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Unlocking growth in the SADC:

Harnessing the potential of non-geostationary satellite orbit systems

September 2025

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Foreword

In an era where digital connectivity propels economic growth and social advancement, the Southern African Development Community (SADC) stands at a critical juncture. With a population exceeding 410 million and contributing nearly a third of Africa's gross domestic product (GDP), the region possesses immense potential that can be unlocked through strategic digital transformation. This meticulously crafted report delves into the transformative impact of extensive and purposeful Internet access, not merely as a technological advancement, but as a fundamental pillar of sustainable development across the SADC.

The community's ambitious 2050 Vision and the Regional Indicative Strategic Plan (2020–2030) envision a future characterized by peace, inclusivity, competitiveness, and industrialization. Digital connectivity serves as the driving force behind these aspirations, a potent enabler that transcends geographical boundaries, fosters innovation, and drives productivity. From enhancing access to financial services, education, and healthcare to empowering micro, small, and medium enterprises (MSMEs) to tap into global markets, the digital economy emerges as a catalyst for inclusive growth.

This report examines the economic advantages of expanded Internet coverage and improved usage, estimating substantial annual economic gains of $16.9 billion for the region. It explores the multifaceted benefits for diverse user groups, presents success stories from member states, and underscores the critical role of Non-Geostationary Satellite Orbit (NGSO) systems in realizing these projected gains. NGSO systems possess the potential to play a pivotal role in reaching the individuals and businesses that are currently not covered by connectivity within the SADC. Additionally, they have the potential to provide coverage to highly remote or geographically challenging terrains at a comparatively lower cost compared to terrestrial technologies such as fibre-to-the-X (FTTx) networks.

For decades, Geostationary Earth Orbit (GEO) satellites have demonstrated its utility in delivering TV signals through direct broadcast to the homes and through distributing TV signals to terrestrial television network providers. NGSO presents similar opportunities for the provision of Internet connectivity.

As we navigate this digital transformation, it is imperative for governments, private sector stakeholders, and development partners to collaborate effectively. They must overcome regulatory obstacles and promote the expansion of broadband networks and their capacity. By working collectively, they can ensure that every individual, irrespective of their geographical location, reaps the benefits of the digital revolution.

We invite you to explore the insights presented within this report, which not only delineate the current landscape but also elucidates the pathways to a digitally empowered SADC.

Ntsibane Ntlatlapa,
Associate Professor
LINK Centre, University of the Witwatersrand

Unlocking growth in the SADC: Harnessing the potential of non-geostationary satellite orbit systems

1 Up to $16.9 billion in economic benefits annually for the Southern African Development Community (SADC) through improved Internet coverage and usage

- Expanding coverage for ***unserved users***
- Broadening Internet usage through increased affordability for ***unconnected users***
- Deepening intensity of usage through improved speeds for ***under-connected users***

$3.0 billion worth of economic benefits from expanding Internet coverage

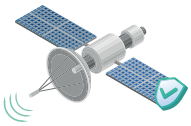
+

$13.9 billion worth of economic benefits from promoting Internet usage

USD 16.9 billion

total economic benefits created for users

2 At least $10.3 billion in infrastructure deployment costs saved by leveraging non-geostationary satellite orbit (NGSO) systems



USD 10.3 billion

at least in cost savings for backhaul infrastructure from deploying NGSO systems to complement terrestrial infrastructure – equivalent to saving 7.6% of total deployment costs of FTTx

3 New growth frontiers and opportunities unlocked

USD 5.4 billion

potential cost savings from enabling the use of Internet of Things (IoT) devices for improved vehicle and cargo tracking and real-time monitoring supported by levers to drive adoption

USD 1.2 billion

saved by mitigating the impact of natural disasters through deploying a more expansive network of early warning systems and real-time tracking of natural disasters

USD 180 million

in potential new economic activity from deployment of IoT-enabled environmental monitoring services to support oversight of natural resources and green financing initiatives

4 Targeted governmental actions are needed to promote NGSO systems

- Enhance regulatory frameworks for managing satellites regulation and enable competition
- Promote broader digital adoption amongst consumers through expanded device and Internet usage initiatives
- Promote satellite as part of the connectivity ecosystem by modernizing epfd requirements
- Foster digital literacy and inclusive policies to encourage widespread digital adoption and engagement

Executive Summary

Broad and reliable digital connectivity is crucial to support the flow of knowledge, goods and services across borders, unlocking opportunities for businesses and workers, fostering innovation, and increasing productivity to drive the growth of the Southern African Development Community (SADC).

