The State of ICT4D Ecosystem as an Enabler for the Achievement of SDGs in Sub Saharan Countries

Erick Ochieng Otieno & Syprose Ochieng
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<td>ARTP</td>
<td>Regulatory Authority for Telecommunications and Posts</td>
</tr>
<tr>
<td>B2B</td>
<td>Business-to-Business</td>
</tr>
<tr>
<td>BPO</td>
<td>Business process outsourcing</td>
</tr>
<tr>
<td>COMESA</td>
<td>Common Market for Eastern and Southern Africa</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross domestic product</td>
</tr>
<tr>
<td>GSM</td>
<td>Global System for Mobile communication</td>
</tr>
<tr>
<td>GSMA</td>
<td>Global System for Mobile communication Association</td>
</tr>
<tr>
<td>ICASA</td>
<td>The Independent Communications Authority of South Africa</td>
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<tr>
<td>ICT</td>
<td>Information and communications technology</td>
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<tr>
<td>ICT4D</td>
<td>Information and communications technology for development</td>
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<tr>
<td>IDP</td>
<td>International Development Partners</td>
</tr>
<tr>
<td>IGF</td>
<td>The Internet Governance Forum</td>
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<tr>
<td>ITU</td>
<td>The International Telecommunication Union</td>
</tr>
<tr>
<td>LTE</td>
<td>Long-Term Evolution</td>
</tr>
<tr>
<td>WiMAX</td>
<td>Worldwide Interoperability for Microwave Access</td>
</tr>
<tr>
<td>NCA</td>
<td>The National Communications Authority of Ghana</td>
</tr>
<tr>
<td>NDP</td>
<td>The National Development Partners</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-governmental organization</td>
</tr>
<tr>
<td>NITDA</td>
<td>The National Information Technology Development Agency</td>
</tr>
<tr>
<td>RURA</td>
<td>The Rwanda Utilities Regulatory Authority</td>
</tr>
<tr>
<td>SDG</td>
<td>Sustainable Development Goals</td>
</tr>
<tr>
<td>UN</td>
<td>The United Nations</td>
</tr>
<tr>
<td>UNDESA</td>
<td>United Nations Department of Economic and Social Affairs</td>
</tr>
<tr>
<td>UNDGC</td>
<td>United Nations Department of Global Communications</td>
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Executive Summary

Population projections show that Africa's future relies on its youthful demographic, with immense potential for ICT to drive social and economic development. However, challenges persist in achieving SDGs related to poverty, hunger, and healthcare for a large portion of the African population. While some SDGs, such as Goals 12 and 13, are on track in some African countries, others struggle to meet their commitments, particularly those related to basic human needs. The whitepaper highlights the urgent need for ICT to enable the achievement of SDGs in Sub-Saharan Africa.

The objectives of the whitepaper were to assess the readiness of Sub-Saharan Africa's ICT ecosystem to integrate ICT for Development (ICT4D) as an enabler for achieving SDGs and identify best practices for ICT4D adoption in various social and economic domains.

The study employed a systematic desktop analysis of Sub-Saharan African countries' ICT ecosystems, SDG progress, and ICT4D integrations, offering recommendations to support the incorporation of ICT4D in achieving SDGs.

This document explored the critical role of Information and Communication Technology (ICT) in achieving Sustainable Development Goals (SDGs) in Sub-Saharan Africa. It begins by addressing the challenges and opportunities surrounding ICT adoption for development in the region.

Challenges in ICT Adoption: Africa has encountered obstacles in fully harnessing ICT for development, with outcomes lagging behind the Asia-Pacific region. A dearth of reliable statistics and information about Africa's ICT sector has impeded its integration into development projects. Moreover, limited citizen participation and impact on SDG achievement have been observed, despite some positive contributions from the ICT sector.

Opportunities in ICT Adoption: The document underscores the necessity of creating an enabling environment for ICT adoption, with a focus on key factors such as infrastructure, affordability, consumer readiness, and relevant content. It highlights the increasing prevalence of mobile internet usage, especially the growth of mobile platforms and services. The authors argue that Africa is increasingly prepared to sustain the digital revolution, citing factors like locally developed apps, mobile infrastructure, affordable data, and digital literacy.

Pathways for Sustainable Development: Several pathways through which ICT can contribute to SDG achievement are explored, including poverty alleviation, digitalization of agriculture, and inclusive access to quality healthcare. The document emphasizes the potential of the digital economy in reducing poverty and generating job opportunities. Various ICT-enabled startups making significant contributions to agriculture, healthcare, and food security are showcased. Digital hubs are discussed for their role in providing job opportunities in the digital sector.

Inclusive ICT Ecosystem Development: The document presents a theory of change illustrating how creating a stable and responsive environment for ICT can lead to increased internet usage, innovation, and accelerated progress in achieving SDGs. It underscores the importance of affordability, accessible internet, and relevant content in driving consumer readiness and fostering a transformative ecosystem. The impact is seen in enhanced SDG achievement, increased internet penetration, a culture of innovation, and empowered consumers.

Proposed Stakeholder Matrix: A stakeholder matrix is proposed to identify and categorize the various entities and individuals involved in ICT for Development (ICT4D) initiatives. It includes primary, secondary, and tertiary stakeholders, each with distinct roles and interests. This matrix aids in mapping and understanding the complex network of stakeholders involved in ICT4D projects.

In conclusion, the document underscores the pivotal role of ICT adoption in achieving the SDGs in Sub-Saharan Africa. It addresses both challenges and opportunities, showcases pathways for sustainable development, and proposes a stakeholder matrix to facilitate collaboration among key actors in the ICT4D ecosystem. The authors advocate for an enabling environment, responsive policies, and inclusive strategies to harness the potential of ICT for the betterment of African communities and the achievement of SDGs.
of the SDGs. This comprehensive approach to ICT adoption in Sub-Saharan Africa has the potential to drive substantial progress toward the region's sustainable development goals.

The document recommends an array of proactive initiatives to address the challenges in fulfilling SDG commitments by emphasizing the role of ICT4D as an enabler for achieving these goals and supporting the sustainable development of Sub-Saharan Africa while optimizing organizational stakeholder matrices to respond to "Impact oriented" ICT tools development and interventions in the sustainable development goals.
Introduction

According to The Infrastructure Consortium for Africa, there is a significant growth in Information and Communications Technology (ICT) as is evident in the recent decade’s rise of ICT investments and infrastructure development to the tune of $2.5bn in 2015, which appeared to be slightly more than the $2.3bn recorded the previous year, (The Infrastructure Consortium for Africa, 2015). There was also a significant increase by 85% of the national allocation to the ICT sector which managed to reach $1.1bn in 2018 signifying a $514m higher allocation than in 2017 with West Africa and Central Africa countries recording changes to the tune of $193m increase and $109m increase in allocation respectively, (The Infrastructure Consortium for Africa, 2018). The analysis from the Infrastructure Consortium for Africa went on to report that Kenya ($160m), and Egypt ($116m) were the largest allocators at the country level.

While the allocations have significantly shown progress, there are still concerns of deficits to meet the reach and penetration of ICT services for an all-inclusive benefit. In the year 2020, Africa’s ICT development prospects were projected to experience an investment deficit of close to $3 billion a year will be required to address the challenge of lagging behind the rest of the world in terms of reach and quality of its ICT penetration, (Corrigan, 2020). This implies that a significant portion of the population in Africa would not benefit from the digital inclusive drives that are needed to stimulate the social and economic prospects of the population. As agreed by experts, we concur that increasing the investments to address penetration and access is paramount. This agrees with the projection to the effect that an average inclusive growth of 0.4% to 0.7% would be experienced if there is an average increase of ICT infrastructure investments, (Mamello & Mohammed, 2022).

The narrative above therefore shows that while Africa has some milestones to reach in terms of internet penetration and access to an all-inclusive digital ecosystem, there is already a substantive base to boost its digital-led development portfolio for the benefit of its population for social and economic growth agenda. A world bank report showed that a paltry 22% out of the 84% of people living in areas with 3G service and 54% who have access to the 4G mobile internet service living across countries in Sub-Saharan Africa African used mobile internet (Begazo, Dutz, & Blimpo, 2023). While the percentage may seem discouraging, the numbers make a significant change if looked at from the overall people who would be impacted if technology was made to work for them in terms of social and economic development. This is pegged on a total of 322,128,411 which is based on the data presented by (Worldometers, 2023) which showed the current population of Africa as 1,464,220,050 as of Thursday, August 10, 2023. There are even more forward-looking prospects to advance benefits with ICT to impact Africa’s population which is projected to reach 2,485,135,539 as seen in Table 1.
### Table 1: Africa population forecast.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>POPULATION</th>
<th>MEDIAN AGE</th>
<th>URBAN POPULATION</th>
<th>AFRICA'S SHARE OF WORLD POP</th>
</tr>
</thead>
<tbody>
<tr>
<td>2025</td>
<td>1,530,031,247</td>
<td>19.1</td>
<td>698,148,943</td>
<td>19.5 %</td>
</tr>
<tr>
<td>2030</td>
<td>1,710,666,359</td>
<td>19.9</td>
<td>824,013,801</td>
<td>20.9 %</td>
</tr>
<tr>
<td>2035</td>
<td>1,899,296,806</td>
<td>20.8</td>
<td>966,329,885</td>
<td>21.4 %</td>
</tr>
<tr>
<td>2040</td>
<td>2,093,408,427</td>
<td>21.8</td>
<td>1,125,161,515</td>
<td>23.6 %</td>
</tr>
<tr>
<td>2045</td>
<td>2,289,760,657</td>
<td>22.9</td>
<td>1,299,953,249</td>
<td>24.9 %</td>
</tr>
<tr>
<td>2050</td>
<td>2,485,135,539</td>
<td>23.9</td>
<td>1,488,920,045</td>
<td>26.2 %</td>
</tr>
</tbody>
</table>

*Source: Worldometer (www.Worldometers.info)*


Population projections show that Africa will remain an average young continent. The implications therefore are that the future of Africa relies on the youth who comprise most of the population. The potential benefits of ICT in achieving social economic development are immense if well strategized and executed if the demographic composition is anything to go by. In Africa, numerous benefits have been foreseen in areas traversing agriculture through information sharing in the rural areas, and trade areas, among others where ICT skills and infrastructure capacity allow, (Ponelis & Holmner, 2015). The role that ICT plays in the growth of economies and communities cannot be understated. There is, therefore, a need to understand the extent to which the development partners and stakeholders have adopted ICT4D in their social economic development impact agenda to ensure that inclusive development agenda is achieved and how best approach to embed and govern the adoption of ICT4D as an enabler for social and economic development and the achievement of sustainable development is constituted. We achieve this by conducting a systematic desktop analysis of cases in Africa focusing.

## A glimpse of the state SDG implementation

A paradox in play can be seen in Sub-Saharan Africa where many have indicated how rich it is in terms of resources while still appearing to be unable to achieve the most important SDG commitments when it comes to the dignity and survival of its population. Many reports such as the one by (Izvorski, Coulibaly, & Doumbia, 2018) highlight this paradox clearly in terms of how rich Sub-Saharan Africa manages to grow dismally as compared to other regions in the same status. The SDG report shows that the efforts to ensure no poverty, zero hunger, and good health among other SDGs touching on human dignity remain a mirage for almost 90% of the African population.

From the country profiles on SDG implementation, it is evident that almost all African nations in the sub-Saharan countries are struggling to meet their commitments. As seen in **Figure 1**, only SDG 13 and SDG 12 appear to be well on track since most of the countries have achieved it and none is in the red for the countries where data was available. An even more worrying tends is the commitments that are indicated as appearing on the red. Based on the index, the countries that have managed to keep the progress going well despite not being able to have even one of the
commitments in the green zone have made it to the top best-performing index. According to the 2023 SDG index, only Mauritius has managed to surpass the achievement milestone of ensuring they have only three goals in the red while keeping almost all the achievements in good trajectory.

Figure 1: Illustration of individual SDG state of achievement by Sub-Saharan African countries

Source: Compiled by Authors based on SDG 2023 index report

**Statement of the problem**

In 2015, Sustainable Development Goals (SDGs)\(^1\) were adopted by countries in a bid to promote prosperity and address inequalities while protecting the environment for a sustainable future through 17 goals that were believed to be the best proactive pathway to have a better world. According to an assessment of the state of SDG implementation in 2023 by Sachs, Lafortune, Fuller, and Drumm, Africa appears to have some difficulties fulfilling its SDG goals, (Sachs, Lafortune, Fuller, & Drumm, 2023). Out of the seventeen goals, most African countries have managed an average of two goals only which are SDG Goal 12 and SDG Goal 13. The most vital and basic human needs related to goals such as SDG 3, SDG 2, SDG 1, etc. however, appear to lag in terms of achievement. The 2023 SDG Summit launched a new phase of accelerated action on development by providing six major transitions among them Digital Transformation that is meant to drive progress across the SDGs, (UNDGC, 2023). A similar echo has been made in a press release after the Kyoto IGF for urgent action to enable opportunities provided by information and digital technology while mitigating the risks that come along with information and digital technology, (IGF, 2023). It is from this background that we explore the potential of ICT for development

\(^{1}\) Sustainable Development Goals
interventions and the underlaying digitalization ecosystem in enabling the achievement of SDG in Sub-Saharan Africa.

Despite efforts from all parties to identify strategic pathways to ensure a higher rate of fulfilling the commitments, the role of ICT as an enabler for attaining the SDGs does not seem to be documented or to be absent entirely, even though technology-driven advancements to assist the communities we serve through ICT interventions, ICT for Development (ICT4D), has been around. In our economies' corporate and business sectors, this is readily apparent. We are lacking in-depth understanding of ICT4D that connects development partners on a local, national, and international level. We conduct an in-depth analysis of the ICT ecosystem among the Sub-Saharan countries to ascertain the readiness for ICT intervention for sustainable development and showcase comparative examples of these interventions. We also propose a theory within the frameworks of conception, implementation, and impact to close the knowledge gaps in the following areas: Understanding ICT4D adoption in the context of National Development Partners (NDP) and International Development Partners (IDP), ICT4D framework for integration and implementation in the context of rolling out Development agenda for the benefit of the target population, We thereafter develop a stakeholder matrix that provides a platform for best practices in ICT4D adoption, and Impact of these interventions on the target population.

Objectives
The main objective of this work is to assess the status of the ICT ecosystem in Sub-Saharan Africa that can facilitate a systematic integration of ICT4D as an enabler for the Achievement of SDGs in Africa and recommend pathways of incorporating ICT4D in the quest to achieve SDGs in Africa.

Research Questions
- To what extent is Sub-Saharan Africa ready to adopt ICT4D as an enabler for SDG achievements and reporting?
- What are the identifiable best practices in the consideration for ICT4D as applied in different social and economic domains across multiple SDG dimensions?
- How can policy and practice be streamlined to prove a foundation for increased ICT4D adoption that is responsive to the needs to meet SDG commitments in African countries?

Scope
The scope of this whitepaper was restricted to exploring the extent to which the ICT ecosystem in Africa is ready to adopt ICT4D in the process of achieving the SDGs and not to evaluate the success or challenges to effectively impact the achievement of SDGs by countries in the Sub-Saharan Countries.

Rationale of the white paper
This study derives its justification from current worries that the promises made by nations of the common good to the SDGs are difficult to fulfill. Therefore, by including ICT4D as an enabling platform for the attainment of SDG commitments, this paper presents an opportunity to complement the discourses currently in place and shift the focus from obstacles to solutions for the achievement of SDG commitments. We believe that the ideas and insights from this paper will lead to actionable measures that will put ICT4D back at the forefront of initiatives and strategies that will help struggling nations fulfill their responsibilities to a sustainable global society.
Methodology

The research design adopted was the exploratory systematic desktop study with thematic analysis as the analysis approach. Databases and indices were systematically retrieved and analyzed which included the forty individual Sub-Saharan country profiles on ICT ecosystem status, SDG progress from (Sustainable Development Solutions Network, 2023), Country profile database from 26 Sub-Saharan countries from the Global Innovation Index (World Intellectual Property Organization, 2022), and Other databases and information touching on ICT for Development and Sustainable Development Goals. Data analysis was done through content and thematic analyses.

For a comprehensive and 100 percent representation, we profiled all the Sub-Saharan countries in terms of Internet infrastructure and penetration, Innovation Index, and SDG implementation status and analyzed these against the 2023 SDG index report. We then explored ICT4D integrations in select countries and categorized them against the corresponding SDG goals that they lean towards to showcase pathways in which ICT4D can be aligned towards enabling SDG achievement and reporting.

We then discussed the findings within the context of policy and practices and offered recommendations for the future.
Findings

Internet connectivity trends trend in Sub-Saharan Africa

For a holistic understanding of the connections between SDG implementation, and innovations, and to enable us to draw a correlation on the need for increased attention on ICT tools as an enabling component for development, we explore several data points that illustrate the current trends on internet accessibility and its related usage, connectivity, and penetration among other parameters.

To start with, we compile available data on Internet users, Mobile connections, etc. from the DataReportal\(^2\) Internet World Stats\(^3\), and GSMA report on Mobile connectivity index\(^4\) to bring a rich collection of dimensions touching on internet connectivity.

The ever-improving ICT ecosystem in Sub-Saharan Africa has partly to play in the rise of internet connectivity trends. For example, Nigeria has a growing ICT sector, with a burgeoning tech startup scene in cities like Lagos. The country has made investments in broadband infrastructure and mobile technology and Internet penetration is increasing, with a large population making it a significant market for ICT services. South Africa on the other hand boasts a more mature ICT ecosystem compared to many other African countries with a well-developed telecommunications infrastructure and a strong presence of tech companies. Cape Town and Johannesburg are tech hubs with numerous startups and innovation centers. Kenya has been known for a long time for its innovation in mobile banking, with M-Pesa being a prominent example with Nairobi considered as a tech hub with a growing number of tech startups. There is also increased government investment in improving broadband access and digital literacy such as the Digital schools and the Ajira programme. Ghana is working to develop its ICT infrastructure and promote digital entrepreneurship that is supported by government initiatives to increase internet access and digital skills. This has seen Accra grow its tech ecosystem with co-working spaces and incubators. In Rwanda, there are significant strides made in building its ICT infrastructure. With the government investing in initiatives like the Kigali Innovation City. Broadband connectivity is also rapidly expanding, and there is a focus on e-governance. Uganda equally appears to have a developing ICT sector with a focus on software development and BPO services. The government is investing in internet connectivity, and Kampala is a growing tech center. Another East African nation showing increased digitalization interest is the Republic of Tanzania which has been improving its ICT infrastructure, with a focus on expanding internet access. Dar es Salaam has a budding tech scene with startups and tech hubs. Ethiopia on the other hand has recently opened its ICT sector to private investment, leading to rapid growth. There is a focus on expanding internet access and digital services. Further west of the Sub Sahara Africa, we have Senegal and Niger. Senegal has been making strides in developing its ICT ecosystem, particularly in Dakar with initiatives to improve digital infrastructure and digital literacy underway. Niger on the other hand is seen to be facing challenges in developing its ICT sector due to limited resources and infrastructure. However, there are efforts to improve internet access and digital skills.

It’s important to note that the ICT landscape in Sub-Saharan Africa is dynamic and evolving. Many countries are working to overcome challenges such as limited infrastructure, access to funding, and digital literacy to harness the potential of ICT for economic growth and social development. The level of progress varies significantly from one country to another, but the region as a whole

\(^2\) https://datareportal.com/reports/
\(^3\) https://www.internetworldstats.com/africa.htm#cd
\(^4\) https://www.mobileconnectivityindex.com/index.html
is seeing positive developments in the ICT sector. However, one common trend in the growth of the ICT sector is the consistent rise over the years in terms of tangible and quantifiable investments and impact in terms of internet penetration as seen in Figure 2 shows a consistent rise in mobile connectivity.

Figure 2: Illustration of eight year running mobile connectivity index trends in the Sub Saharan Africa

Source: Compiled by Authors based on datasets from (GSM Association, 2023)
Sub-Saharan Africa Country ICT ecosystems profiles

We delve into each country from the Sub-Saharan region and explore the status of the ICT ecosystem in broader terms number of internet users vs internet connectivity, infrastructure, affordability, consumer readiness, and content and services. The profiles will give us a snapshot of the state of the ICT ecosystem from each country’s perspective.

