks. Access to information and online platforms empowered individuals to engage in civic participation and access government services more easily.

Scalability and Sustainability: Mawingu Networks' model proved to be scalable and sustainable. By involving local entrepreneurs and leveraging existing infrastructure, the initiative established a cost-effective and community-driven approach to providing rural telephony services.[29]

Overview:

Mawingu Networks successfully demonstrated how innovative technologies and community engagement can bridge the digital divide in rural areas, fostering socioeconomic development and empowerment.

4.3 Case Study 3: BharatNet (India)

Background:
BharatNet is an ambitious rural telephony initiative in India aimed at providing broadband connectivity to remote and underserved areas across the country. Launched in 2011 by the Government of India, BharatNet aims to bridge the digital divide and bring the benefits of the internet to rural communities.[30] It is the world's largest rural broadband connectivity program.[31]

Initiative Details:

Fibre Optic Network: BharatNet focuses on establishing an extensive fibre optic network that connects villages and rural areas. High-speed broadband connectivity is provided through optical fibre cables, enabling faster and more reliable internet access for the communities.

Public-Private Partnership: BharatNet operates through a public-private partnership model, collaborating with various telecom service providers and infrastructure companies. This approach leverages the expertise and resources of private entities to accelerate the deployment and maintenance of the network infrastructure.

Last-Mile Connectivity: In addition to building the backbone infrastructure, BharatNet also emphasises last-mile connectivity. It involves setting up Wi-Fi hotspots, community service centres, and access points in rural areas, ensuring that individuals can access the internet conveniently and affordably.

Digital Services: BharatNet aims to provide a range of digital services to rural communities, including e-learning, e-healthcare, digital governance, and e-commerce. By enabling access to these services, the initiative seeks to improve education, healthcare, and economic opportunities for rural residents.

Results:

Enhanced Connectivity: BharatNet has made significant progress in connecting rural areas in India. As of 2021, the initiative had reached over 150,000 gram panchayats (village-level local government institutions), providing broadband connectivity to millions of people in previously underserved areas.

Socioeconomic Development: The availability of broadband connectivity through BharatNet has opened up new avenues for socioeconomic development. It has facilitated online education and skill development, e-commerce activities, telemedicine services, and access to government services, enabling individuals and communities to participate in the digital economy.

Empowerment and Inclusion: BharatNet has played a vital role in empowering individuals, especially women and marginalised communities, by providing access to information, resources, and digital tools. It has bridged the digital divide, allowing previously excluded groups to access opportunities and participate in the digital world.

Government Service Delivery: The initiative has improved the efficiency and accessibility of government services in rural areas. Online platforms and digital governance initiatives enabled by BharatNet have streamlined processes, reduced corruption, and enhanced citizen-government interaction.

Digital Entrepreneurship: BharatNet has encouraged digital entrepreneurship and innovation in rural areas. With improved connectivity, individuals and small businesses can leverage online platforms to market their products, reach wider audiences, and expand their customer base, contributing to local economic growth.[32]

Overview:

BharatNet stands as a significant example of a nationwide rural telephony initiative that focuses on bridging the digital divide and fostering socioeconomic development. Through its extensive fibre optic network and partnerships with private entities, BharatNet has connected millions of people in rural India, opening up new possibilities for education, healthcare, and economic opportunities.

CONCLUSION

Nigeria has a significant disparity in the distribution of telecommunications infrastructure, with rural areas being underserved. Bridging the digital divide between rural and urban areas is crucial for the nation to achieve its economic, social, and developmental goals.

One approach to achieving this goal is by leveraging the current level of mobile communication access and expanding universal access to telecoms services. The use of ICT in rural regions for education, healthcare, agriculture, and finance can significantly enhance rural telephony efforts and create an equitable learning and growing environment.

Additionally, advancements in rural telephony can provide life-saving emergency assistance to people living in remote areas in cases of insecurity or flooding. The examination of the impacts of telecommunications connectivity on rural communities in Nigeria has shown favourable results in areas such as economic growth, community infrastructure development, healthcare service delivery, and socio-political engagement and participation.

In a nutshell, therefore, the major challenges of connecting Nigeria's unconnected, unserved, and underserved areas, which the concept of rural telephony is meant to address include;

- Significant investment is required in Nigeria's ICT sector and the business models of the operators are not aligned with optimising rural telephony
- The traditional business model still leaves many dis-enfranchised
- Insecurity is a notable bottleneck that has discouraged operators from extending coverage to rural areas and threatened the viability of existing telephony installations
- Problems affecting telephony in rural areas abound, particularly power availability, longer meantime to repair, connectivity to the core network, and low GDP. Also, necessary network support is unavailable and, in some cases, availability is very limited – sim cards, scratch cards, handsets, charging facilities.

The good news now is that technology and innovation through the rural telephony initiative, now offers new opportunities with the following smart and low-cost incentives;

- Satellite connectivity and backhaul
- Open Ran technology/BTS radios – disruptive low-cost facilities
- Smart Solar Power Solutions supported by Lithium-Ion Batteries
- Availability of population data – to identify and plan
- Availability of Infrastructure companies with a national presence, and experience
- Low-cost 'super cheap' handsets
- Lower towers and poles
- Quicker deployments
- Independent sites – rather than part of a cellular network
- Community operated facilities.

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