Angola

Angola has made significant strides in improving its telecommunications infrastructure. The country has an extensive fiber optic network that connects major cities and regions, facilitating internet connectivity. For example, reports indicate that it has an interconnected optical fiber that crosses through to the border of Angola and Zambia (Njoya, 2023) while another connects South Africa and Angola with the route from Luanda connecting other Common Market for Eastern and Southern Africa (COMESA) countries such as Democratic Republic of Congo, Zambia, and Zimbabwe, (The Digital Watch, 2023). The government has also invested in expanding mobile network coverage.

Internet penetration in Angola has been steadily increasing, but it remains lower than in many other countries. Access to high-speed internet can be limited in rural areas, with most high-speed connections available in urban centers.

Mobile technology is a key driver of ICT in Angola. A significant portion of the population relies on mobile devices for communication and internet access. Several mobile network operators provide voice and data services.

The Angolan government plays a central role in regulating the ICT sector. In recent years, there have been efforts to promote the growth of the sector through various initiatives and policies. These include the development of a national broadband plan and measures to attract foreign investment.

Angola has been working on e-government initiatives to improve public services and governance. This includes the digitization of government services and the implementation of online platforms for citizens to access government information and services.

There has been a growing interest in technology and entrepreneurship in Angola. Some tech startups and incubators have emerged in recent years, focusing on various sectors, including fintech, agritech, and e-commerce.

Despite progress, Angola’s ICT ecosystem faces several challenges, including limited internet access in rural areas, a lack of digital skills, and the need for further infrastructure development. Additionally, there may be regulatory and bureaucratic hurdles for businesses and startups.

The government has been seeking foreign investment and partnerships to support the development of ICT infrastructure and services in the country. This includes cooperation with international organizations and technology companies.

In January 2020, Angola had approximately 8.90 million internet users, with an internet penetration rate of 28%. This increase by January 2021, in which the number of internet users increased to around 10.36 million, and the internet penetration rate rose to 31.0%. In January 2022, there were approximately 12.41 million internet users in Angola, with an internet penetration rate of 36.0%. This represented an increase of 389,000 users (3.2%) from the previous year. As of January 2023, Angola had 11.78 million internet users, and the internet penetration rate was 32.6%. This data indicates a steady growth in the number of internet users
in Angola and an increase in internet penetration over the years, reflecting a positive trend in the country's digital connectivity.

Table 2: Illustration of Intern penetration rates and internet users for the period covering January 2020 to January 2023

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<th>2020</th>
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<tbody>
<tr>
<td>Internet penetration rate</td>
<td>28</td>
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<td>36</td>
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<td>Internet users (Million)</td>
<td>8.9</td>
<td>10.36</td>
<td>12.41</td>
<td>11.78</td>
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Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 3 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.

![Graph showing the overall trend of ICT ecosystem in Angola]

Source: Compiled by Authors based on datasets from (GSM Association, 2023)

**Benin**

Benin has been working on improving its telecommunications infrastructure, including expanding mobile network coverage and investing in fiber optic networks. The country has made efforts to enhance connectivity and reduce the digital divide. Internet penetration in Benin has been growing steadily, but it remains lower than in some other countries. Access to high-speed internet is limited in rural areas, with urban centers having better connectivity. Mobile technology is a key driver of ICT in Benin.
Many people rely on mobile devices for communication and internet access. Several mobile network operators provide voice and data services. The government plays a central role in regulating the ICT sector. Benin has been working on various initiatives and policies to promote the growth of the sector. This includes efforts to attract foreign investment and develop a favorable regulatory environment.

Benin has taken steps to implement e-government initiatives to improve public services and governance. This involves digitizing government services and creating online platforms for citizens to access government information and services. The country has seen a growing interest in technology and entrepreneurship. Some tech startups and incubators have emerged in recent years, focusing on areas like fintech, agritech, and e-commerce.

Benin's ICT ecosystem, however, faces challenges, including limited internet access in rural areas, a need for digital skills development, and further infrastructure development. Additionally, there may be regulatory and bureaucratic obstacles for businesses and startups. The government has sought foreign investment and partnerships to support the development of ICT infrastructure and services. This includes cooperation with international organizations and technology companies.

At the outset of 2020, Benin registered 2.96 million internet users, reflecting a projected increase of 7.2% from 2019 to 2020. During the same period, an estimated 25% of the population was using the internet. By January 2021, internet penetration in Benin had reached 28.4%, with a global total of 3.5 million internet users. As of January 2022, the number of internet users in the country had risen to 3.66 million, constituting 29% of the population.

In early 2022, Benin was home to an estimated 4.60 million internet users, resulting in an internet penetration rate of 34.0% among the total population at the beginning of 2023. Despite making progress, Benin faces challenges in meeting its Sustainable Development Goals (SDG) commitments, having achieved only two out of sixteen targets, specifically SDG 12 and SDG 13. While there is much work ahead, Benin stands out as one of the African nations that has made significant efforts, ranking 150th out of 166 countries globally and 55th in Sub-Saharan Africa.

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<th>Table 3: Illustration of Intern penetration rates and internet users for the period covering January 2020 to January 2023</th>
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<td><strong>2020</strong></td>
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<td>Internet penetration rate</td>
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<td>Internet users (Million)</td>
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Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 4 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Botswana

Botswana has invested significantly in telecommunications infrastructure. The country has a well-developed mobile network and extensive fiber optic connectivity that supports internet access and communication services. Internet penetration in Botswana is relatively high compared to many other African countries. Access to high-speed internet is widely available in urban areas, and the government has made efforts to improve access in rural regions.

Mobile technology is a major driver of ICT in Botswana. Mobile phones are widely used for communication and accessing the internet, and several mobile network operators provide voice and data services. The government plays a crucial role in regulating the ICT sector. Botswana has implemented policies and initiatives to encourage the growth of the sector, including the establishment of a regulatory authority to oversee telecommunications and broadcasting. Botswana has made efforts to implement e-government initiatives to improve public services and governance. This includes digitizing government services, providing online access to information, and offering online platforms for citizens to access government services.

There is also a growing interest in technology and entrepreneurship. Some tech startups and innovation hubs have emerged, focusing on areas such as fintech, agritech, and e-commerce. While Botswana has made significant progress in developing its ICT ecosystem, challenges remain, including disparities in internet access in rural areas, the need for digital skills development, and ensuring that the benefits of ICT reach all segments of the population. The government has been working to attract foreign investment and foster partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies is part of this effort.

In terms of internet penetration and internet user statistics, 1.09 million people used the internet in Botswana as of January 2020. In the two years between 2019 and 2020, there were 23,000 more internet users (+2.1 percent). In January 2020, however, only 47% of people were using the internet. At the beginning of 2021, there were 1.12 million internet users. In the two years between 2020 and 2021, there were 22,000 more internet users (+20% more).
However, in January 2021, internet penetration was predicted to be 47 percent. 1.48 million people used the internet in Botswana as of January 2022. As of the beginning of 2022, 61 percent of the country’s population was using the internet. According to this, there were 27,000 more internet users in the nation in 2022 than there were in 2021 (a +11% increase). Using these user statistics as an example, it can be seen that 943.4 thousand people were not online at the start of 2022, which equates to a population offline of 39.0 percent. 1.95 million people used the internet in Botswana as of January 2023. Beginning in 2023, 73.5 percent of all people in Botswana had access to the internet.

This suggests that between 2022 and 2023, there were 33,000 more internet users in Botswana (an increase of 1.7 percent). For instance, according to these user statistics, there were 703,000 internet users offline in Botswana at the beginning of 2023, which indicates that 26.5% of the country’s population was not online.

Table 4: Illustration of Internet penetration rates and internet users for the period covering January 2020 to January 2023

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<td>Internet users (Million)</td>
<td>1.09</td>
<td>1.12</td>
<td>1.48</td>
<td>1.95</td>
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Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 5 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.

Figure 5: Botswana’s overall trend of ICT ecosystem covering a running nine-year index.

Source: Compiled by Authors based on datasets from (GSM Association, 2023)
Burkina Faso

Burkina Faso has been making efforts to develop its telecommunications infrastructure. While the country's infrastructure is still developing, it has expanded mobile network coverage and invested in fiber optic networks to improve internet connectivity. Internet penetration in Burkina Faso is relatively low compared to some other countries, and access to high-speed internet can be limited in rural areas. However, urban centers generally have better connectivity. Mobile technology plays a central role in the country’s ICT ecosystem.

Mobile phones are widely used for communication, and there are multiple mobile network operators providing voice and data services. The government is actively involved in regulating and promoting the ICT sector. Burkina Faso has implemented policies and initiatives to encourage the growth of the sector, including measures to attract foreign investment. Burkina Faso has been working to implement e-government initiatives aimed at improving public services and governance. This includes efforts to digitize government services and provide online platforms for citizens to access government information and services.

The country has witnessed the emergence of technology startups and innovation hubs. These startups are focusing on a range of sectors, including fintech, agritech, and e-commerce. Burkina Faso’s ICT ecosystem faces challenges such as limited internet access in rural areas, the need for digital skills development, and further infrastructure development. Additionally, political and economic stability can impact the sector's growth. The government has been seeking foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies is part of this effort.

In January 2020, Burkina Faso had 4.59 million internet users, reflecting an increase of 328,000 users (7.7%) between 2019 and 2020. At the outset of 2020, 22% of the population had internet access.

By January 2021, the number of internet users in Burkina Faso had risen to 5.46 million, with 867,000 more internet users compared to 2020, representing a 19% increase. In January 2021, 25.7% of the population used the internet.

In January 2022, Burkina Faso recorded 5.95 million internet users, resulting in a 27.3% internet penetration rate at the beginning of 2022. These figures indicate 572,000 more internet users in 2022 compared to 2021, marking a 10.6% increase. According to these user statistics, only 15.85 million people were online at the start of 2022, translating to a population offline rate of 72.7%.

At the beginning of 2023, Burkina Faso had 4.96 million internet users, with 21.6% of the population having access to the internet. This suggests that there were 123,000 more internet users in 2023 compared to 2022, reflecting a 2.6% increase. Based on these user statistics, 18.00 million people were not using the internet at the start of 2023, indicating that 78.4% of the population remained unconnected.
Table 5: Illustration of Internet penetration rates and internet users for the period covering January 2020 to January 2023

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<tbody>
<tr>
<td>Internet penetration rate</td>
<td>22</td>
<td>25.7</td>
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<tr>
<td>Internet users (Million)</td>
<td>4.59</td>
<td>5.46</td>
<td>5.95</td>
<td>4.96</td>
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</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 6 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.

![Figure 6: Burkina Faso’s overall trend of ICT ecosystem covering a running nine-year index.](image)

Source: Compiled by Authors based on datasets from (GSM Association, 2023)

**Burundi**

Burundi has been working to develop its telecommunications infrastructure for quite some time and their efforts appear to be bearing fruits. The country has made investments in expanding mobile network coverage and improving connectivity. However, the telecommunications infrastructure is still in the process of development. Internet penetration in Burundi is relatively low compared to many other countries, and access to high-speed internet can be limited, especially in rural areas. Urban centers tend to have better connectivity. Mobile technology is a crucial component of the ICT ecosystem in Burundi.

Many Burundians use mobile phones for communication and accessing the internet. Several mobile network operators provide voice and data services. The government plays a significant
role in regulating and promoting the ICT sector. Burundi has been working on initiatives and policies to stimulate growth in the sector, including measures to attract foreign investment.

Efforts have been made to implement e-government initiatives in Burundi, with a focus on improving public services and governance. This includes digitizing government services and creating online platforms for citizens to access government information and services.

The country has seen a nascent interest in technology and entrepreneurship, with some tech startups emerging. These startups often focus on areas such as fintech, agritech, and e-commerce. The ICT ecosystem in Burundi faces several challenges, including limited internet access in rural areas, a need for digital skills development, and further infrastructure development. Political and economic stability can also impact the sector’s growth. The government has sought foreign investment and partnerships to support the development of ICT infrastructure and services in Burundi. Collaboration with international organizations and technology companies is part of this effort.

In January 2020, there were 1.5 million Burundians online, with an additional 202,000 internet users, signifying a substantial 21 percent increase between 2019 and 2020. At the outset of 2020, a high 91.9% of the population was connected to the internet.

By the beginning of 2021, the number of internet users in Burundi had risen to 1.6 million, indicating an increase of 452,000 users (39%) between 2020 and 2021. In January 2021, 13.3% of the population was online.

In January 2022, there were 1.82 million internet users in Burundi, and 14.6% of the population had internet access. To illustrate, these user statistics reveal that 10.62 million people were not online at the beginning of 2022, indicating that 85.4% of the population remained offline.

As of January 2023, 1.33 million people in Burundi were online, with 10.2% of the population having internet access at the beginning of 2023. To provide an example, these user statistics indicate that 11.73 million people were not online at the start of 2023, representing 89.8% of the population that was not connected at that time.

Table 6: Illustration of Intern penetration rates and internet users for the period covering January 2020 to January 2023

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<tbody>
<tr>
<td>Internet penetration rate</td>
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<td>14.6</td>
<td>10.2</td>
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<tr>
<td>Internet users (Million)</td>
<td>1.15</td>
<td>1.61</td>
<td>1.82</td>
<td>1.33</td>
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Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 7 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Cabo Verde

Cabo Verde has invested in developing its telecommunications infrastructure. The country has a relatively well-established telecommunications network that includes mobile and fixed-line services. The government has also been investing in undersea fiber optic cables to enhance international connectivity. Internet penetration in Cabo Verde has been increasing, and the country has made efforts to expand access to high-speed internet. Urban areas typically have better connectivity than rural regions.

Mobile technology is a key driver of ICT in Cabo Verde. Mobile phones are widely used for communication and accessing the internet. Multiple mobile network operators provide voice and data services. The government plays a significant role in regulating and promoting the ICT sector. Cabo Verde has implemented policies and initiatives to stimulate the growth of the sector, including measures to attract foreign investment.

Cabo Verde has made progress in implementing e-government initiatives to improve public services and governance. This includes digitizing government services, offering online platforms for citizens to access government information and services, and facilitating online interactions with public institutions. There has been a growing interest in technology and entrepreneurship in Cabo Verde. Some tech startups have emerged, focusing on various sectors, including fintech, tourism, and e-commerce. Incubators and innovation hubs have also been established to support these ventures.

In terms of challenges, Cabo Verde's ICT ecosystem faces challenges such as limited internet access in rural areas, a need for digital skills development, and ensuring that the benefits of ICT
reach all segments of the population despite the progress that has so far been made on this front. The country’s small size and market can also present limitations. Investment and Partnerships can be seen in terms of the government’s seeking foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies is part of this effort. Cabo Verde’s ICT ecosystem is relatively dynamic, and the government’s efforts to promote the sector’s growth are contributing to its development. However, the country’s unique geographic and economic context presents both opportunities and challenges for the expansion of ICT services and digital innovation.

In January 2020, Cape Verde saw an increase of 3,703 more internet users compared to January 2019, representing a 1.2 percent growth, bringing the total number of internet users in the country to 316.3 thousand. However, at the beginning of 2020, only 57% of the population had internet access.

Between 2020 and 2021, there was an additional 30,000 internet users, marking a significant 9.4 percent increase. In January 2021, internet usage reached 61.9% of the population. By January 2022, Cabo Verde had 349.8 thousand internet users, and 61.9% of the entire population was online.

Looking at these user statistics, it’s apparent that 214.9 thousand Cape Verdeans who typically use the internet were not online at the start of 2022, accounting for 38.1% of the country’s population.

As of January 2023, Cape Verde had 415,000 internet users, and 69.8% of the population had internet access at the beginning of 2023. For example, these user statistics indicate that 179.9 thousand Cabo Verdeans were not online at the start of 2023, representing 30.2 percent of the country’s population that was not online at that time.

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<th>Table 7: Illustration of Internet penetration rates and internet users for the period covering January 2020 to January 2023</th>
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<td>Internet penetration rate</td>
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<td>2020</td>
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<tr>
<td>Internet users (Million)</td>
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<td>0.3162</td>
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Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 8 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Figure 8: Cabo Verde’s overall trend of ICT ecosystem covering a running nine-year index.

Source: Compiled by Authors based on datasets from (GSM Association, 2023)

Cameroon

Cameroon has made significant investments in its telecommunications infrastructure. The country has an extensive network of mobile and fixed-line services. The government has also been involved in initiatives to expand internet connectivity and undersea fiber optic cables to enhance international connectivity.

Internet penetration in Cameroon has been increasing, and the country has made efforts to expand access to high-speed internet. Urban areas typically have better connectivity than rural regions, but the digital divide remains a challenge.

Mobile technology is a key driver of ICT in Cameroon. Mobile phones are widely used for communication and accessing the internet, with several mobile network operators providing voice and data services.

The government plays a significant role in regulating and promoting the ICT sector. Cameroon has implemented policies and initiatives to stimulate the growth of the sector, including measures to attract foreign investment and develop a regulatory framework.

Cameroon has been working on e-government initiatives to improve public services and governance. This includes digitizing government services and providing online platforms for citizens to access government information and services.

The country has seen a growing interest in technology and entrepreneurship. Some tech startups and innovation hubs have emerged, focusing on various sectors, including fintech, health tech, agritech, and e-commerce. The Cameroonian government has also established innovation centers to support these ventures.

Despite progress, Cameroon's ICT ecosystem faces challenges, including limited internet access in rural areas, a need for digital skills development, and ensuring that the benefits of ICT reach all
segments of the population. Infrastructure development and cybersecurity are also areas of concern.

The government has been seeking foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies is part of this effort.

Cameroon's ICT ecosystem is dynamic and evolving, with the government's commitment to promoting digital innovation and infrastructure development. The country has made significant progress, but there are still challenges to address, particularly in bridging the digital divide and ensuring that ICT benefits reach all citizens.

In January 2020, Cameroon had 7.87 million internet users, marking an increase of 570,000 users (7.8%) between 2019 and 2020. At the beginning of 2020, 30% of Cameroon's population was online.

By January 2021, the number of internet users in Cameroon had risen to 9.15 million, reflecting a significant increase of 1.3 million users (16%) compared to the previous year. In January 2021, 34.1% of the country's population had internet access.

Moving to January 2022, 10.5 million Cameroonians were online, representing 36.5% of the population with internet access. These user statistics highlight that 17.51 million Cameroon citizens were not online at the start of 2022, indicating a 63.5% offline rate.

As of January 2023, the number of internet users in Cameroon had increased to 12.89 million, with 45.6% of the population having internet access at the beginning of 2023. For instance, based on these user statistics, 15.38 million people in Cameroon were not online at the start of 2023, accounting for a 54.4% offline rate.

Table 8: Illustration of Intern penetration rates and internet users for the period covering January 2020 to January 2023

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<td>Internet users (Million)</td>
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Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 9 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Central African Republic

Central African Republic's telecommunications infrastructure was underdeveloped, with limited network coverage in rural areas. However, efforts were underway to expand and improve the country's telecommunications infrastructure.

Internet penetration in the Central African Republic was relatively low, with limited access to high-speed internet, especially in rural regions. Internet access was primarily available in urban centers, with low levels of connectivity outside these areas.

Mobile technology played a significant role in the Central African Republic, and mobile phones were the primary means of communication and internet access for the population. Several mobile network operators provided voice and data services.

The government in the Central African Republic had started taking steps to regulate and promote the ICT sector. However, the political and security situation in the country often posed challenges to the consistent development and regulation of the sector.

Central African Republic faced numerous challenges in its efforts to develop the ICT ecosystem, including political instability, limited infrastructure development, a lack of digital skills, and limited internet access in rural areas. Additionally, the country had to address issues related to security and governance.

Due to the challenges mentioned, foreign investment and partnerships in the ICT sector were limited. The security situation and political instability deterred significant foreign investment.

Various humanitarian organizations and NGOs have been working in the Central African Republic to provide ICT solutions and connectivity in support of their operations, particularly in areas of conflict and displacement.
The development of e-government initiatives and digitization of public services was in its early stages. The government faced significant hurdles in providing online services to citizens due to limited infrastructure and security concerns.

It’s important to note that the situation in the Central African Republic is highly fluid, and the development of the ICT ecosystem was influenced by a range of factors, including security, governance, and infrastructure challenges. Efforts were being made to improve the country’s ICT infrastructure and connectivity, but these efforts were constrained by the broader challenges facing the nation.

In January 2020, the Central African Republic had 65,000 residents connected to the internet. The country experienced a notable 20 percent increase in internet users between 2019 and 2020, resulting in 107,000 additional users. During the same period, 14% of the nation’s population had internet access.

By January 2021, the number of internet users had grown to 557,000. The Central African Republic’s internet penetration rate in January 2021 was 11.4 percent. In January 2022, 355,000 people in the Central African Republic were online, representing 7.1 percent of the population. Notably, 4.61 million people, or 92.9 percent of the population, did not have internet access at the beginning of 2022, according to the data.

As of January 2023, there were 599,700 internet users in the Central African Republic, with 10.6 percent of the population having internet access at the start of 2023. In light of these statistics, it can be observed that a total of 5.06 million people reside in the Central African Republic.

Table 9: Illustration of Internet penetration rates and internet users for the period covering January 2020 to January 2023

<table>
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<tr>
<th></th>
<th>2020</th>
<th>2021</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Internet penetration rate</td>
<td>14</td>
<td>11</td>
<td>7.1</td>
<td>10.6</td>
</tr>
<tr>
<td>Internet users (Million)</td>
<td>0.6555</td>
<td>0.5571</td>
<td>0.3551</td>
<td>0.5997</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 10 shows a consistent improvement in infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Chad

Chad’s telecommunications infrastructure was limited, with significant gaps in network coverage in rural areas. However, efforts were underway to expand and improve the country’s telecommunications infrastructure.

Internet penetration in Chad was relatively low, with limited access to high-speed internet, especially in rural regions. Internet access was primarily available in urban centers, and even there, it could be unreliable.

Mobile technology played a significant role in Chad, with mobile phones serving as the primary means of communication and internet access for the population. Several mobile network operators provided voice and data services.

The Chadian government had started taking steps to regulate and promote the ICT sector. However, political, and economic challenges often hindered the consistent development and regulation of the sector.

Chad faced numerous challenges in its efforts to develop the ICT ecosystem. These challenges included political instability, limited infrastructure development, a lack of digital skills, limited internet access in rural areas, and issues related to security and governance.

Foreign investment and partnerships in the ICT sector were limited due to the challenging political and economic environment. Chad faced obstacles in attracting foreign investment in the technology sector.

The development of e-government initiatives and digitization of public services was in its early stages. The government faced hurdles in providing online services to citizens due to limited infrastructure and security concerns.
Various humanitarian organizations and NGOs have been working in Chad to provide ICT solutions and connectivity in support of their operations, particularly in areas of conflict and displacement.

Chad's ICT ecosystem development was influenced by a range of factors, including political instability, governance issues, and infrastructure challenges. While there were efforts to improve ICT infrastructure and connectivity, these efforts were constrained by the broader challenges facing the country.

As of January 2020, Chad had 2.23 million internet users. The country witnessed an increase of 153,000 (+7.4%) internet users between 2019 and 2020. At the beginning of 2020, 14% of Chad's population was connected to the internet.

By January 2021, Chad's internet user count had reached 2.086 million, signifying a significant growth of 630,000 users (+28%) from 2020 to 2021. In January 2021, 17.2% of Chad's population was online.

In Chad, there were 3.26 million internet users as of January 2022, with 19% of the population online at the start of the year. In other words, based on these user statistics, 13.91 million people in the nation were not using the internet at all at the beginning of 2022, representing 81.0% of the population offline.

Moving to January 2023, Chad had 3.22 million internet users, and 17.9% of the population had internet access at the start of 2023. Put differently, these user numbers indicate that at the beginning of 2023, 14.78 million people were not using the internet, reflecting that 82.1% of the population remained offline.

Table 10: Illustration of Internet penetration rates and internet users for the period covering January 2020 to January 2023

<table>
<thead>
<tr>
<th></th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet penetration rate</td>
<td>14</td>
<td>17.2</td>
<td>19</td>
<td>17.9</td>
</tr>
<tr>
<td>Internet users (Million)</td>
<td>2.23</td>
<td>2.86</td>
<td>3.26</td>
<td>3.22</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 11 shows a consistent improvement in infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services. Though the rise seems to be more rapid in the years 2021 and 2022 in terms of content and service relevance, consumer readiness, and affordability, on the infrastructure front, for some reason there was a slight dip in the same period.
Figure 11: Chad's overall trend of the ICT ecosystem covering a running nine-year index.

Source: Compiled by Authors based on datasets from (GSM Association, 2023)

Republic of Congo

The Republic of Congo has been working on improving its telecommunications infrastructure. The country had an expanding network of mobile and fixed-line services. Efforts have been made to enhance connectivity and internet access.

Internet penetration in the Republic of Congo was growing, with efforts to expand access to high-speed internet. Urban areas typically had better connectivity than rural regions, but progress was being made to bridge the digital divide. Mobile technology plays a significant role in the ICT ecosystem. Mobile phones were widely used for communication and internet access. Multiple mobile network operators provided voice and data services.

The government played a role in regulating and promoting the ICT sector. Initiatives aimed at stimulating the sector's growth, attracting foreign investment, and establishing a regulatory framework were underway.

The development of e-government initiatives and the digitization of public services were progressing. Online platforms for accessing government information and services were being introduced to improve public services and governance.

The Republic of Congo saw a growing interest in technology and entrepreneurship, with some tech startups emerging. These startups often focused on sectors like fintech, e-commerce, and mobile app development.

Despite progress, the Republic of Congo's ICT ecosystem faced challenges such as limited internet access in rural areas, a need for digital skills development, and ensuring that the benefits of ICT reached all segments of the population.

The government sought foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies was part of this effort.
The Republic of Congo was actively working on developing its ICT ecosystem and expanding access to digital services. However, it is essential to consider that the progress in the ICT sector may be influenced by factors such as political stability, economic conditions, and the availability of infrastructure.

In January 2020, the Republic of the Congo had 1.53 million internet users. Notably, the number of internet users in the Republic of the Congo surged by 855,000 (+126%) between 2019 and 2020. At that time, internet penetration in the Republic of the Congo was at 28%.

By January 2021, there were 1.79 million internet users in the Republic of the Congo, signifying an increase of 260,000 users (+17%) between 2020 and 2021. The internet penetration rate in the Republic of the Congo was 32.1% in January 2021.

Moving to January 2022, there were 1.45 million internet users in the Congo, with an internet penetration rate of 25.4% of the total population at the start of 2022. The analysis indicates that internet users in the Congo increased by 276,000 (+23.4%) between 2021 and 2022. To put it in perspective, these user figures reveal that 4.27 million people in the Congo did not use the internet at the beginning of 2022, indicating that 74.6% of the population remained offline.

In January 2023, the Congo had 1.33 million internet users, with an internet penetration rate of 22.0% of the total population at the start of 2023. The analysis suggests that internet users in the Congo increased by 94,000 (+7.6%) between 2022 and 2023. To provide context, these user figures indicate that 4.71 million people in the Congo were not using the internet at the start of 2023, highlighting that 78.0% of the population remained offline at the beginning of the year.

Table 11: Illustration of Internet penetration rates and internet users for the period covering January 2020 to January 2023

<table>
<thead>
<tr>
<th></th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
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<tbody>
<tr>
<td>Internet penetration rate</td>
<td>28</td>
<td>32.1</td>
<td>25.4</td>
<td>22</td>
</tr>
<tr>
<td>Internet users (Million)</td>
<td>1.53</td>
<td>1.79</td>
<td>1.45</td>
<td>1.33</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 12 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services. However, the trend takes a surprising dip between 2019 and 2022.
Democratic Republic of Congo

The Democratic Republic of Congo's telecommunications infrastructure was undergoing development, with an expanding network of mobile and fixed-line services. The government had been investing in improving connectivity, including expanding mobile network coverage. The potential benefits that route from Luanda connecting other Common Market for Eastern and Southern Africa (COMESA) countries such as Zambia, and Zimbabwe (The Digital Watch, 2023) is one of the great spillover effects of interconnected region through one fiber optic and has the potential to uplift the Democratic Republic of Congo's internet infrastructure to a high level.

Internet penetration in the Democratic Republic of Congo was relatively low, with limited access to high-speed internet, especially in rural areas. Urban centers had better connectivity, but there was a significant digital divide.

Mobile technology played a pivotal role in the Democratic Republic of Congo's ICT ecosystem. Mobile phones were widely used for communication and accessing the internet, with multiple mobile network operators providing voice and data services.

The government has been taking steps to regulate and promote the ICT sector. The Democratic Republic of Congo was working on initiatives to stimulate sector growth, attract foreign investment, and establish a regulatory framework.

The development of e-government initiatives and the digitization of public services were in their early stages. Efforts were being made to improve public services and governance through digital solutions.

The Democratic Republic of Congo's ICT ecosystem faced numerous challenges, including limited internet access in rural areas, a need for digital skills development, and ensuring that the benefits of ICT reached all segments of the population. Political instability, economic conditions, and security concerns also presented challenges.
Foreign investment and partnerships in the ICT sector were limited, with challenges related to political instability and governance issues potentially deterring significant foreign investment.

Various humanitarian organizations and NGOs have been working in the Democratic Republic of Congo to provide ICT solutions and connectivity in support of their operations, especially in conflict-affected and remote areas.

The Democratic Republic of Congo's ICT ecosystem was characterized by both potential for growth and a range of challenges. The development of the ICT sector was influenced by factors such as political stability, governance issues, infrastructure limitations, and the broader economic environment.

In January 2020, the Democratic Republic of Congo boasted 16.35 million internet users. The number of internet users in the country surged by 9.0 million (+122%) between 2019 and 2020. At that time, internet penetration in the Democratic Republic of Congo stood at 19%.


By January 2022, there were 16.50 million internet users in the Democratic Republic of Congo, with an internet penetration rate of 17.6% of the total population at the start of 2022. To put it in perspective, these user figures reveal that a substantial 77.29 million people in the Democratic Republic of Congo were not using the internet at the beginning of 2022, indicating that 82.4% of the population remained offline.

As of January 2023, there were 23.04 million internet users in the Democratic Republic of Congo. The internet penetration rate in the Democratic Republic of Congo was 22.9% of the total population at the start of 2023. In the same context, these user statistics indicate that 77.57 million people in the Democratic Republic of Congo increased by 731,000 (+3.3%) between 2022 and 2023.

Table 12: Illustration of Intern penetration rates and internet users for the period covering January 2020 to January 2023

<table>
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<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet penetration rate</td>
<td>19</td>
<td>23.2</td>
<td>17.6</td>
<td>22.9</td>
</tr>
<tr>
<td>Internet users (Million)</td>
<td>16.35</td>
<td>21.14</td>
<td>16.5</td>
<td>23.02</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 13 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Cote d'Ivoire

Cote d'Ivoire has been investing in its telecommunications infrastructure. The country has a well-developed network of mobile and fixed-line services, and the government has been expanding mobile network coverage.

Internet penetration in Cote d'Ivoire has been steadily increasing, and the country has made efforts to expand access to high-speed internet. Urban areas typically have better connectivity, but internet access is also spreading to rural regions.

Mobile technology plays a central role in Cote d'Ivoire's ICT ecosystem. Mobile phones are widely used for communication and internet access. Several mobile network operators provide voice and data services.

The government has played a significant role in regulating and promoting the ICT sector. Cote d'Ivoire has implemented policies and initiatives to stimulate sector growth, attract foreign investment, and establish a regulatory framework.

Cote d'Ivoire has been working on e-government initiatives to improve public services and governance. This includes digitizing government services, offering online platforms for citizens to access government information and services, and facilitating online interactions with public institutions.

Cote d'Ivoire has seen a growing interest in technology and entrepreneurship. Several tech startups and innovation hubs have emerged, focusing on various sectors, including fintech, agritech, health tech, and e-commerce.

While the country has made significant progress, challenges remain, including limited internet access in some rural areas, a need for digital skills development, and ensuring that the benefits of
ICT reach all segments of the population. Cybersecurity and data privacy also remain important issues.

Côte d’Ivoire has actively sought foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies is part of this effort.

Côte d’Ivoire’s ICT ecosystem has demonstrated substantial potential for growth and development. The government’s commitment to promoting digital innovation and infrastructure development has contributed to its progress. However, ongoing efforts are necessary to address challenges and ensure that the benefits of ICT reach all citizens.

In January 2020, Côte d’Ivoire had a total of 12.20 million internet users. During the transition from 2019 to 2020, the number of internet users in Côte d’Ivoire saw an increase of 1.1 million users (+9.6%). At that time, the internet penetration rate in Côte d’Ivoire was 47%.

By January 2021, the number of internet users in Côte d’Ivoire had reached 12.50 million, with an increase of 306,000 users (+2.5%) from 2020. In January 2021, the internet penetration rate was 46.8%.

Moving to January 2022, there were 9.94 million internet users in Côte d’Ivoire, and the internet penetration rate was 36.3% of the total population at the start of 2022. This indicates that there was an increase of 248,000 internet users between 2021 and 2022.

As of January 2023, Côte d’Ivoire had 12.94 million internet users, with an internet penetration rate of 45.4% of the total population at the beginning of 2023. To provide context, these user statistics indicate that 15.57 million people in Côte d’Ivoire were not using the internet at the start of 2023, highlighting that 54.6% of the population remained offline.

Table 13: Illustration of Internet penetration rates and internet users for the period covering January 2020 to January 2023

<table>
<thead>
<tr>
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<th>2020</th>
<th>2021</th>
<th>2022</th>
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<tbody>
<tr>
<td>Internet penetration rate</td>
<td>47</td>
<td>46.8</td>
<td>36.3</td>
<td>45.4</td>
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<tr>
<td>Internet users (Million)</td>
<td>12.2</td>
<td>12.5</td>
<td>9.94</td>
<td>12.94</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 14 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Eswatini

Eswatini has been making investments in its telecommunications infrastructure. The country has a well-established network of mobile and fixed-line services. Efforts have been made to expand mobile network coverage and improve internet connectivity.

Internet penetration in Eswatini has been increasing, with urban areas having better connectivity than rural regions. The government has been working to expand access to high-speed internet, and various internet service providers operate in the country.

Mobile technology plays a significant role in Eswatini's ICT ecosystem. Mobile phones are widely used for communication and internet access. Multiple mobile network operators provide voice and data services.

The government plays a role in regulating and promoting the ICT sector. Eswatini has implemented policies and initiatives to stimulate sector growth, attract foreign investment, and establish a regulatory framework.

Eswatini has been working on e-government initiatives to improve public services and governance. This includes digitizing government services, offering online platforms for citizens to access government information and services, and facilitating online interactions with public institutions.

Despite progress, Eswatini's ICT ecosystem faces challenges, including limited internet access in some rural areas, a need for digital skills development, and ensuring that the benefits of ICT reach all segments of the population. Cybersecurity and data privacy are also important considerations.
The country has seen a growing interest in technology and entrepreneurship. Some tech startups and innovation hubs have emerged, focusing on various sectors, including fintech, health tech, and e-commerce.

The government has sought foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies is part of this effort.

Eswatini’s ICT ecosystem shows potential for growth and development, with the government actively promoting digital innovation and infrastructure development. Ongoing efforts are necessary to address challenges and ensure that the benefits of ICT are accessible to all citizens.

In January 2020, Eswatini had 542.4 thousand internet users, with a 1.0% increase from the previous year. The internet penetration rate was 47% at that time. By January 2021, the number of internet users in Eswatini had grown to 548.1 thousand, marking a 1.0% increase, and the penetration rate remained at 47.0%.

Moving to January 2022, there were 553.9 thousand internet users in Eswatini, with a 1.1% increase in internet users compared to the previous year. The internet penetration rate was still 47.0%. In January 2023, Eswatini had 710.3 thousand internet users, and the internet penetration rate had risen to 58.9% of the total population, with a 0.7% increase in internet users from the previous year.

To put it in perspective, these user figures reveal that 495.6 thousand people in Eswatini were not using the internet at that time, indicating that 41.1% of the population remained offline at the beginning of the year.

<table>
<thead>
<tr>
<th>Table 14: Illustration of Internet penetration rates and internet users for the period covering January 2020 to January 2023</th>
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<tbody>
<tr>
<td><strong>2020</strong></td>
</tr>
<tr>
<td>Internet penetration rate</td>
</tr>
<tr>
<td>Internet users (Million)</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 15 shows a consistent improvement in infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Ethiopia

Ethiopia has been making substantial investments in its telecommunications infrastructure. The government has embarked on a major initiative to liberalize the telecommunications sector, inviting international telecom operators to enter the market and expand network coverage.

Internet penetration in Ethiopia has been relatively low compared to some other countries, but the government's efforts to open up the telecommunications market are expected to lead to increased internet access. Internet service providers and mobile network operators have been expanding their networks and services.

Mobile technology is central to Ethiopia's ICT ecosystem. Mobile phones are widely used for communication and accessing the internet, and the country has a growing mobile subscriber base. The liberalization of the telecom sector is expected to enhance mobile connectivity.

The Ethiopian government has played a crucial role in regulating and driving the ICT sector. In addition to telecom sector liberalization, the government has established a regulatory authority to oversee the sector and promote investment.

Ethiopia has been working on e-government initiatives to enhance public services and governance. The digitization of government services and the introduction of online platforms for citizens to access government information and services are part of these efforts.

There has been a growing interest in technology and entrepreneurship in Ethiopia. Several tech startups and innovation hubs have emerged, focusing on areas such as fintech, agritech, and e-commerce. The liberalization of the telecommunications sector is expected to encourage innovation and entrepreneurship.

Ethiopia's ICT ecosystem faces both challenges and opportunities. Challenges include limited internet access in rural areas, a need for digital skills development, and ensuring that the benefits
of ICT reach all segments of the population. The liberalization process presents opportunities for increased investment and innovation in the sector.

Ethiopia has been actively seeking foreign investment and partnerships to support the development of ICT infrastructure and services. The participation of international telecommunications companies is expected to drive infrastructure expansion and technology adoption.

Ethiopia’s ICT ecosystem is in a state of transition, with significant changes driven by telecom sector liberalization and a growing focus on digital innovation. The government’s commitment to these reforms and the participation of international players are expected to shape the country’s digital future.

In January 2020, Ethiopia had a total of 21.14 million internet users, with a 2.6% increase compared to the previous year. The internet penetration rate at that time was 19%.

By January 2021, the number of internet users in Ethiopia had risen to 23.96 million, representing a significant increase of 2.8 million users (+13%) from 2020. The internet penetration rate in Ethiopia was 20.6%.

Moving to January 2022, Ethiopia had 29.83 million internet users, and the internet penetration rate was 25.0% of the total population at the start of 2022. This marked an increase of 731,000 internet users between 2021 and 2022.

As of January 2023, there were 20.86 million internet users in Ethiopia, and the internet penetration rate was 16.7% of the total population at the beginning of 2023. This indicated an increase of 520,000 internet users (+2.6%) between 2022 and 2023.

To provide context, these user statistics show that 104.1 million people in Ethiopia were not using the internet at the start of 2023, suggesting that 83.3% of the population remained offline at the beginning of the year.

Table 15: Illustration of Internet penetration rates and internet users for the period covering January 2020 to January 2023

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<tr>
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<th>2020</th>
<th>2021</th>
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<th>2023</th>
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<tbody>
<tr>
<td>Internet penetration rate</td>
<td>19</td>
<td>20.6</td>
<td>25</td>
<td>16.7</td>
</tr>
<tr>
<td>Internet users (Million)</td>
<td>21.14</td>
<td>23.96</td>
<td>29.83</td>
<td>20.86</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 16 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Gabon

Gabon has invested in its telecommunications infrastructure. The country has a relatively well-developed network of mobile and fixed-line services. Efforts have been made to expand mobile network coverage and improve internet connectivity. Internet penetration in Gabon has been growing, and the country has made efforts to expand access to high-speed internet. Urban areas typically have better connectivity, while rural regions may still face challenges. Mobile technology is a central component of Gabon’s ICT ecosystem. Mobile phones are widely used for communication and internet access. Multiple mobile network operators provide voice and data services.

The government plays a significant role in regulating and promoting the ICT sector. Gabon has implemented policies and initiatives to stimulate the growth of the sector, including measures to attract foreign investment. Gabon has been working on e-government initiatives to improve public services and governance. This includes digitizing government services, providing online platforms for citizens to access government information and services, and facilitating online interactions with public institutions.

Gabon has seen a growing interest in technology and entrepreneurship. Some tech startups and innovation hubs have emerged, focusing on various sectors, including fintech, agritech, and e-commerce.

Despite progress, Gabon’s ICT ecosystem faces challenges, including limited internet access in some rural areas, a need for digital skills development, and ensuring that the benefits of ICT reach all segments of the population.

The government has sought foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies is part of this effort.
Gabon’s ICT ecosystem is dynamic, and the government’s commitment to promoting digital innovation and infrastructure development has contributed to its progress. However, ongoing efforts are necessary to address challenges and ensure that the benefits of ICT are accessible to all citizens.

In January 2020, Gabon had 1.36 million internet users. The number of internet users increased by 33,000 (2.5%) between 2019 and 2020, resulting in an internet penetration rate of 62% in January 2020.

By January 2021, the number of internet users in Gabon had reached 1.40 million, with a slight increase of 33,000 users (2.4%) from the previous year. Internet penetration remained at 62.0% at the beginning of 2021.

As of January 2022, there were 1.43 million internet users in Gabon, and the internet penetration rate remained steady at 62.0% of the total population. This indicates a minor increase of 33,000 users (2.3%) between 2021 and 2022.

For context, these user statistics reveal that 875.9 thousand people in Gabon were not using the internet at the beginning of 2022, with 38.0% of the population remaining offline.

In January 2023, Gabon recorded 1.73 million internet users, and the internet penetration rate had increased to 71.7% of the total population. The number of internet users grew by 34,000 (2.0%) between 2022 and 2023.

To illustrate, these user figures show that 682.8 thousand people in Gabon were not using the internet at the start of 2023, suggesting that 28.3% of the population remained offline at the beginning of the year.

| Table 16: Illustration of Intern penetration rates and internet users for the period covering January 2020 to January 2023 |
|----------|-------|-------|-------|
| Internet penetration rate | 2020 | 2021 | 2022 | 2023 |
| Internet users (Million)   | 1.36 | 1.4  | 1.43 | 1.73 |

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 17 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Ghana

Ghana has a well-developed telecommunications infrastructure, with a network of mobile and fixed-line services covering much of the country. The government has made efforts to enhance and expand this infrastructure, including the deployment of fiber optic networks.

Internet penetration in Ghana is relatively high compared to many other African countries. The nation has made efforts to expand access to high-speed internet, with a focus on improving connectivity in rural and underserved areas.

Mobile technology is widely used in Ghana, and mobile phones are the primary means of communication and internet access. Multiple mobile network operators provide voice and data services.

The government plays a significant role in regulating and promoting the ICT sector. Ghana has implemented policies and initiatives to stimulate the growth of the sector, attract foreign investment, and establish a regulatory framework. The National Communications Authority (NCA) oversees the telecommunications sector.

Ghana has made significant progress in e-government initiatives, digitizing government services, and offering online platforms for citizens to access government information and services. Initiatives like the Ghana Government platform provide access to various government services online.

The country has a vibrant tech startup ecosystem, with a growing number of startups in various sectors, including fintech, health tech, agritech, and e-commerce. Innovation hubs and incubators support these ventures.
Despite progress, Ghana's ICT ecosystem faces challenges, including limited internet access in some rural areas, a need for digital skills development, and ensuring that the benefits of ICT reach all segments of the population. Cybersecurity and data privacy are also important considerations.

Ghana has sought foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies is an integral part of the country's ICT growth strategy.

Ghana’s ICT ecosystem demonstrates a significant level of maturity and growth, with a government committed to digital innovation and infrastructure development. The country is well-regarded for its ICT progress in the West African region.

In January 2020, Ghana had 14.76 million internet users. The number of internet users in Ghana increased by 1.0 million (7.5%) between 2019 and 2020, resulting in an internet penetration rate of 48% in January 2020.

By January 2021, Ghana recorded 15.70 million internet users, with a notable increase of 943,000 users (6.4%) from the previous year. Internet penetration reached 50% at the beginning of 2021.

As of January 2022, there were 16.99 million internet users in Ghana, and the internet penetration rate stood at 53% of the total population. This indicates an increase of 350,000 users (2.1%) between 2021 and 2022.

To provide context, these user statistics indicate that 15.07 million people in Ghana were not using the internet at the start of 2022, with 47% of the population remaining offline.

As of January 2023, there were 23.05 million internet users in Ghana, and the internet penetration rate was 68.2% of the total population. This implies that the number of internet users in Ghana increased by 438,000 (1.9%) between 2022 and 2023.

To illustrate, these user figures show that 10.75 million people in Ghana were not using the internet at the start of 2023, suggesting that 31.8% of the population remained offline at the start of the year.

Table 17: Illustration of Intern penetration rates and internet users for the period covering January 2020 to January 2023

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<th>2020</th>
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<th>2022</th>
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</thead>
<tbody>
<tr>
<td>Internet penetration rate</td>
<td>48</td>
<td>50</td>
<td>53</td>
<td>68.2</td>
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<tr>
<td>Internet users (Million)</td>
<td>14.76</td>
<td>15.7</td>
<td>16.99</td>
<td>23.05</td>
</tr>
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</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 18 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Guinea

Guinea has been working on expanding and modernizing its telecommunications infrastructure. The country had a network of mobile and fixed-line services, but coverage could be limited in some rural areas. Internet penetration in Guinea was relatively low compared to many other countries. Access to high-speed internet could be limited in some regions, particularly in rural areas. Mobile technology played a significant role in Guinea's ICT ecosystem. Mobile phones were widely used for communication and, in some cases, accessing the internet. Multiple mobile network operators provided voice and data services.

The government has taken steps to regulate and promote the ICT sector. Guinea was working on policies and initiatives to stimulate sector growth, attract foreign investment, and establish a regulatory framework. Guinea was in the early stages of e-government development. Efforts were being made to digitize government services and provide online platforms for citizens to access government information and services.

Guinea's ICT ecosystem faced several challenges, including limited internet access in rural areas, a need for digital skills development, and ensuring that the benefits of ICT reached all segments of the population. Infrastructure development and cybersecurity were also areas of concern. Guinea had been seeking foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies was part of this effort.

Guinea's ICT ecosystem was in the process of growth and development. The government's commitment to promoting digital innovation and infrastructure development was a positive sign. However, the country faced various challenges in bridging the digital divide, ensuring widespread access to ICT, and fostering digital skills.

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**Figure 18: Ghana's overall trend of ICT ecosystem covering a running nine-year index.**

*Source: Compiled by Authors based on datasets from (GSM Association, 2023)*

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Content and Services</td>
<td>29.56</td>
<td>31.02</td>
<td>32.75</td>
<td>34.84</td>
<td>38.7</td>
<td>43.69</td>
<td>49.94</td>
<td>49.95</td>
<td>49.29</td>
</tr>
<tr>
<td>Consumer Readiness</td>
<td>42.65</td>
<td>42.81</td>
<td>44.28</td>
<td>56.81</td>
<td>54.91</td>
<td>60.22</td>
<td>56.63</td>
<td>57.63</td>
<td>59.91</td>
</tr>
<tr>
<td>Affordability</td>
<td>38.88</td>
<td>37.99</td>
<td>41.88</td>
<td>43.75</td>
<td>49.48</td>
<td>37.03</td>
<td>36.2</td>
<td>40.79</td>
<td>40.95</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>30.68</td>
<td>34.66</td>
<td>41.59</td>
<td>47</td>
<td>50.68</td>
<td>53.54</td>
<td>56.11</td>
<td>55.18</td>
<td>57.85</td>
</tr>
</tbody>
</table>
In January 2020, Guinea had 2.55 million internet users. The number of internet users in Guinea increased by 165,000 (6.9%) between 2019 and 2020, resulting in an internet penetration rate of 20% in January 2020.

By January 2021, Guinea recorded 2.91 million internet users, with a significant increase of 355,000 users (14%) from the previous year. Internet penetration reached 21.8% at the beginning of 2021.

As of January 2022, there were 3.15 million internet users in Guinea, and the internet penetration rate stood at 23% of the total population. This indicates an increase of 84,000 users (2.8%) between 2021 and 2022.

To provide context, these user statistics indicate that 10.53 million people in Guinea were not using the internet at the start of 2022, with 77% of the population remaining offline.

As of January 2023, there were 4.87 million internet users in Guinea, and the internet penetration rate was 34.7% of the total population. This implies that the number of internet users in Guinea increased by 114,000 (2.4%) between 2022 and 2023.

To illustrate, these user figures show that 9.16 million people in Guinea were not using the internet at the start of 2023, suggesting that 65.3% of the population remained offline at the start of the year.

<table>
<thead>
<tr>
<th>Table 18: Illustration of Intern penetration rates and internet users for the period covering January 2020 to January 2023</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2020</strong></td>
</tr>
<tr>
<td>Internet penetration rate</td>
</tr>
<tr>
<td>Internet users (Million)</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 19 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Guinea-Bissau

Guinea-Bissau had basic telecommunications infrastructure in place, including mobile and fixed-line services. However, network coverage was limited in rural areas, and the quality of services could vary. Internet penetration in Guinea-Bissau was relatively low, and access to high-speed internet was limited, particularly in rural regions. Internet connectivity was primarily available in urban areas. Mobile technology played a significant role in Guinea-Bissau's ICT ecosystem. Mobile phones were widely used for communication, and mobile network operators provided voice and data services.

The government has taken steps to regulate and promote the ICT sector. Guinea-Bissau was in the process of developing policies and initiatives to stimulate sector growth, attract foreign investment, and establish a regulatory framework.

Guinea-Bissau's ICT ecosystem faced several challenges, including limited internet access in rural areas, a need for digital skills development, and ensuring that the benefits of ICT reached all segments of the population. Infrastructure development and cybersecurity were also areas of concern.

Guinea-Bissau has been seeking foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies was part of this effort.

Guinea-Bissau's ICT ecosystem was in the early stages of development. The country faced several challenges, including political instability and limited resources, which impacted its ability to invest in and expand its ICT infrastructure.

In January 2020, Guinea-Bissau had 250,000 internet users. The number of internet users in the country increased by 52,000 (26%) between 2019 and 2020, resulting in an internet penetration rate of 13% in January 2020.
By January 2021, Guinea-Bissau recorded 401.7 thousand internet users, with a notable increase of 153,000 users (62%) from the previous year. Internet penetration was at 20.2% at the start of 2021.

As of January 2022, there were 571,000 internet users in Guinea-Bissau, and the internet penetration rate was 28% of the total population. This indicates an increase of 13,000 users (2.4%) between 2021 and 2022. These figures provide a contextualized indication that 1.47 million people in Guinea-Bissau were not using the internet at the beginning of 2022, with 72% of the population remaining offline.

As of January 2023, there were 749.1 thousand internet users in Guinea-Bissau, and the internet penetration rate stood at 35.2% of the total population. This implies that the number of internet users in Guinea-Bissau increased by 16,000 (2.2%) between 2022 and 2023.

To illustrate, these user statistics show that 1.38 million people in Guinea-Bissau were not using the internet at the start of 2023, suggesting that 64.8% of the population remained offline.

Table 19: Illustration of Internet penetration rates and internet users for the period covering January 2020 to January 2023

<table>
<thead>
<tr>
<th></th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet penetration rate</td>
<td>13</td>
<td>20.2</td>
<td>28</td>
<td>35.2</td>
</tr>
<tr>
<td>Internet users (Million)</td>
<td>0.25</td>
<td>0.4017</td>
<td>0.571</td>
<td>0.7491</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 20 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Figure 20: Guinea-Bissau's overall trend of ICT ecosystem covering a running nine-year index.

Source: Compiled by Authors based on datasets from (GSM Association, 2023)

Kenya

Kenya has been a frontrunner in Africa's ICT (Information and Communication Technology) ecosystem. Kenya has made significant progress in various aspects of the sector. The country's ICT ecosystem was marked by innovation, investment, and a strong commitment to digital development. Kenya has a well-developed telecommunications infrastructure, with extensive mobile and fixed-line services covering most of the country. The government and private sector have made substantial investments in infrastructure development. Internet penetration in Kenya is relatively high for the region, with widespread access to high-speed internet. The country is known for its extensive and reliable internet connectivity, particularly in urban areas. Mobile technology is central to Kenya's ICT ecosystem. Mobile phones are widely used for communication and internet access, and mobile money services (e.g., M-Pesa) have gained significant adoption.

The government has played a significant role in regulating and promoting the ICT sector. Kenya has implemented policies and initiatives to stimulate sector growth, attract foreign investment, and establish a regulatory framework. The Communications Authority of Kenya oversees the sector. Kenya has made notable progress in e-government initiatives. The government has digitized many public services and established online platforms for citizens to access government information and services.

Kenya has a vibrant technology startup ecosystem, with numerous startups and innovation hubs. Nairobi, often referred to as "Silicon Savannah," is a hub for tech innovation and entrepreneurship. Startups in fintech, health tech, agritech, and e-commerce have gained prominence.

While Kenya's ICT ecosystem is advanced, challenges include addressing the digital divide to ensure that the benefits of ICT reach all segments of the population. Cybersecurity and data privacy are also important considerations.
Kenya has actively sought foreign investment and partnerships to support the development of ICT infrastructure and services. The country's innovative and entrepreneurial environment has attracted investment from various international organizations and technology companies.

Kenya's ICT ecosystem is known for its dynamism, innovation, and government support. The country has been a leader in adopting digital technologies and leveraging them for various sectors, including finance, agriculture, healthcare, and education.

In January 2020, Kenya had a total of 22.86 million internet users. The number of internet users in Kenya increased by 3.2 million users (16%) between 2019 and 2020. Internet penetration in Kenya stood at 43% in January 2020.

By January 2021, Kenya had 21.75 million internet users. Internet penetration was at 40% at the beginning of 2021.

As of January 2022, Kenya recorded 23.35 million internet users, and the internet penetration rate was 42% of the total population. Analysis indicates that the number of internet users in Kenya increased by 1.6 million users (7.4%) between 2021 and 2022.

To put this in context, these user statistics indicated that 32.25 million people in Kenya were not using the internet at the start of 2022, meaning 58% of the population remained offline.

As of January 2023, Kenya had 17.86 million internet users, and the internet penetration rate was 32.7% of the total population. This implies that internet users in Kenya increased by 1.3 million users (8.0%) between 2022 and 2023.

To illustrate, these user figures showed that 36.70 million people in Kenya were not using the internet at the beginning of 2023, indicating that 67.3% of the population remained offline.

<table>
<thead>
<tr>
<th>Table 20: Illustration of Intern penetration rates and internet users for the period covering January 2020 to January 2023</th>
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</thead>
<tbody>
<tr>
<td>Internet penetration rate</td>
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<tr>
<td>---------------------------</td>
</tr>
<tr>
<td>Internet users (Million)</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 21 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Lesotho

Lesotho, a landlocked country in Southern Africa, had been working on developing its ICT. While the country faced challenges, it had made progress in expanding its ICT infrastructure and services. Lesotho had basic telecommunications infrastructure, including mobile and fixed-line services. The country’s mountainous terrain presented challenges in expanding network coverage to remote and rural areas. Internet penetration in Lesotho was relatively low, and access to high-speed internet was limited, particularly in rural regions. Internet access was primarily available in urban areas. Mobile technology played a significant role in Lesotho’s ICT ecosystem. Mobile phones were widely used for communication and, in some cases, accessing the internet. Multiple mobile network operators provided voice and data services.

The government has taken steps to regulate and promote the ICT sector. Lesotho was working on policies and initiatives to stimulate sector growth, attract foreign investment, and establish a regulatory framework.

Lesotho’s ICT ecosystem faced challenges, including limited internet access in rural areas, a need for digital skills development, and ensuring that the benefits of ICT reached all segments of the population. The country’s mountainous terrain and limited resources presented obstacles to infrastructure development.

Lesotho had been seeking foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies was part of this effort.

Lesotho’s ICT environment was in its early stages of development, marked by the government's commitment to advancing digital innovation and infrastructure. Nonetheless, challenges linked to geographical factors, limited resources, and disparities in connectivity needed attention.
In January 2020, Lesotho had 946.3 thousand internet users, reflecting an increase of 84 thousand users (9.8%) from the previous year. Internet penetration in Lesotho stood at 44% in January 2020.

By January 2021, the number of internet users in Lesotho had grown to 1.03 million, with an additional 85,000 users (8.9%) compared to 2020. The internet penetration rate had reached 47.9% in January 2021.

As of January 2022, Lesotho registered 1.13 million internet users, and the internet penetration rate at the start of 2022 was 51.9% of the total population. This represented an increase of 110,000 users (10.8%) between 2021 and 2022.

To provide context, these user statistics indicated that 1.04 million people in Lesotho were not using the internet at the beginning of 2022, meaning 48.1% of the population remained offline.

As of January 2023, Lesotho had 1.11 million internet users, and the internet penetration rate had reached 48.0% of the total population at the beginning of 2023. This demonstrated an increase of 11,000 users (1.0%) from the previous year.

To illustrate, these user figures revealed that 1.21 million people in Lesotho were not using the internet at the beginning of 2023, suggesting that 52.0% of the population remained offline.

Table 21: Illustration of Internet penetration rates and internet users for the period covering January 2020 to January 2023

<table>
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<tr>
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<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
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<tbody>
<tr>
<td>Internet penetration rate</td>
<td>44</td>
<td>47.9</td>
<td>51.9</td>
<td>48</td>
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<tr>
<td>Internet users (Million)</td>
<td>0.9463</td>
<td>1.03</td>
<td>1.13</td>
<td>1.11</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 22 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Liberia

Liberia's ICT (Information and Communication Technology) ecosystem has been gradually developing, with efforts to improve infrastructure, access, and digital services. The country has faced challenges, but it has equally been making progress in expanding its ICT capabilities.

Liberia had basic telecommunications infrastructure, including mobile and fixed-line services. Network coverage was more extensive in urban areas, while rural and remote regions faced limited connectivity. Internet penetration in Liberia was relatively low, and access to high-speed internet was limited. Internet services were primarily available in urban centers, and connectivity in rural areas could be challenging. Mobile technology played a significant role in Liberia's ICT ecosystem. Mobile phones were widely used for communication, and mobile network operators provided voice and data services.

The Liberian government has been working on regulating and promoting the ICT sector. Initiatives were underway to stimulate sector growth, attract foreign investment, and establish a regulatory framework.

Liberia’s ICT ecosystem faced challenges, including limited internet access in rural areas, a need for digital skills development, and ensuring that the benefits of ICT reached all segments of the population. Additionally, Liberia’s recovery from a prolonged civil war had an impact on infrastructure development.

Liberia had been seeking foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies was part of this effort.

Liberia’s ICT ecosystem was in the early stages of development, with various challenges to overcome. The government’s commitment to promoting digital innovation and infrastructure development was evident, but progress was influenced by factors such as limited resources and the impact of past conflicts.
In January 2020, Liberia had 624.6 thousand internet users, indicating a growth of 57 thousand users (10%) from the previous year. The internet penetration rate in Liberia was 12% in January 2020.

By January 2021, the number of internet users in Liberia had risen to 761.0 thousand, with a substantial increase of 136,000 users (22%) compared to 2020. The internet penetration rate reached 14.9% in January 2021.

As of January 2022, Liberia recorded 1.15 million internet users, and the internet penetration rate at the beginning of 2022 was 22.0% among the total population. This represented an increase of 27,000 users (2.4%) between 2021 and 2022. These user statistics indicate that 4.09 million people in Liberia were not using the internet at the start of 2022, meaning 78.0% of the population remained offline.

As of January 2023, Liberia had 1.80 million internet users, and the internet penetration rate had reached 33.6% of the total population at the beginning of 2023. This demonstrated an increase of 38,000 users (2.2%) from the previous year.

To illustrate, these user figures revealed that 3.56 million people in Liberia were not using the internet at the beginning of 2023, suggesting that 66.4% of the population remained offline.

<table>
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<tr>
<th>Table 22: Illustration of Intern penetration rates and internet users for the period covering January 2020 to January 2023</th>
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<tbody>
<tr>
<td><strong>Internet penetration rate</strong></td>
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<td>------------------------------</td>
</tr>
<tr>
<td>Internet users (Million)</td>
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</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, **Figure 23** shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Madagascar

Madagascar, a large island nation located in the Indian Ocean, has been working on developing its ICT ecosystem for a while. The country had made progress in expanding its ICT infrastructure and services, but it faced various challenges. Madagascar had made investments in its telecommunications infrastructure, with mobile and fixed-line services available in urban and some rural areas. However, coverage in remote regions could be limited. Internet penetration in Madagascar was relatively low, and access to high-speed internet was primarily available in urban centers. Rural areas and some remote regions faced challenges in internet access. Mobile technology played a significant role in Madagascar’s ICT ecosystem. Mobile phones were widely used for communication, and mobile network operators provided voice and data services.

The government has been working on regulating and promoting the ICT sector. Madagascar was in the process of developing policies and initiatives to stimulate sector growth, attract foreign investment, and establish a regulatory framework.

Madagascar’s ICT ecosystem faced challenges, including limited internet access in rural and remote areas, a need for digital skills development, and ensuring that the benefits of ICT reached all segments of the population. The country’s geographical and infrastructural challenges influenced the expansion of ICT services.

Madagascar had been seeking foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies was part of this effort.

Madagascar’s ICT ecosystem was in a state of development, with ongoing efforts to overcome infrastructure challenges and promote digital inclusion. The country’s unique geographical and ecological characteristics, including its biodiversity, have presented both opportunities and obstacles for ICT development.
In January 2020, Madagascar had 3.84 million internet users, marking an increase of 394,000 users (11%) from the previous year. The internet penetration rate in Madagascar was 14% in January 2020.

By January 2021, the number of internet users in Madagascar had grown to 5.45 million, with a substantial increase of 1.6 million users (42%) compared to 2020. The internet penetration rate reached 19.4% in January 2021.

In January 2022, Madagascar counted 6.43 million internet users, and the internet penetration rate at the beginning of 2022 was 22.3% among the total population. This represented an increase of 576,000 users (9.8%) between 2021 and 2022.

To provide context, these user statistics indicated that 22.37 million people in Madagascar were not using the internet at the start of 2022, meaning 77.7% of the population remained offline.

As of January 2023, Madagascar had 5.90 million internet users, and the internet penetration rate had reached 19.7% of the total population at the beginning of 2023. This demonstrated an increase of 139,000 users (2.4%) from the previous year.

To illustrate, these user figures revealed that 24.06 million people in Madagascar were not using the internet at the beginning of 2023, suggesting that 80.3% of the population remained offline.

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<th>2020</th>
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</thead>
<tbody>
<tr>
<td>Internet penetration rate</td>
<td>14</td>
<td>19.4</td>
<td>22.3</td>
<td>19.7</td>
</tr>
<tr>
<td>Internet users (Million)</td>
<td>3.84</td>
<td>5.45</td>
<td>6.43</td>
<td>5.9</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 24 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Malawi

Malawi’s Information and Communication Technology ecosystem has been evolving, with efforts to improve infrastructure, connectivity, and digital services. As of January 2022, Malawi appears to be facing challenges although with slight progress in expanding its ICT capabilities. Malawi had basic telecommunications infrastructure, including mobile and fixed-line services. While network coverage was relatively well-established in urban areas, rural regions faced limited connectivity.

Internet Connectivity: Internet penetration in Malawi was relatively low, and access to high-speed internet was primarily available in urban centers. Rural areas often had limited internet access.

Mobile Technology: Mobile technology plays a significant role in Malawi’s ICT ecosystem. Mobile phones were widely used for communication, and mobile network operators provided voice and data services.

Regulation and Government Initiatives: The government has been working on regulating and promoting the ICT sector. Initiatives were underway to stimulate sector growth, attract foreign investment, and establish a regulatory framework.

Challenges: Malawi’s ICT ecosystem faced challenges, including limited internet access in rural areas, a need for digital skills development, and ensuring that the benefits of ICT reached all segments of the population. The country's economic conditions influenced infrastructure development.

Investment and Partnerships: Malawi has been seeking foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies was part of this effort.

Malawi’s ICT ecosystem was in the early stages of development, with various challenges to address. The government’s commitment to promoting digital innovation and infrastructure
development was evident, but progress was influenced by factors such as limited resources and economic conditions.

In January 2020, Malawi had 2.81 million internet users, marking an increase of 243,000 users (9.5%) from the previous year. The internet penetration rate in Malawi was 15% in January 2020.

By January 2021, the number of internet users in Malawi had grown to 3.45 million, with a significant increase of 639,000 users (23%) compared to 2020. The internet penetration rate reached 17.8% in January 2021.

In January 2022, Malawi counted 4.03 million internet users, and the internet penetration rate at the beginning of 2022 was 20.2% among the total population. This represented an increase of 596,000 users (17.4%) between 2021 and 2022.

To provide context, these user statistics indicated that 15.88 million people in Malawi were not using the internet at the start of 2022, meaning that 79.8% of the population remained offline.

As of January 2023, Malawi had 5.04 million internet users, and the internet penetration rate had reached 24.4% of the total population at the beginning of 2023. This demonstrated an increase of 126,000 users (2.6%) from the previous year.

To illustrate, these user figures revealed that 15.62 million people in Malawi were not using the internet at the beginning of 2023, suggesting that 75.6% of the population remained offline.

Table 24: Illustration of Intern penetration rates and internet users for the period covering January 2020 to January 2023

<table>
<thead>
<tr>
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<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
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</thead>
<tbody>
<tr>
<td>Internet penetration rate</td>
<td>15</td>
<td>17.8</td>
<td>20.2</td>
<td>24.4</td>
</tr>
<tr>
<td>Internet users (Million)</td>
<td>2.81</td>
<td>3.45</td>
<td>4.03</td>
<td>5.04</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 25 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Mali

Mali, which is a landlocked country in West Africa, has been working to develop its Information and Communication Technology ecosystem. The country faced challenges but was making progress in expanding its ICT infrastructure and services. Mali had basic telecommunications infrastructure, including mobile and fixed-line services. However, network coverage was more established in urban areas, and rural regions faced limited connectivity. Internet penetration in Mali was relatively low, and access to high-speed internet was primarily available in urban centers. Rural areas often had limited internet access. Mobile technology played a significant role in Mali’s ICT ecosystem. Mobile phones were widely used for communication, and mobile network operators provided voice and data services.

The government has been working on regulating and promoting the ICT sector. Initiatives were underway to stimulate sector growth, attract foreign investment, and establish a regulatory framework.

Mali's ICT ecosystem faced challenges, including limited internet access in rural areas, a need for digital skills development, and ensuring that the benefits of ICT reached all segments of the population. The country’s vast and sparsely populated areas presented challenges for infrastructure development.

Mali had been seeking foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies was part of this effort.

Mali's ICT sector was in its early developmental stages, marked by the government's commitment to fostering digital innovation and infrastructure expansion. Nonetheless, the nation faced challenges related to limited resources, infrastructure constraints, and the wide geographical distribution of its population, necessitating efforts to achieve more widespread ICT adoption.
In January 2020, Mali had 4.85 million internet users, reflecting an increase of 339,000 users (7.5%) compared to the previous year. Internet penetration in Mali stood at 24% in January 2020.

By January 2021, Mali’s internet users had grown to 5.74 million, experiencing a substantial increase of 895,000 users (18%) from 2020. The internet penetration rate reached 27.9% in January 2021.

In January 2022, Mali counted 6.33 million internet users, with an internet penetration rate of 29.9% among the total population. This represented an increase of 612,000 users (10.7%) between 2021 and 2022.

To put it into perspective, these user figures indicated that 14.83 million people in Mali were not using the internet at the beginning of 2022, indicating that 70.1% of the population remained offline.

As of January 2023, Mali had 7.91 million internet users, and the internet penetration rate had reached 34.5% of the total population at the start of 2023. This demonstrated an increase of 238,000 users (3.1%) from the previous year.

To illustrate, these user statistics revealed that 15.02 million people in Mali were not using the internet at the beginning of 2023, suggesting that 65.5% of the population remained offline.

Table 25: Illustration of Internet penetration rates and internet users for the period covering January 2020 to January 2023

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<th>2020</th>
<th>2021</th>
<th>2022</th>
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</thead>
<tbody>
<tr>
<td>Internet penetration rate</td>
<td>24</td>
<td>27.9</td>
<td>29.9</td>
<td>34.5</td>
</tr>
<tr>
<td>Internet users (Million)</td>
<td>4.85</td>
<td>5.74</td>
<td>6.33</td>
<td>7.91</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 26 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Mauritius

Mauritius has developed a robust Information and Communication Technology ecosystem and has positioned itself as a technology hub in the African region. As of January 2022, Mauritius has made significant progress in various aspects of the ICT sector. The country's ICT ecosystem was marked by innovation, investment, and a strong commitment to digital development. Mauritius has a well-developed telecommunications infrastructure, with extensive mobile and fixed-line services covering the entire island. The government and private sector have made substantial investments in infrastructure development. Internet penetration in Mauritius is relatively high, with widespread access to high-speed internet. The country is known for its reliable and extensive internet connectivity. Mobile technology is central to Mauritius' ICT ecosystem. Mobile phones are widely used for communication and internet access, and mobile network operators provide voice and data services.

The government has played a significant role in regulating and promoting the ICT sector. Mauritius has implemented policies and initiatives to stimulate sector growth, attract foreign investment, and establish a regulatory framework.

Mauritius has made significant progress in e-government initiatives. The government has digitized numerous public services and established online platforms for citizens to access government information and services.

The country has a growing technology startup ecosystem, with numerous startups and innovation hubs. These startups cover various sectors, including fintech, health tech, agritech, and e-commerce.

While Mauritius' ICT ecosystem is advanced, challenges include addressing the digital divide to ensure that the benefits of ICT reach all segments of the population. Cybersecurity and data privacy are also important considerations.
Mauritius has actively sought foreign investment and partnerships to support the development of ICT infrastructure and services. The country's innovative and entrepreneurial environment has attracted investment from various international organizations and technology companies.

Mauritius' ICT ecosystem is known for its dynamism, innovation, and government support. The country has been a leader in adopting digital technologies and leveraging them for various sectors, including finance, agriculture, healthcare, and education.

As of January 2020, Mauritius had 860.0 thousand internet users, reflecting a growth of 40,000 users (4.9%) from the previous year. Internet penetration in Mauritius was at 68% in January 2020.

By January 2021, the number of internet users in Mauritius had reached 814.5 thousand, marking a significant increase of 70,000 users (9.4%) from 2020. The internet penetration rate was 64.0% in January 2021.

In January 2022, there were 826.9 thousand internet users in Mauritius, and the internet penetration rate was 64.9 percent of the total population. There was a minor increase of 958 users (0.1%) between 2021 and 2022.

Looking ahead to January 2023, Mauritius counted 878.7 thousand internet users, which was a growth of 453 users (0.05%) from the previous year. The internet penetration rate was 67.6% at the beginning of 2023.

To provide context, these user statistics indicated that 421.1 thousand people in Mauritius were not using the internet at the start of 2023, signifying that 32.4% of the population remained offline.

*Table 26: Illustration of Internet penetration rates and internet users for the period covering January 2020 to January 2023*

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<th>2020</th>
<th>2021</th>
<th>2022</th>
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<tbody>
<tr>
<td>Internet penetration rate</td>
<td>68</td>
<td>64</td>
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<td>Internet users (Million)</td>
<td>0.86</td>
<td>0.8145</td>
<td>0.8269</td>
<td>0.8787</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 27 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Mauritius’ overall trend of ICT ecosystem covering a running nine-year index.

Source: Compiled by Authors based on datasets from (GSM Association, 2023)

Mozambique

Mozambique, a country in Southeastern Africa, has been working to develop its Information and Communication Technology ecosystem. The country has been facing challenges, but progress is underway in expanding its ICT infrastructure and services. Mozambique had basic telecommunications infrastructure, including mobile and fixed-line services. Network coverage was relatively well-established in urban areas, while rural and remote regions faced limited connectivity. Internet penetration in Mozambique was relatively low, and access to high-speed internet was primarily available in urban centers. Rural areas often had limited internet access. Mobile technology played a significant role in Mozambique’s ICT ecosystem. Mobile phones were widely used for communication, and mobile network operators provided voice and data services.

The government has been working on regulating and promoting the ICT sector. Initiatives were underway to stimulate sector growth, attract foreign investment, and establish a regulatory framework.

Mozambique's ICT ecosystem faced challenges, including limited internet access in rural areas, a need for digital skills development, and ensuring that the benefits of ICT reached all segments of the population. The country’s vast and sparsely populated areas presented challenges for infrastructure development.

Mozambique had been seeking foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies was part of this effort.

Mozambique's ICT ecosystem was in the early stages of development, with the government's commitment to promoting digital innovation and infrastructure development. However, challenges related to limited resources, infrastructure limitations, and the geographical spread of the population required attention for broader ICT adoption.
In January 2020, Mozambique had 5.36 million internet users, reflecting a growth of 439,000 users (8.9%) from the previous year. Internet penetration in Mozambique was at 17% in January 2020.

By January 2021, Mozambique’s internet user base had expanded to 6.72 million, marking a substantial increase of 1.4 million users (25%) from 2020. The internet penetration rate was 21.2% in January 2021.

As of January 2022, there were 7.54 million internet users in Mozambique, representing a 22.9% increase of 1.4 million users from the previous year. The internet penetration rate was 23.1% at the beginning of 2022.

Transitioning to January 2023, Mozambique counted 6.92 million internet users, which was still a growth of 848,000 users (14.0%) from the prior year. The internet penetration rate in Mozambique was 20.7% at the beginning of 2023.

For context, these user statistics indicated that 26.50 million people in Mozambique were not using the internet at the start of 2023, suggesting that 79.3% of the population remained offline.

<table>
<thead>
<tr>
<th>Table 27: Illustration of Intern penetration rates and internet users for the period covering January 2020 to January 2023</th>
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<tr>
<td>2020</td>
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<tr>
<td>Internet penetration rate</td>
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<tr>
<td>Internet users (Million)</td>
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</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 28 shows a consistent improvement in infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Mozambique’s overall trend of ICT ecosystem covering a running nine-year index.

Source: Compiled by Authors based on datasets from (GSM Association, 2023)

**Namibia**

Namibia, a country located in southwestern Africa, has been making strides in developing its Information and Communication Technology ecosystem. As of January 2022, Namibia has been actively working to expand its ICT infrastructure and services. The country’s ICT ecosystem was marked by progress, but challenges and opportunities remained. Namibia has developed a telecommunications infrastructure that includes mobile and fixed-line services. Network coverage extends to many urban and rural areas, although remote regions may still face connectivity challenges. Internet penetration in Namibia was relatively low compared to some other countries, but access to high-speed internet was available in urban areas. Efforts were being made to expand access to rural and underserved areas. Mobile technology is widely used in Namibia, with mobile phones serving as the primary means of communication and internet access. Multiple mobile network operators provide voice and data services.

The Namibian government has played a key role in regulating and promoting the ICT sector. Various initiatives aimed to stimulate growth, attract foreign investment, and establish a regulatory framework for the sector.

Namibia has been working on e-government initiatives to improve public services and governance. This included digitizing government services and providing online platforms for citizens to access government information and services.

Namibia has seen a growing interest in technology and entrepreneurship. Some tech startups and innovation hubs have emerged, focusing on sectors such as fintech, agritech, and e-commerce.

Namibia’s ICT ecosystem faced challenges such as limited internet access in rural areas, a need for digital skills development, and ensuring that the benefits of ICT are accessible to all segments of the population. Geographic factors, including the country’s vast landscapes, can impact infrastructure development.

Namibia has been seeking foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies was part of this effort.
Namibia’s ICT sector was undergoing development, with a government commitment to foster digital innovation and expand infrastructure. The country’s distinct geographic and demographic characteristics presented both opportunities and challenges for ICT progress.

In January 2020, Namibia had 1.28 million internet users, reflecting an increase of 24,000 users (1.9%) from 2019. The internet penetration rate in Namibia was 51% in January 2020.

By January 2021, Namibia’s internet users numbered 1.31 million, with a slight increase of 24,000 users (1.8%) from 2020. Internet penetration was at 51.0% in January 2021.

As of January 2022, there were 1.33 million internet users in Namibia, maintaining the 1.8% increase, adding 24,000 users, from 2021. The internet penetration rate remained at 51.0%.

Transitioning to January 2023, Namibia counted 1.37 million internet users, marking a 1.4% growth of 19,000 users from the previous year. The internet penetration rate in Namibia stood at 53.0% at the beginning of 2023.

For context, these user statistics indicated that 1.21 million people in Namibia were not using the internet at the start of 2023, signifying that 47.0% of the population remained offline.

Table 28: Illustration of Internet penetration rates and internet users for the period covering January 2020 to January 2023

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<th>2020</th>
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<tbody>
<tr>
<td>Internet penetration rate</td>
<td>51</td>
<td>51</td>
<td>51</td>
<td>53</td>
</tr>
<tr>
<td>Internet users (Million)</td>
<td>1.25</td>
<td>1.31</td>
<td>1.33</td>
<td>1.37</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 29 shows a consistent improvement in infrastructure development, affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Niger

Niger, a landlocked country in West Africa, has been in the process of developing its Information and Communication Technology ecosystem. The country has been faced with various challenges but is seen to making efforts to expand its ICT infrastructure and services. Niger had basic telecommunications infrastructure, including mobile and fixed-line services. Network coverage was relatively well-established in urban areas, while rural and remote regions faced limited connectivity. Internet penetration in Niger was relatively low, and access to high-speed internet was primarily available in urban centers. Rural areas often had limited internet access. Mobile technology played a significant role in Niger’s ICT ecosystem. Mobile phones were widely used for communication, and mobile network operators provided voice and data services.

The government has been working on regulating and promoting the ICT sector. Initiatives were underway to stimulate sector growth, attract foreign investment, and establish a regulatory framework.

Niger’s ICT ecosystem faced challenges, including limited internet access in rural areas, a need for digital skills development, and ensuring that the benefits of ICT reached all segments of the population. The country’s vast and sparsely populated areas presented infrastructure challenges.

Niger had been seeking foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies was part of this effort.

Niger’s ICT ecosystem was in the early stages of development, with the government’s commitment to promoting digital innovation and infrastructure expansion. However, challenges related to limited resources, infrastructure limitations, and the geographical spread of the population required attention for broader ICT adoption.

As of January 2020, Niger had 2.78 million internet users, and there was a growth of 220,000 users (8.6%) from 2019 to 2020. The internet penetration in Niger was 12% in January 2020.
By January 2021, Niger had 3.36 million internet users, representing an increase of 583,000 users (21%) from the previous year. Internet penetration had risen to 13.6% in January 2021.

As of January 2022, there were 3.72 million internet users in Niger, with a 10.8% increase, adding 362,000 users, from 2021. At the start of 2022, the internet penetration rate in Niger was 14.5%.

Transitioning to January 2023, Niger counted 5.98 million internet users, marking a 3.8% growth of 219,000 users from the previous year. The internet penetration rate in Niger reached 22.4% at the beginning of 2023.

To provide context, these user statistics show that 20.72 million people in Niger were not using the internet at the start of 2023, indicating that 77.6% of the population remained offline.

Table 29: Illustration of Intern penetration rates and internet users for the period covering January 2020 to January 2023

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<th></th>
<th>2020</th>
<th>2021</th>
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<td>Internet users (Million)</td>
<td>2.78</td>
<td>3.36</td>
<td>3.72</td>
<td>5.98</td>
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</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 30 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Nigeria

Nigeria’s Information and Communication Technology ecosystem is considered one of the most dynamic and rapidly growing in Africa. The country has made significant progress in various aspects of the ICT sector. Nigeria’s ICT ecosystem has been marked by innovation, investment, and a strong commitment to digital development. This has led to a robust telecommunications infrastructure. Nigeria has a well-developed telecommunications infrastructure, with extensive mobile and fixed-line services covering most of the country. The government and private sector have made substantial investments in infrastructure development. Internet penetration in Nigeria is relatively high, with widespread access to high-speed internet. The country has a growing number of internet users, with extensive coverage, particularly in urban areas. Mobile technology is central to Nigeria’s ICT ecosystem. Mobile phones are widely used for communication and internet access, and multiple mobile network operators provide voice and data services.

The government has played a significant role in regulating and promoting the ICT sector. Nigeria has implemented policies and initiatives to stimulate sector growth, attract foreign investment, and establish a regulatory framework. The National Information Technology Development Agency\(^5\) (NITDA) is a key regulatory body. Nigeria has made significant progress in e-government initiatives. The government has digitized many public services and established online platforms for citizens to access government information and services.

Nigeria’s ICT ecosystem has also demonstrated a vibrant technology startup ecosystem, particularly in cities like Lagos and Abuja. Startups in fintech, health tech, agritech, e-commerce, and other sectors have gained prominence and attracted investment.

\(^5\) The National Information Technology Development Agency NITDA
While Nigeria's ICT ecosystem is advanced, challenges include addressing the digital divide to ensure that the benefits of ICT reach all segments of the population. Cybersecurity, data privacy, and issues related to broadband penetration in rural areas are areas of concern.

Nigeria has actively sought foreign investment and partnerships to support the development of ICT infrastructure and services. The country's innovative and entrepreneurial environment has attracted investment from various international organizations and technology companies.

Nigeria’s ICT ecosystem is known for its dynamism, innovation, and government support. The country has been a leader in adopting digital technologies and leveraging them for various sectors, including finance, agriculture, healthcare, and education.

Between 2019 and 2020, the number of internet users in Nigeria increased by 2.2 million, marking a 2.6% growth. In January 2020, internet penetration in Nigeria was at 42%.

By January 2021, Nigeria had 104.4 million internet users, with a substantial increase of 19 million users (a 22% rise) compared to 2020. Internet penetration reached 50.0% in Nigeria by January 2021.

As of January 2022, there were 109.2 million internet users in Nigeria, representing a 4.6% increase of 4.8 million users from the previous year. At the beginning of 2022, the internet penetration rate in Nigeria was 51.0%.

Moving to January 2023, Nigeria had 122.5 million internet users, marking a 2.4% increase of 2.9 million users from the previous year. The internet penetration rate in Nigeria reached 55.4% at the beginning of 2023.

To provide context, these user statistics show that 98.63 million people in Nigeria were not using the internet at the start of 2023, indicating that 44.6% of the population remained offline.

Table 30: Illustration of Intern penetration rates and internet users for the period covering January 2020 to January 2023

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<th>2020</th>
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<tbody>
<tr>
<td>Internet penetration rate</td>
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<td>50</td>
<td>51</td>
<td>55.4</td>
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<td>Internet users (Million)</td>
<td>84.49</td>
<td>104.4</td>
<td>109.2</td>
<td>122.5</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 31 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Rwanda
Rwanda’s Information and Communication Technology ecosystem has been undergoing significant development and transformation in recent years. The Rwandan government has shown a strong commitment to leveraging technology and innovation for economic growth and social development. As of early January 2022, Rwanda has made remarkable progress in various aspects of the ICT sector, and it continues to be a model for digital transformation in Africa. This can be seen in the form of Rwanda’s investment in building a reliable telecommunications infrastructure, including mobile and fixed-line services. The government and private sector have worked to expand network coverage, including in rural areas.

Internet penetration in Rwanda is relatively high compared to many African countries, with widespread access to high-speed internet. The country has invested in broadband infrastructure, and initiatives like the National Backbone Network have improved connectivity. Mobile technology plays a central role in Rwanda’s ICT ecosystem. Mobile phones are widely used for communication, and mobile network operators provide voice and data services. Rwanda also has a growing mobile banking and mobile money sector.

The Rwandan government has been proactive in regulating and promoting the ICT sector. Initiatives like the Smart Rwanda Master Plan aim to drive sector growth, attract foreign investment, and establish a regulatory framework. The Rwanda Utilities Regulatory Authority (RURA) oversees the sector. The country has also made significant progress in e-government initiatives. The government has digitized many public services, and online platforms are widely used for accessing government information and services. Notably, Rwanda’s digital ID system is a key component of these services.

\[\text{The Rwanda Utilities Regulatory Authority}\]
A further positive indicator of Rwanda’s ICT ecosystem robustness is the increasing interest from various startups in the ICT industry. Rwanda has a burgeoning technology startup ecosystem, with numerous startups in areas such as fintech, health tech, agritech, and e-commerce. The Kigali Innovation City and various innovation hubs have been instrumental in fostering entrepreneurship.

With all the success, there are still a few challenges that the ICT sector is facing in Rwanda. While Rwanda’s ICT ecosystem is advanced, challenges include ensuring that the benefits of technology reach all segments of the population and addressing issues related to digital literacy and skills development. Cybersecurity and data privacy are also important considerations. Rwanda has actively sought foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies has been a priority.

Rwanda’s ICT ecosystem is known for its dynamism, innovation, and government support. The country has set ambitious goals to become a technology and innovation hub in Africa, and it has made substantial progress toward achieving those goals.

In January 2020, Rwanda had 3.31 million internet users, with an 8.8% increase of 267,000 users from the previous year. At that time, the internet penetration rate in Rwanda was 26%.

By January 2021, the number of internet users in Rwanda had grown to 4.12 million, marking a significant 24% increase with 806,000 more users from 2020. The internet penetration rate in Rwanda reached 31.4% in January 2021.

Moving to January 2022, Rwanda had 3.54 million internet users, with a 3.7% increase of 126,000 users compared to the previous year. The internet penetration rate was 26.3% at the start of 2022.

As of January 2023, Rwanda had 4.25 million internet users, representing a 2.3% increase with an internet penetration rate of 30.5% of the total population at the beginning of 2023.

To provide context, these user statistics indicate that 9.68 million people in Rwanda were not using the internet at the start of 2023, suggesting that 69.5% of the population remained offline.

<table>
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<th>Table 31: Illustration of internet penetration rates and internet users for the period covering January 2020 to January 2023</th>
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<tr>
<td><strong>Internet penetration rate</strong></td>
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<tr>
<td>Internet users (Million)</td>
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Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 32 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Senegal

Senegal has been actively working to develop its Information and Communication Technology ecosystem and has made significant progress in recent years. The country’s ICT ecosystem is marked by innovation, investment, and a commitment to digital development. This can be seen in infrastructure status. Senegal has a relatively well-developed telecommunications infrastructure, with widespread access to mobile and fixed-line services. The country has worked to expand network coverage to urban and rural areas. Internet penetration in Senegal is relatively high, with widespread access to high-speed internet. The country has invested in improving broadband infrastructure. The country’s mobile technology is central to Senegal’s ICT ecosystem. Mobile phones are widely used for communication and internet access, and several mobile network operators provide voice and data services.

In terms of regulation and other government initiatives, the Senegalese government has played a significant role in regulating and promoting the ICT sector. Initiatives have aimed to stimulate sector growth, attract foreign investment, and establish a regulatory framework. The Regulatory Authority for Telecommunications and Posts7 (ARTP) oversees the sector. For example, Senegal has made progress in e-government initiatives, with the digitization of many public services. Online platforms and digital services are used for accessing government information and services. The country also has a growing technology startup ecosystem, particularly in the capital, Dakar. Startups in fintech, health tech, agritech, and e-commerce have gained prominence and attracted investment.

Challenges in Senegal’s ICT ecosystem include ensuring that the benefits of technology reach all segments of the population, addressing issues related to digital literacy and skills development, and enhancing cybersecurity and data privacy.

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7 *Autorité de Régulation des Télécommunications et des Postes* ARTP
Senegal has actively sought foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies has been a priority.

Senegal's ICT ecosystem is known for its dynamism, innovation, and government support. The country has been working to leverage digital technologies for economic growth and social development.

In January 2020, Senegal had 7.60 million internet users, marking a 2.8% increase of 205,000 users from the previous year. At that time, internet penetration in Senegal stood at 46%. Moving into January 2021, the number of internet users in Senegal rose to 7.81 million, representing a 2.7% increase of 206,000 users from the previous year, with internet penetration remaining at 46.0%.

By January 2022, Senegal recorded 8.01 million internet users, a 2.7% increase of 209,000 users from the previous year. This meant that at the beginning of 2022, 54.0% of the population, or 9.41 million people, remained offline.

In January 2023, Senegal’s internet user base continued to grow, reaching 10.19 million users, reflecting a 2.6% increase of 255,000 users from the previous year. Internet penetration at the start of 2023 was 58.1%, implying that 7.35 million people in Senegal did not use the Internet at that time.

Table 32: Illustration of Intern penetration rates and internet users for the period covering January 2020 to January 2023

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<th>2022</th>
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<tbody>
<tr>
<td>Internet penetration rate</td>
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<td>46</td>
<td>46</td>
<td>58.1</td>
</tr>
<tr>
<td>Internet users (Million)</td>
<td>7.6</td>
<td>7.81</td>
<td>8.1</td>
<td>10.19</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 33 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Sierra Leone

On the west coast of Africa is Sierra Leone, a country, that has been making efforts to develop its Information and Communication Technology ecosystem with some success just like many other Sub-Saharan countries. Sierra Leone has progressively made it in expanding its ICT infrastructure and services, although it faced various challenges.

Sierra Leone has a basic telecommunications infrastructure, including mobile and fixed-line services. Network coverage is more established in urban areas, while rural regions may face limited connectivity. Internet penetration in Sierra Leone was relatively low, and access to high-speed internet was primarily available in urban centers. Rural areas often had limited internet access. Mobile technology played a significant role in Sierra Leone’s ICT ecosystem. Mobile phones were widely used for communication, and mobile network operators provided voice and data services.

The government has been working on regulating and promoting the ICT sector. Initiatives aimed to stimulate sector growth, attract foreign investment, and establish a regulatory framework. Sierra Leone’s ICT ecosystem faced challenges, including limited internet access in rural areas, a need for digital skills development, and ensuring that the benefits of ICT reached all segments of the population. The country’s infrastructure and economic conditions influenced the expansion of ICT services. Sierra Leone had been seeking foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies was part of this effort.

Sierra Leone’s ICT ecosystem was in the early stages of development, with the government’s commitment to promoting digital innovation and infrastructure expansion. However, challenges related to limited resources, infrastructure limitations, and the geographical spread of the population required attention for broader ICT adoption.
In January 2020, Sierra Leone had 1.99 million internet users, reflecting an 8.1% increase of 149,000 users from the previous year. At that time, internet penetration in Sierra Leone stood at 25%. Moving into January 2021, the number of internet users in Sierra Leone increased to 2.39 million, marking a substantial 20% growth of 399,000 users from the previous year, with internet penetration rising to 29.7%.

By January 2022, Sierra Leone recorded 2.67 million internet users, a 12.5% increase of 296,000 users from the previous year. This meant that at the beginning of 2022, 67.6% of the population, or 5.56 million people, were using the Internet.

In January 2023, Sierra Leone’s internet user base slightly decreased to 1.84 million users, with a 7.3% drop of 126,000 users from the previous year. Internet penetration at the start of 2023 was 21.2%, implying that 78.8% of the population, or 6.85 million people, did not use the internet at that time.

Table 33: Illustration of Internet penetration rates and internet users for the period covering January 2020 to January 2023

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<th>2020</th>
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<tbody>
<tr>
<td>Internet penetration rate</td>
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<td>Internet users (Million)</td>
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<td>2.39</td>
<td>2.67</td>
<td>1.84</td>
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</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 34 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Figure 34: Sierra Leone's overall trend of ICT ecosystem covering a running nine-year index.

Source: Compiled by Authors based on datasets from (GSM Association, 2023)

South Africa

South Africa has a well-developed and dynamic Information and Communication Technology ecosystem. The country has been among the regional leaders in ICT infrastructure and services and has made significant progress in various aspects of the sector. This can be seen in its robust telecommunications infrastructure, with widespread access to mobile and fixed-line services. Network coverage extends to urban and rural areas, and the country has invested in expanding its telecommunications network. The Internet penetration in South Africa has relatively consistently remained high, with widespread access to high-speed Internet. The country has a well-developed broadband infrastructure. This has resulted in mobile technology becoming central to South Africa’s ICT ecosystem. Mobile phones are widely used for communication and internet access, and multiple mobile network operators provide voice and data services.

In terms of regulation and government initiatives, there has been a critical role that the government has played a significant regulating and promoting the ICT sector. Initiatives have aimed to stimulate sector growth, attract foreign investment, and establish a regulatory framework. The Independent Communications Authority of South Africa (ICASA) oversees the sector. South Africa has made progress in e-government initiatives, with the digitization of many public services. Online platforms and digital services are used for accessing government information and services.

South Africa has a thriving technology startup ecosystem, particularly in cities like Johannesburg and Cape Town. Startups cover various sectors, including fintech, health tech, agritech, and e-commerce.

Challenges in South Africa's ICT ecosystem include addressing the digital divide to ensure that the benefits of technology reach all segments of the population. Cybersecurity, data privacy, and issues related to affordable access to the Internet are also important considerations.

The Independent Communications Authority of South Africa

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The Independent Communications Authority of South Africa
South Africa has actively sought foreign investment and partnerships to support the development of ICT infrastructure and services. The country's well-established financial and business sectors make it an attractive destination for investment.

South Africa's ICT ecosystem is known for its dynamism, innovation, and government support. The country has been a leader in adopting digital technologies and leveraging them for various sectors, including finance, agriculture, healthcare, and education.

In January 2020, South Africa had 36.54 million internet users, marking a 3.1% increase of 1.1 million users from the previous year. At that time, internet penetration in South Africa stood at 62%. Moving into January 2021, the number of internet users in South Africa rose to 38.19 million, reflecting a 4.5% growth of 1.7 million users from the previous year, with internet penetration rising to 64.0%.

By January 2022, South Africa recorded 41.19 million internet users, a 1.2% increase of 494,000 users from the previous year. This meant that at the beginning of 2022, 31.8% of the population, or 19.21 million people, were not using the internet.

In January 2023, South Africa’s internet user base continued to grow, reaching 43.48 million users, a 0.8% increase of 357,000 users from the previous year. Internet penetration at the start of 2023 was 72.3%, implying that 27.7% of the population, or 16.66 million people, were not using the Internet at that time.

Table 34: Illustration of internet penetration rates and internet users for the period covering January 2020 to January 2023

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<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
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<tr>
<td>Internet penetration rate</td>
<td>62</td>
<td>64</td>
<td>68.2</td>
<td>72.3</td>
</tr>
<tr>
<td>Internet users (Million)</td>
<td>36.54</td>
<td>38.19</td>
<td>41.19</td>
<td>43.48</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 35 shows a consistent improvement in infrastructure development, affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Figure 35: South Africa’s overall trend of ICT ecosystem covering a running nine-year index.

Source: Compiled by Authors based on datasets from (GSM Association, 2023)

South Sudan

South Sudan, the world’s youngest nation, has faced significant challenges in developing its Information and Communication Technology ecosystem. The country has been grappling with the effects of conflict and a lack of infrastructure, which has limited progress in the ICT sector. To this end, South Sudan has limited telecommunications infrastructure. The country has basic mobile and fixed-line services, but network coverage remains limited, particularly in rural and remote areas. Internet penetration in South Sudan has been quite low, and access to high-speed internet is seen to be primarily available in a few urban centers. Rural areas have often been perceived to have limited or no internet access. Mobile technology is one of the key drivers of ICT in South Sudan. Mobile phones are widely used for communication, and a few mobile network operators provide voice and data services.

The government has been working on regulating and promoting the ICT sector, but challenges related to political instability and infrastructure development have hampered progress. Though challenges are still being experienced such as South Sudan’s ICT ecosystem which is facing significant challenges due to its history of conflict, limited infrastructure, and lack of resources. These challenges include limited internet access in rural areas, a lack of digital skills, and the need for significant infrastructure development.

In terms of investment and partnerships in the ICT sector, South Sudan has been seeking foreign investment and partnerships to support the development of ICT infrastructure and services. However, political instability and security concerns have been obstacles to attracting investment.

South Sudan’s ICT ecosystem is currently in its infancy and facing immense challenges related to the country’s history of conflict, limited infrastructure, and economic constraints. Progress in developing the sector was hindered by these factors that have seen dwindling but steadily improving internet connectivity and penetration.
For example, in January 2020, South Sudan had 887.7 thousand internet users, with a modest 1.0% increase of 8,688 users from the previous year. At that time, internet penetration in South Sudan was 8.0%. Moving into January 2021, the number of internet users in South Sudan rose to 900.7 thousand, representing a 1.5% increase of 13,000 users from the previous year, with internet penetration remaining at 8.0%.

By January 2022, South Sudan recorded 1.25 million internet users, reflecting a significant 17.3% increase of 184,000 users from the previous year. This meant that at the beginning of 2022, 89.1% of the population, or 10.25 million people, were not using the internet.

In January 2023, South Sudan's internet user base decreased to 773.4 thousand users, with a 7.6% drop of 55,000 users from the previous year. Internet penetration at the start of 2023 was 7.0%, implying that 93.0% of the population, or 10.22 million people, were not using the Internet at that time.

Table 35: Illustration of Internet penetration rates and internet users for the period covering January 2020 to January 2023

<table>
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<tr>
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<th>2020</th>
<th>2021</th>
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<td>10.9</td>
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<tr>
<td>Internet users (Million)</td>
<td>0.8877</td>
<td>0.9007</td>
<td>1.25</td>
<td>0.7734</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 36 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
Figure 36: South Sudan's overall trend of ICT ecosystem covering a running nine-year index.

Source: Compiled by Authors based on datasets from (GSM Association, 2023)

Tanzania
Tanzania's Information and Communication Technology ecosystem has been steadily developing as seen in the progress that has been made in terms of expanding ICT infrastructure and services, particularly in the telecommunications and mobile sectors.

Tanzania has invested in developing its telecommunications infrastructure, including mobile and fixed-line services. The government and private sector have worked to expand network coverage, both in urban and rural areas.

Internet penetration in Tanzania was growing, with increasing access to high-speed internet. The country has invested in improving broadband infrastructure and expanding access to underserved areas.

Mobile technology plays a pivotal role in Tanzania's ICT ecosystem. Mobile phones are widely used for communication and internet access, with multiple mobile network operators providing voice and data services. Mobile money services have also gained significant popularity.

The government has been active in regulating and promoting the ICT sector. Initiatives aim to stimulate sector growth, attract foreign investment, and establish a regulatory framework. Tanzania has made progress in e-government initiatives, including the digitization of public services. Online platforms are used for accessing government information and services.

Challenges in Tanzania’s ICT ecosystem include ensuring that the benefits of technology reach all segments of the population, addressing issues related to digital literacy and skills development, and enhancing cybersecurity and data privacy.

Tanzania has actively sought foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies has been a priority.
Tanzania's ICT ecosystem was on a growth trajectory, with the government's commitment to promoting digital innovation and infrastructure expansion. Progress was evident in the mobile and telecommunications sectors, which had a significant impact on connectivity and digital services.

In January 2020, Tanzania had 14.72 million internet users, marking a 3.0% increase of 428,000 users from the previous year. At that time, internet penetration in Tanzania stood at 25%. Moving into January 2021, the number of internet users in Tanzania rose to 15.15 million, reflecting a 3.0% growth of 435,000 users from the previous year, with internet penetration remaining at 25.0%.

By January 2022, Tanzania recorded 15.60 million internet users, a 2.9% increase of 446,000 users from the previous year. This meant that at the beginning of 2022, 75.0% of the population, or 46.79 million people, were not using the internet.

In January 2023, Tanzania's internet user base continued to grow, reaching 21.00 million users, a 3.0% increase of 606,000 users from the previous year. Internet penetration at the start of 2023 was 31.6%, implying that 68.4% of the population, or 45.46 million people, were not using the Internet at that time.

| Source: Compiled by Authors based on datasets from (DataReportal, 2023) |

On average, **Figure 37** shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.
The Gambia

The Gambia had been making progress in expanding its ICT infrastructure and services as part of its efforts in working to develop its ICT ecosystem, though it faced certain challenges.

The country has made investments in its telecommunications infrastructure, including mobile and fixed-line services. Network coverage extends to urban and peri-urban areas, but rural regions may still face limited connectivity. Internet penetration in The Gambia was growing, and access to high-speed internet was primarily available in urban centers. Efforts have been made to expand broadband access to underserved areas.

Mobile technology plays a central role in The Gambia's ICT ecosystem. Mobile phones are widely used for communication and internet access, and multiple mobile network operators provide voice and data services. Mobile money services have also gained popularity. The government has been involved in regulating and promoting the ICT sector. Initiatives aim to stimulate sector growth, attract foreign investment, and establish a regulatory framework.

Challenges in The Gambia's ICT ecosystem include addressing the digital divide to ensure that the benefits of technology reach all segments of the population. Cybersecurity, data privacy, and issues related to affordable access to the internet are also important considerations, though the country has been actively seeking foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies has been a priority.

The Gambia's ICT ecosystem was in a state of development, with efforts focused on expanding infrastructure and improving digital access. While progress was evident, certain challenges related to affordability, skills development, and reaching underserved areas remained.

In January 2020, The Gambia had 472.5 thousand internet users, reflecting a 3.0% increase of 14 thousand users from the previous year. At that time, internet penetration in The Gambia stood at 20%. Moving into January 2021, the number of internet users in The Gambia rose to 580.2 thousand.
thousand, marking a substantial 23% growth of 108 thousand users from the previous year, with internet penetration rising to 23.7%.

By January 2022, The Gambia recorded 1.29 million internet users, a 2.9% increase of 36,000 users from the previous year. This meant that at the beginning of 2022, 49.0% of the population, or 1.24 million people, were not using the internet.

In January 2023, The Gambia’s internet user base decreased to 903.9 thousand users, with a 2.5% drop of 22,000 users from the previous year. Internet penetration at the start of 2023 was 33.0%, implying that 67.0% of the population, or 1.84 million people, were not using the Internet at that time.

*Table 37: Illustration of Intern penetration rates and internet users for the period covering January 2020 to January 2023*

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<th>2020</th>
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<tbody>
<tr>
<td>Internet penetration rate</td>
<td>20</td>
<td>23.7</td>
<td>51</td>
<td>33</td>
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<tr>
<td>Internet users (Million)</td>
<td>0.4725</td>
<td>0.5802</td>
<td>1.2</td>
<td>0.9039</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, *Figure 38* shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.

*Figure 38: Gambia’s overall trend of ICT ecosystem covering a running nine-year index.*

Source: Compiled by Authors based on datasets from (GSM Association, 2023)
Togo

Togo, a West African country, has been working to develop its ICT ecosystem and has made progress in expanding its ICT infrastructure and services, with a focus on improving access and digital literacy.

Togo has been investing in its telecommunications infrastructure, including mobile and fixed-line services. The government and private sector have been working to expand network coverage, both in urban and rural areas.

Internet penetration in Togo was growing, with increasing access to high-speed internet. Efforts have been made to expand broadband access to underserved areas, including through fiber optic network expansion.

Mobile technology plays a crucial role in Togo's ICT ecosystem. Mobile phones are widely used for communication and internet access, and multiple mobile network operators provide voice and data services. Mobile money services have also gained popularity.

The government has been active in regulating and promoting the ICT sector. Initiatives aim to stimulate sector growth, attract foreign investment, and establish a regulatory framework.

Togo has been working on e-government initiatives, including the digitization of public services. Online platforms and digital services are used for accessing government information and services.

Challenges in Togo's ICT ecosystem include addressing the digital divide to ensure that the benefits of technology reach all segments of the population, improving digital skills and education, and enhancing cybersecurity and data privacy.

Togo has actively sought foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies has been a priority.

Togo's ICT ecosystem was in a state of development, with efforts focused on expanding infrastructure, improving digital access, and enhancing digital literacy. While progress was evident, certain challenges related to affordability, skills development, and reaching underserved areas remained.

In January 2020, Togo had 1.71 million internet users, marking a substantial 7.8% increase of 124,000 users from the previous year. At that time, internet penetration in Togo stood at 21%. Moving into January 2021, the number of internet users in Togo rose to 1.99 million, reflecting a remarkable 17% growth of 287,000 users from the previous year, with internet penetration rising to 23.8%.

By January 2022, Togo recorded 2.23 million internet users, a 13.1% increase of 259,000 users from the previous year. This meant that at the beginning of 2022, 74.1% of the population, or 6.35 million people, were not using the internet.

In January 2023, Togo's internet user base continued to grow, reaching 3.13 million users, with a 2.3% increase of 71,000 users from the previous year. Internet penetration at the start of 2023 was 35.0%, implying that 65.0% of the population, or 5.82 million people, were not using the Internet at that time.
Table 38: Illustration of Internet penetration rates and internet users for the period covering January 2020 to January 2023

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<th>2022</th>
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<td>Internet penetration rate</td>
<td>21</td>
<td>23.8</td>
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<td>35</td>
</tr>
<tr>
<td>Internet users (Million)</td>
<td>1.71</td>
<td>1.99</td>
<td>2.23</td>
<td>3.13</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 39 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.

Figure 39: Togo’s overall trend of ICT ecosystem covering a running nine-year index.

Source: Compiled by Authors based on datasets from (GSM Association, 2023)

Uganda

Uganda, a country in East Africa, has been working to develop its ecosystem with significant progress made in expanding its ICT infrastructure and services while focusing on improving digital access and innovation. These are seen in the development of various areas that are pertinent to a strong ICT ecosystem.

For example, Uganda has invested in its telecommunications infrastructure, including mobile and fixed-line services. The government and private sector have worked to expand network coverage,
both in urban and rural areas. Internet penetration in Uganda was growing, with efforts to improve access in underserved areas. The country has invested in improving broadband infrastructure and expanding access to remote regions.

In terms of the mobile technology front, mobile technology has been argued to play a significant role in Uganda's ICT ecosystem. Mobile phones are widely used for communication and internet access, and multiple mobile network operators provide voice and data services. Mobile money services, such as M-Pesa, are popular for financial transactions. This is also supported by a strong regulations and Government Initiatives. To this end, the government has been active in regulating and promoting the ICT sector. Initiatives aim to stimulate sector growth, attract foreign investment, and establish a regulatory framework.

In the area of E-Government and Public Services, Uganda is seen to have made progress in e-government initiatives, including the digitization of public services. Online platforms and digital services are used for accessing government information and services.

Challenges in Uganda's ICT ecosystem include addressing the digital divide to ensure that the benefits of technology reach all segments of the population, improving digital skills and education, and enhancing cybersecurity and data privacy.

Uganda has actively sought foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies has been a priority.

Uganda's ICT ecosystem was in a state of development, with efforts focused on expanding infrastructure, improving digital access, and enhancing digital literacy. While progress was evident, certain challenges related to affordability, skills development, and reaching underserved areas remained.

In January 2020, Uganda had 10.67 million internet users, marking a 3.5% increase of 357,000 users from the previous year. At that time, internet penetration in Uganda was 24%. Moving into January 2021, the number of internet users in Uganda significantly rose to 12.16 million, reflecting a substantial 14% growth of 1.5 million users from the previous year, with internet penetration increasing to 26.2%.

By January 2022, Uganda recorded 13.92 million internet users, a 15.1% increase of 1.8 million users from the previous year. This meant that at the beginning of 2022, 70.9% of the population, or 33.85 million people, were not using the Internet.

In January 2023, Uganda’s internet user base decreased to 11.77 million users, with a 9.4% drop of 1.0 million users from the previous year. Internet penetration at the start of 2023 was 24.6%, implying that 75.4% of the population, or 36.15 million people, were not using the Internet at that time.
Table 39: Illustration of Internet penetration rates and internet users for the period covering January 2020 to January 2023

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<th>2020</th>
<th>2021</th>
<th>2022</th>
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<tbody>
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<td>Internet penetration rate</td>
<td>24</td>
<td>26.2</td>
<td>29.1</td>
<td>24.6</td>
</tr>
<tr>
<td>Internet users (Million)</td>
<td>10.67</td>
<td>12.12</td>
<td>13.92</td>
<td>11.77</td>
</tr>
</tbody>
</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 40 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.

![Graph showing trends](image)

**Figure 40: Uganda’s overall trend of ICT ecosystem covering a running nine-year index.**

Source: Compiled by Authors based on datasets from (GSM Association, 2023)

**Zambia**

Zambia is a landlocked country in southern Africa, that has been steadily developing its ecosystem. The country has so far made progress in expanding ICT infrastructure and services, although challenges remain. One of the most significant developments in Zabia’s internet infrastructure can be seen in benefits to be accrued in the route from Luanda connecting through some of the COMESA countries to Johannesburg, (The Digital Watch, 2023).
Zambia has made investments in its telecommunications infrastructure, including mobile and fixed-line services. The country has been working to expand network coverage, particularly in urban and peri-urban areas.

Internet penetration in Zambia was growing, with efforts to improve access to high-speed internet and expand broadband infrastructure. However, access in rural areas remained a challenge.

Mobile technology plays a key role in Zambia's ICT ecosystem. Mobile phones are widely used for communication and internet access, with multiple mobile network operators providing voice and data services. Mobile money services are also popular.

The government has been involved in regulating and promoting the ICT sector. Initiatives aim to stimulate sector growth, attract foreign investment, and establish a regulatory framework.

Zambia has made progress in e-government initiatives, including the digitization of public services. Online platforms and digital services are used for accessing government information and services.

Challenges in Zambia's ICT ecosystem include addressing the digital divide to ensure that the benefits of technology reach all segments of the population, improving digital skills and education, and enhancing cybersecurity and data privacy.

Zambia has actively sought foreign investment and partnerships to support the development of ICT infrastructure and services. Collaboration with international organizations and technology companies has been a priority.

Zambia's ICT ecosystem was on a growth trajectory, with a focus on expanding infrastructure, improving digital access, and enhancing digital literacy. While progress was evident, challenges related to affordability, skills development, and reaching underserved areas persisted.

In January 2020, Zambia had 4.43 million internet users, reflecting a significant 16% increase of 595,000 users from the previous year. At that time, internet penetration in Zambia stood at 24%. Moving into January 2021, the number of internet users in Zambia substantially rose to 5.48 million, marking a remarkable 24% growth of 1.1 million users from the previous year, with internet penetration increasing to 29.4%.

By January 2022, Zambia recorded 5.47 million internet users, a 5.4% increase of 279,000 users from the previous year. This meant that at the beginning of 2022, 71.5% of the population, or 13.72 million people, were not using the internet.

In January 2023, Zambia's internet user base decreased to 4.30 million users, with a 2.8% drop of 115,000 users from the previous year. Internet penetration at the start of 2023 was 21.2%, implying that 78.8% of the population, or 15.99 million people, were not using the Internet at that time.
Table 40: Illustration of Intern penetration rates and internet users for the period covering January 2020 to January 2023

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<th>2020</th>
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<tbody>
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<tr>
<td>Internet users (Million)</td>
<td>4.43</td>
<td>5.48</td>
<td>5.47</td>
<td>4.3</td>
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</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 41 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.

![Zambia's overall trend of ICT ecosystem covering a running nine-year index.]

Source: Compiled by Authors based on datasets from (GSM Association, 2023)

Zimbabwe

We can see that Zimbabwe has been working to develop its ICT ecosystem for a while and has since made progress in expanding its ICT infrastructure and services, although challenges remain. Just like Zambia, the country has also benefited from a fiber optic connection that runs through its country to connect Lwanda and Johannesburg in South Africa alongside the Democratic Republic of Congo, Zambia, and Zimbabwe, (The Digital Watch, 2023).
This can be observed from the fact that Zimbabwe has invested in its telecommunications infrastructure, including mobile and fixed-line services. The government and private sector have been working to expand network coverage, both in urban and rural areas.

Internet penetration in Zimbabwe was growing, with increasing access to high-speed internet. Efforts have been made to expand broadband access to underserved areas, including through fiber optic network expansion.

Mobile technology plays a crucial role in Zimbabwe's ICT ecosystem. Mobile phones are widely used for communication and internet access, and multiple mobile network operators provide voice and data services. Mobile money services are also popular for financial transactions.

The government has been active in regulating and promoting the ICT sector. Initiatives aim to stimulate sector growth, attract foreign investment, and establish a regulatory framework.

Zimbabwe has been working on e-government initiatives to improve public services and governance. This includes the digitization of government services and the implementation of online platforms for citizens to access government information and services.

Challenges in Zimbabwe's ICT ecosystem include addressing the digital divide to ensure that the benefits of technology reach all segments of the population, improving digital skills and education, and enhancing cybersecurity and data privacy.

Zimbabwe has been seeking foreign investment and partnerships to support the development of ICT infrastructure and services in the country. This includes cooperation with international organizations and technology companies.

Zimbabwe's ICT ecosystem was in a state of development, with efforts focused on expanding infrastructure, improving digital access, and enhancing digital literacy. While progress was evident, certain challenges related to affordability, skills development, and reaching underserved areas remained.

As of January 2020, Zimbabwe had 4.81 million internet users, marking a 9.4% increase of 413,000 users from the previous year. At that time, internet penetration in Zimbabwe stood at 33%. Moving into January 2021, the number of internet users in Zimbabwe slightly increased to 5.01 million, reflecting a 4.2% growth of 203,000 users from the previous year, with internet penetration increasing to 33.4%.

By January 2022, Zimbabwe recorded 4.65 million internet users, a 6.0% decrease of 265,000 users from the previous year. This meant that at the beginning of 2022, 69.4% of the population, or 10.56 million people, were not using the internet.

In January 2023, Zimbabwe's internet user base increased to 5.74 million users, with a 2.1% growth of 117,000 users from the previous year. Internet penetration at the start of 2023 was 34.8%, implying that 65.2% of the population, or 10.75 million people, were not using the Internet at that time.
Table 41: Illustration of Intern penetration rates and internet users for the period covering January 2020 to January 2023

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<th>2020</th>
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<th>2022</th>
<th>2023</th>
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<tbody>
<tr>
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<td>Internet users (Million)</td>
<td>4.81</td>
<td>5.01</td>
<td>4.64</td>
<td>5.74</td>
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</table>

Source: Compiled by Authors based on datasets from (DataReportal, 2023)

On average, Figure 42 shows a consistent improvement in Infrastructure development, Affordability of mobile phones and cost of accessing the internet, consumer readiness, and relevance of content and services.

Figure 42: Zimbabwe's overall trend of ICT ecosystem covering a running nine-year index.

Source: Compiled by Authors based on datasets from (GSM Association, 2023)

The innovation trend in Sub-Saharan Africa by regions

According to the global innovation index, which includes two sub-indices: the innovation input sub-index and the innovation output sub-index. The first sub-index is based on five pillars: institutions, human capital and research, infrastructure, market development, and business development. The second sub-index is based on two pillars: knowledge and technology outputs and creative outputs. Each pillar is divided into sub-pillars and each sub-pillar consists of individual indicators. We see a general declining trend in innovation practices in the sub-Saharan region, as shown in the graphic below. The innovation index over 5 years from 2018 shows that only Mauritius. South Africa, Kenya, Botswana, and Tanzania reached the five-year average of
25%, with only Mauritius and South Africa above 30%. It is worth noting that Mauritius has a stronger innovation performance, consistently above 30%.

Figure 43: Illustration of a 5-year average of innovation index for Sub-Saharan countries

Source: Compiled by Authors based on datasets from, (The Global Economy, 2023)

Summarized Findings on state of SDG implementation vs Innovation and Internet Penetration in Sub-Saharan Africa

The Internet in general has undergone major cycles of revolution around the world particularly in Africa, as shown by the ITU data. The shift from fixed telephony to mobile platforms has brought mixed results for various stakeholders, be it economic, social, or developmental. There are more people connected to and using mobile phone-enabled platforms than those using landline phone-enabled platforms. Although fixed broadband subscriptions have increased significantly, there is a huge number of mobile and mobile broadband subscriptions. The rise of alternative internet connectivity that complements mobile broadband is also evident in the increasing number of the population having at least one LTE/WiMAX mobile network and the increasing number of people connected to international bandwidth in Africa a continent ready to benefit from the benefits that ICT interventions bring. The overall increase in the population that has a mobile network, and particularly the population that has at least a 3G mobile network, which has led to a significantly large increase in Internet users, suggests that the future lies in digitalization.
Figure 44: Illustration of the mobile cellular and broadband subscription trends in Africa between 2005 and 2022

Source: Compiled by Authors based on datasets from, (International Telecommunication Union, 2023)
Regarding innovation and internet access, the continent of Africa seems to be heading in the right direction. The numbers provided by the GSMA Mobile Connectivity Index show that, along with other indicators, the use of mobile phones for the Internet has constantly increased.

This suggests that digitalization is already occurring throughout Africa, which is cause for optimism. Africa is starting to understand the reality of innovation, according to the innovation index. Therefore, the intersection of global and innovation trends offers a nexus that is worth exploring when considered in the context of accomplishing sustainable development goals.

As has already been established, other developed countries have done a better job of achieving the SDGs than Africa has. While there are several potential factors for this, we argue that one of the biggest ones may be the lack of ICT integration during the process of making strategic decisions or carrying out the SDG implementation.

The findings suggest that there is a slight correlation between internet penetration and innovation efforts on the one side and SDG commitment achievement on the other side. As seen in Figure 46, in the graph below, we followed the trends of a 4-year average internet penetration rate and a 5-year average innovation index score for the period covering 2019 to 2022 against the 2023 SDG index scores. This implies that ICT plays a significant role in enabling countries to achieve or report on SDG commitments to a greater extent. The findings suggest that countries that have higher internet penetration rates combined with a strong foundation for internet connectivity and penetration have a bigger chance of increasing their innovation portfolio while at the same time managing to achieve some if not most of their SDG commitment. This is further demonstrated in Table 42 in which we see Carbo Verde and Mauritius exhibiting similar trends as highlighted therein.
Comparative trend analysis of 4-year average internet penetration rates, 5-year average innovation index score, and SDG country score

Figure 46: Combination of Innovation index, mobile connectivity index, and SDG index
Source: Compiled by Authors based on datasets from, (The Global Economy, 2023), (World Intellectual Property Organization, 2022), (DataReportal, 2023), and (GSM Association, 2023)
Table 42: Illustration for a comparative analysis of the country’s performance in terms of internet penetration index, innovation index, and SDG scores

<table>
<thead>
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Source: Compiled by Authors based on datasets from, (The Global Economy, 2023), (World Intellectual Property Organization, 2022), (DataReportal, 2023), and (GSM Association, 2023)
Discussion of the findings

We examine how ICT has made adoption possible or how it can be adapted to meet the SDGs, all from the standpoint of an ecosystem that is already robust and built on factors like consumer readiness, infrastructure development, content relevance, affordability, and so on. The use of ICT by Africa to speed up its development has not produced the same favorable outcomes as the Asia-Pacific region, according to a 2014 report (Odongo, 2015). The author examined Africa's ICT research progress in the context of an increasingly information-age and knowledge-based global economy, focusing on the benefits, trends, challenges, and solutions. Among other needs, the author noted that policies and strategies aimed at realizing ICT prospects for development must prioritize establishing clear ICT visions, be action-oriented, and have measurable and achievable goals. Africa is beginning to place more emphasis on ICT and digitization, as seen by the latest trends.

According to Begazo, Dutz, and Blimpo (2023), only 22% of people in Sub-Saharan Africa were using mobile internet services at the end of 2021, even though 54% of the region's population has access to 4G mobile internet service and 84% of people live in areas with 3G coverage on average. There is now a chance for customized engagement through a variety of entry points thanks to the growth of mobile platforms as services via smartphones, (Begazo, Dutz, & Blimpo, 2023). To investigate this question, we looked at four indicator parameters provided by the GSMA Mobile connectivity index.

A lack of trustworthy statistics and other information about Africa, especially information that provides an overview of the ICT sector and how development actors from both national and international ecosystems have adopted these ICT interventions to achieve the SDG, is the primary obstacle to the integration of ICT in development projects and processes, as evidenced by the ICT Sector in Africa. This was also mentioned by those who pointed out how difficult it is to comprehend the scope and depth of the ICT industry in Africa, (Naito, 2018).

There is still little to show in terms of citizen participation and impact on the achievement and reporting of the SDGs, despite the ICT sector appearing to have made positive contributions to the economy through the rise of startups and government interest in digitizing its services and governance. For instance, there is a growing interest among investors in investing in Silicon Valley, but it is still unclear how this interest will affect the development of an environment that will facilitate the achievement and reporting of the Sustainable Development Goals (SDGs), which include, among other things, the creation of large-scale jobs with social and economic synergies that can change people's lives, affordable, inclusive, and high-quality education, high-quality and reasonably priced healthcare, and a sustainable supply of wholesome foods to reduce food insecurity.

Nonetheless, we make an effort to present a broad overview of the ICT for development agenda in the African development agenda as well as the accomplishment of the SDG commitments from the standpoint of common SDG entry points, such as ICT for digital finance, ICT for transformative information access and ICT for enabling the digital economy, ICT for lowering carbon emissions and stimulating climate finance, and ICT for enabling the agenda for digitalized agriculture. We investigate these by being aware of the crucial framework conditions—like B—that must exist for the digital ecosystem to prosper. Affordable mobile data, the wider availability of locally created apps, the importance of local content, and the ability of people without access to digital technology to own and use it. To support greater penetration while guaranteeing population security in the digital space in terms of maintaining trust in the Internet and the dependability of digital security, mobile phones increase internet penetration and access, digital literacy, and language support. Based on the results, the significance of this is that a framework for
determining what should be prioritized is required to enhance the best possible integration of ICT for the advancement and realization of socioeconomic well-being in Africa.

Using the results of our analysis, we offer a few suggestions for the framework that could be used to fully optimize ICT-integrated services for sustainable development. To be responsive to both local and global needs, we contend that applications that provide solutions across the spectrum of SDGs must be localized, and their content must be relevant to the general public. To improve access to and utilization of ICT for development services, it is necessary to create a more favorable environment for phones and the infrastructure where mobile phones will be used to download apps. Support language and digital literacy must also be improved throughout Africa, but especially in rural areas where connectivity and access to ICT for development integration are still limited due to problems with internet access. Finally, as we promote the use of more internet-enabled technologies, such as ICT for development platforms, we must emphasize the importance of digital space security and safety for the successful integration of these platforms.

The future is depicted as being bright by the mobile connectivity index based on recent developments. This is due to the rate at which locally developed apps and local content relevance, mobile infrastructure, affordable mobile data, affordable handsets, support for digital languages and digital literacy, and the outlook for digital space safety from 2014 to 2022 all indicate that Africa is increasingly prepared to sustain the digital revolution in terms of bolstering the ICT for development ecosystem.

Opportunities for ICT integration as a pathway for sustainable development

Several examples in the literature demonstrate how ICT has either directly or indirectly enabled a few SDG goals and indicators worldwide. There is a case to be made for many of these interventions consisting of ICT interventions and efforts that offer Sub-Saharan African nations a chance to fulfill their SDG commitments.

While in the business and corporate sector, ICT has been seen as a game changer towards enhancing the business environment through automation, data analytics, and cloud computing, optimizing processes and enhancing productivity, it has also enabled online marketing, e-commerce, and customer relationship management, expanded business reach and improving customer experiences, (Brown, 2020). A well-planned and practical ICT penetration is highly supported by ICT infrastructure policy, which in turn has given an enabling environment for processes of economic development and innovation that support economic growth, (Kurniawati, 2022).

A significant argument has been made by authors (Nchake & Shuaibu, 2022) for additional ICT infrastructure investment, particularly in rural regions, to foster equitable growth in the region and to fully take advantage of new prospects of economic advancements. As already established in the findings, this is something that is already in high gear. The question is whether Africa has the right tone to tap into the ICT and digitalization wave to take full advantage of ICT interventions and drive them towards achieving sustainable development.

We posit that several initiatives are already in place to enable Africa to achieve the SDGs through the adoption of ICT interventions. We highlight several pathways that are already ongoing by identifying a few examples of how ICT has been channeled towards the achievement of SDG such as poverty alleviation, sustainable agriculture, inclusive education, and access to healthcare among others.
A Case of Poverty alleviation in the digital era

Ending poverty in all its manifestations worldwide is the first Sustainable Development Goal. Many African nations in the Sub-Saharan region are having difficulty, whereas many developed nations have been able to keep up or are improving in this area. It seems that efforts to guarantee job creation have moved from traditional manufacturing and labor-intensive, casual industries to include the digital labor market. It can be argued that other emerging markets fall under the digital economy’s umbrella of digitization, even though manufacturing and agriculture continue to be Africa's two largest job markets.

According to research, labor income is the main driver of changes in poverty; in some cases, it explains more changes in moderate poverty and accounts for more than 40% of the poverty reduction, (Azevedo, Inchauste, Olivieri, Saavedra, & Winkler, 2013). Over time, more and better-paying jobs were the main drivers of poverty reduction. The digital economy has been proposed by some as the golden chalice of Africa, especially for linking youth employment and business success by creating decent wedges and paying jobs. The growth of the e-commerce sector has meant that there is an opportunity for many to venture into online sales of goods and services with minimal overheads such as rent expenditure of other consumables. An International Finance Corporation report found that there is an opportunity for digital skills holders amounting to an estimated value of $130 Billion across Sub-Saharan Africa, (International Finance Corporation, 2019).

The digitalized job market landscape as an enabler for the achievement of SDG 1 on the reduction of extreme poverty

Here, we concentrate on initiatives that support the creation of well-paying jobs for Africans to advance the Sustainable Development Goals (SDGs): SDG 1: No Poverty – end poverty in all its forms everywhere; SDG 8: Decent Work and Economic Growth – promote sustained, inclusive, and sustainable economic growth; full and productive employment; and SDG 9: Industry, Innovation, and Infrastructure – create resilient infrastructure; and SDG 10: Gender Equality and Human Rights. These include, but are not limited to, jobs that are based on the need to support the digital economy, jobs that are enabled by technology, and many more.

There is a rising positive trend in the opportunities that digitalization brings, as has already been shown by the increased investments in the internet and digital platforms. It is still difficult to imagine how much demand the digital economy will have on Africans. As the other markets are already regarded as being oversaturated, Africa has also become the preferred market for digital inventions. While the fact that Africa is a net importer of technology still presents a challenge, there are more opportunities for an in-built expertise to be developed, giving Sub-Saharan Africa the chance to become an ICT and digital tech giant continent like Asia and Europe. We draw attention to a few instances that show how Africa will likely use ICT in the future to help it meet its economic and employment-related SDG targets.

The digital Hubs as a pathway for digital job creation in Africa

While the conventional job markets are still the way to secure a sustainable living among job seekers in a typical environment, the digital job market has gained a fast pace in many developing nations in the global south. As a net importer of technology, many job opportunities have been confined to non-technical job seekers with more sophisticated technology-based jobs only appealing to a few due to lack of capacity. This, however, has not stopped the digital hubs from sprouting in most of the Sub-Saharan African countries as an alternative source to secure jobs and reduce unemployment, especially among the youth. In Kenya, this is seen in the form of digital hubs that have provided a shared working space for interested people in 1400 wards across the country, (Mwangi, 2023).
A Case of Digitalization of Agriculture in Africa

International development partners and domestic stakeholders in developing nations have remained driven to address food insecurity even though SDG goal 2 has garnered the attention of many stakeholders. The increased use of technology in agriculture and the associated practice and research activities are contributing factors to this. To end hunger, achieve food security and better nutrition, and support sustainable agriculture, the real challenge lies in how ICT might support and encourage household-level agricultural practices to increase household-level or communal agricultural engagement.

According to (Poku, 2022) agriculture has historically been the economic backbone of Africa, accounting for 25.40% of the continent's GDP. 60% of the world's uncultivated arable land is on this continent, where a wide range of crops can be grown that could feed more than half of the world's population. In addition, 80% of farms in sub-Saharan Africa are believed to be owned and operated by small or marginal farmers, feeding an estimated 60% of the continent's population and possibly 80% in some countries. Out of this 80% of farms in sub-Saharan Africa, (Goedde, Ombaka, & Pais, 2019) project that Smallholder farmers make up more than 60% of the population in sub-Saharan Africa, and agriculture accounts for around 23% of the region's GDP. This implies that the continent’s full agricultural potential is still unrealized.

African smallholder farmers may now operate more profitably and efficiently thanks to the hardware and software developed by Releaf, a Nigerian startup. An innovative Kenyan company called Twiga Foods connects farmers, manufacturers, fast-moving consumer goods companies, and vendors via mobile technology. The issue of inaccessible veterinary care in rural areas is resolved by CowTribe, a Ghanaian startup that offers smallholder farmers mobile veterinary services. Drone technology has also increased its entourage in Africa such as those that are being used to deliver essential inputs to farmers, analyze soil profiles, etc. The only challenge here is that most of these technologies are yet to be homegrown and are more or less imported technologies. Farms, aggregators, and buyers can adopt cold storage without having to make any upfront investments thanks to SokoFresh which is a Kenyan venture that offers farm-level cold storage via a "pay-as-you-store" model. There is also the Senegalese startup Tolbi which utilizes satellite imagery, soil and moisture sensors, and agricultural expertise to increase Senegalese crop yields. Another ICT-led startup is the Apollo Agriculture which is a Kenyan startup that offers small-scale farmers personalized guidance on planting, irrigation, and fertilizer use to increase crop yields and lower Labor costs through the incorporation of machine learning and remote sensing. In the same niche of employing emerging technologies like artificial intelligence is the South African startup known as Aerobotics which employs drones and artificial intelligence to detect pests and illnesses in tree crops. One other best example of a startup employing ICT to further food security is the Agrix Tech which is a Cameroon-based startup that provides information resources to farmers such potentially damaging diseases, market and funding opportunities in a digital platform. These are potential efforts to increase small-scale farmers’ output, especially in rural areas. To reduce post-harvest losses by guaranteeing prompt delivery of fresh produce, Taimba, a Kenyan startup, has created a B2B mobile app that links smallholder farmers with buyers and markets. Zowasel is a Nigerian startup that uses mobile and data science to give smallholder farmers access to technology, training, and capital to increase yields and lower post-harvest losses. Esoko is an African agricultural market information and communication service that links smallholder farmers through the use of mobile technology and last-mile agent networks to farm input suppliers, financial service providers, and commodity buyers. An organization based in Kenya called UjuziKilimo uses machine learning and data science to give farmers practical agronomic information.

The above are just a few out of many ICT-enabled startups that contribute to ICT for development ventures that are already making big steps in contributing toward achieving SDG goal number 2.
A Case of Inclusive access to quality healthcare

The current life expectancy for Africa in 2023 according to (Macrotrends, 2023) is estimated to be 64.11 years which implies a 0.45 per cent increase from 2022 which stood at 63.82 years translating to a 0.46 per cent increase from 2021. This was still lower than the current life expectancy for the World which stands at 73.16 years signifying a 0.24 per cent increase from 2022.

We make the case for localizing health efforts and frameworks that are centered on leveraging the mutually reinforcing health and economic benefits of proximity, which offers a chance to highlight the importance of the local context as stated by (Mackintosh, et al., 2018). To build sustainably stronger local health systems and a more robust industrial base, the authors made a case for urgent policy-making in Africa that sought medium-term strengthening of their local health-industrial linkages and associated scientific and industrial capabilities. We concur with the assertion of (Karamagi, Munene, Droti, Jepchumba, & Okeibunor) that there are numerous and varied digital health solutions available in Sub-Saharan Africa. Coordination, integration, scalability, sustainability, and equitable distribution of investments in digital health are all things that are lacking. There is hope for universal health care in the subregion thanks to digital insurance plans, e-pharmacies, e-diagnostic tools, e-health record-keeping platforms, digital doctor appointment platforms, and many other innovations.

Summary of the discussion of the findings

There is an increased need to continue the efforts of identifying, nurturing, and scaling the ICT ecosystem to respond to the need for enabling sustainable development in Sub-Saharan Africa and the global south in general.

The emerging theory of change

Why have we prioritized infrastructure, accessibility, consumer readiness, content, and services as factors to boost internet usage and penetration and offer a flexible ecosystem for innovation to flourish within digital interventions to support SDG achievement and reporting?
Theory of Change Narrative

When we create a stable, sustainable, and responsive environment that fosters an inclusive ICT ecosystem, we observe a significant increase in the number of internet users. This shift is attributed to the combined factors of affordability, accessible internet, affordable devices, and bandwidth. Furthermore, the presence of relevant, context-specific content and services plays a crucial role in driving the adoption of technology-based solutions. As consumers become more ready to embrace these solutions, it triggers a surge in innovative approaches to cater to the growing demand for technology services.

This transformative ecosystem, characterized by accessible internet, affordable devices and bandwidth, and context-specific content and services, not only propels innovation but also accelerates the achievement of the Sustainable Development Goals (SDGs). The use of ICT interventions for development not only fosters a more interconnected society but also paves the way for more rapid and verifiable progress toward the SDGs. The impact is felt in enhanced SDG achievement and reporting, increased internet penetration rates, a culture of innovation, and empowered consumers who are ready to harness the potential of technology for their benefit and the betterment of their communities.

When we have a stable, sustainable, and responsive environment to foster an inclusive ICT ecosystem we experience a rise in internet users due to affordability, accessible internet, affordable devices and bandwidth, and content relevant to the population and contextualized to the benefitting population, which leads to an environment where consumers become more ready to adopt new technology-based solution to them. This in the end spurs the need for more innovative approaches to respond to the increased consumer demand for the technology service. In the process, we foresee a situation in which achieving the SDGs becomes a faster and verifiable process using ICT interventions for development.
Proposed stakeholder matrix

From the foreseen theory of change, we foresee the need to have a responsive stakeholder framework that will inform and direct an impactful theory of change. We identify several proposed stakeholder frameworks in the existing literature and propose a stakeholder matrix that we believe would be a critical component toward achieving the objective of ICT4D interoperability within and across sustainable development projects for greater impact-oriented outcomes.

Stakeholders can be viewed from different angles based on various dimensions. For example, (Thomas, Li, Sistenich, Diango, & Kabongo, 2022) looked at stakeholders in terms of conceptualized knowledge management in the context of ICT4D based on the people, process, and technology perspective. Another view of the stakeholders for ICT for development can be seen in UNDESA’s description of the role the Government plays in enabling ICT for development interventions (Department of Economic and Social Affairs, n.d.). In terms of processes and enabling environment, the stakeholders must find an ecosystem that is responsive enough to allow for ICT development to grow. The enabling ecosystems are equally reliant on the other key stakeholders such as the developers, internet providers, regulatory bodies, and government agencies in charge of policies that impact affordability, safety and privacy, infrastructure, and many others. Capacity development is also another key process that is equally vital. Without a continuous capacity development avenue, users will get starved of knowledge and the ICT for development intervention will be dwarfed in terms of the impact that is needed.

In summary, we derive a stakeholder matrix from an Information and Communication Technologies for Development (ICT4D) perspective as a tool used to identify and categorize the various actors involved in ICT4D initiatives. Our proposed stakeholder matrix provides a holistic structured framework for understanding the roles and interests of different stakeholders in the context of ICT development projects. Here's a summary of the key components of an ICT4D stakeholder matrix as illustrated in Figure 48 and subsequent explanatory narrative.
### Emergent stakeholder matrix explanatory narrative.

1. **Primary Stakeholders:**
   - **Government**: National and local government bodies play a significant role in shaping ICT policies, regulations, and infrastructure development. National governments often play a central role in ICT4D initiatives by formulating policies, regulations, and strategies for technology development and deployment. Ministries of ICT, education, and finance are key players.
   - **Private Sector**: Private companies, including telecom providers, technology firms, and service providers, are crucial for investment, innovation, and service delivery. They are important stakeholders due to their role in investing in infrastructure and services for profit. Partnerships with businesses can drive innovation and resource mobilization.
   - **Civil Society Organizations**: NGOs, community-based organizations, and advocacy groups often work to ensure that ICT initiatives address the needs and rights of marginalized communities. For example, NGOs, such as Oxfam, Save the Children, and the Red Cross may implement ICT projects for various development goals, including healthcare, education, and poverty reduction. Local communities, advocacy groups, and grassroots organizations are also key stakeholders advocating for digital inclusion, privacy, and equitable access to ICT.
   - **Academia**: Universities and research institutions contribute to ICT4D through research, knowledge generation, and training for human capacity development in ICT4D.

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**Figure 48: Emergent Stakeholder matrix for responsive and sustainable ICT4D interventions**
• **Donors and Development Agencies**: International organizations, bilateral and multilateral donors, and development agencies provide funding and technical support for ICT4D projects. One critical component of the donor and development agencies are the philanthropic organizations that plug in to provide financial resources for ICT4D projects.

2. **Secondary Stakeholders**:

   • **End Users**: The people who directly benefit from ICT services, including individuals, communities, and businesses. The individuals and communities benefiting from ICT4D interventions may be farmers accessing weather information or students using e-learning platforms.

   • **Media**: Media organizations play a role in disseminating information about ICT initiatives and their impacts.

   • **Regulatory Bodies**: Agencies responsible for regulating and overseeing the ICT sector to ensure compliance and fairness. The entities are expected to set and enforce regulations and standards for the ICT sector, thereby ensuring fair competition and protecting consumers.

   • **Industry Associations**: Groups representing the interests of specific sectors within the ICT industry.

   • **Community Leaders**: Local leaders and influencers in communities where ICT projects are implemented.

3. **Tertiary Stakeholders**:

   • **International Organizations**: Organizations like the United Nations and the World Bank, provide global support and standards for ICT4D.

   • **Technology Innovators**: Individuals and startups that create new ICT solutions and applications. Organizations that provide essential technology infrastructure, like internet service providers, mobile network operators, and hardware manufacturers.

   • **Consultants and Experts**: Specialists in ICT, development, and related fields who offer technical expertise. This may also include individuals and startups that drive innovation in ICT solutions for development challenges, often through social entrepreneurship.

   • **Media Content Providers**: Companies or individuals producing digital content such as apps, websites, and educational materials.

   • **Trade Unions**: Organizations representing the interests of workers in the ICT sector.
Conclusion and recommendations

The discussion in this document revolves around the adoption of Information and Communication Technology (ICT) for achieving Sustainable Development Goals (SDGs) in Sub-Saharan Africa. It begins by highlighting the challenges and opportunities in adopting ICT for development in the region.

1. **Challenges in ICT Adoption:**
   - Africa has faced challenges in realizing the full potential of ICT for development, with outcomes lagging behind the Asia-Pacific region.
   - The lack of trustworthy statistics and information about Africa's ICT sector has hindered integration into development projects.
   - Limited citizen participation and impact on SDG achievement, despite some positive contributions from the ICT sector.

2. **Opportunities in ICT Adoption:**
   - The document emphasizes the need to create an enabling environment for ICT adoption, focusing on key factors such as infrastructure, affordability, consumer readiness, and relevant content.
   - It highlights a rising trend in mobile internet usage, particularly the growth of mobile platforms and services.
   - The authors suggest that Africa is increasingly prepared to sustain the digital revolution, citing factors like locally developed apps, mobile infrastructure, affordable data, and digital literacy.

3. **Pathways for Sustainable Development:**
   - The document explores several pathways through which ICT can contribute to achieving SDGs, including poverty alleviation, digitalization of agriculture, and inclusive access to quality healthcare.
   - It highlights the potential of the digital economy in reducing poverty and generating job opportunities.
   - It showcases various ICT-enabled startups that are making significant contributions to agriculture, healthcare, and food security.
   - The authors discuss the role of digital hubs in providing job opportunities in the digital sector.

4. **Inclusive ICT Ecosystem Development:**
   - The document presents a theory of change that illustrates how creating a stable and responsive environment for ICT can lead to increased internet usage, innovation, and accelerated progress in achieving SDGs.
   - It emphasizes the importance of affordability, accessible internet, and relevant content in driving consumer readiness and fostering a transformative ecosystem.
   - The impact is seen in enhanced SDG achievement, increased internet penetration, a culture of innovation, and empowered consumers.

5. **Proposed Stakeholder Matrix:**
   - A stakeholder matrix is proposed to identify and categorize the various entities and individuals involved in ICT4D initiatives. It includes primary, secondary, and tertiary stakeholders, each with distinct roles and interests.
   - The matrix helps in mapping and understanding the complex network of stakeholders involved in ICT4D projects.

In conclusion, the document underlines the importance of ICT adoption in achieving the SDGs in Sub-Saharan Africa. It highlights both challenges and opportunities, showcases pathways for sustainable development, and proposes a stakeholder matrix to facilitate collaboration among key actors in the ICT4D ecosystem. The authors advocate for an enabling environment, responsive policies, and inclusive strategies to harness the potential of ICT for the betterment of African communities and the achievement of the SDGs.
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Appendix 1: Compiled 5-year running trend on average for Sub-Sharan Africa

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