Our study estimates that progress toward improved Internet coverage and usage is expected to unlock $16.9 billion worth of annual economic benefits for the SADC region.[1] These benefits can be achieved by promoting Internet coverage and usage through three key user groups: *unserved users* (i.e., those who live in areas not covered by any type of Internet network); *unconnected users* (i.e., those who live in coverage areas but do not use the Internet), and; *under-connected users* (i.e., those who are connected and use the Internet but in a constrained manner).

However, this can only be achieved by tackling specific infrastructural challenges that constrain the SADC from reaping the benefits of improved connectivity. Today, while the global 4G mobile network population coverage rate stands at an average of 90% globally, the average among SADC economies remained at around 77% as of 2023.[2] SADC economies have an average mobile network geographical coverage rate of around 75% in 2024, translating to around a quarter of the region that still remains outside of network coverage.[3] Significant investment in infrastructure is needed to drive Internet coverage and usage in the region, and various challenges, including low population density in certain areas and terrain-based constraints, must first be addressed.

Technological advancements in Non-Geostationary Satellite Orbit (NGSO) systems offer a promising solution for expanding electronic communications networks. NGSO systems can reduce costs associated with deploying new fixed broadband infrastructure, especially in areas where traditional terrestrial solutions are expensive or impractical. In highly remote or geographically challenging terrains, NGSO systems[4] may be the only technically and commercially feasible option to provide wide coverage with minimal ground infrastructure. NGSO systems could serve as a complement to terrestrial fiber-optic networks to bridge the connectivity gap and achieve broader coverage. NGSO systems can also help to reduce the cost of deployment of terrestrial networks - **our analysis suggests that using NGSO systems for backhaul could save at least $10.3 billion in terrestrial infrastructure costs for mobile network operators (MNOs).** This represents approximately 7.6% of total deployment costs (inclusive of backbone, backhaul and last-mile costs) compared to reaching these same remote customers using fiber backhaul in fiber-to-the-X (FTTx) networks.[5]

The deployment of NGSO satellite-enabled connectivity could also create new growth opportunities for the SADC. NGSO systems enable the use of Internet of Things (IoT) devices for improved vehicle and cargo tracking and real-time monitoring across entire road journeys, and, depending on adoption rate, could translate into road logistics savings of an estimated $5.4 billion by 2030.[6] Additionally, connectivity enabled by NGSO systems would allow early warning systems

[1] Internet coverage is defined as the share of the population geographically within range of a network. Internet usage is defined as the share of the population that actually goes online. Internet access combines both coverage and usage, reflecting the proportion of people who both have network connectivity and choose to use it. In this report, Internet access always refers to efforts to improve both coverage and usage among the population.

[2] Based on data from the International Telecommunication Union (n.d.), DataHub, "Population coverage, by mobile network technology." Available at: https://datahub.itu.int/data/?i=100095&s=19306Southern

[3] Southern African Development Community (SADC), ICT Observatory. Available at: https://ictobservatory.sadc.int/?year_filter=2024

[4] NGSO satellites, or satellites that move in low-earth orbits (LEO), differ from conventional satellites used today – which mostly consists of geostationary (GEO) satellites. While GEO satellites orbit further away from earth and provide connectivity by remaining fixed at a geographical point, NGSO satellites orbit closer to earth and offer opportunities to significantly reduce latency and data transmission times, thereby providing reliable service that can even match speeds provided by fiber optic connections. See Box 5 of this report for more details.

[5] Fiber-to-the-X encompasses a wide range of fiber optic infrastructure designs, where "X" represents various endpoints including homes, buildings, and other termination points close to the user.

[6] The benefits of the three new growth frontiers can only be unlocked with regulatory support, and would require relevant regulatory changes to enable these land-based mobility applications, as well as policies that drive technology adoption.

to be established, mitigating the impact of natural disasters and facilitating an estimated $1.21 billion worth of cost savings by preventing infrastructure damage. NGSO systems can also foster new economic opportunities by enabling environmental monitoring services that support better oversight of natural resources and green finance initiatives, creating an estimated $180 million in economic activity through IoT-enabled services.

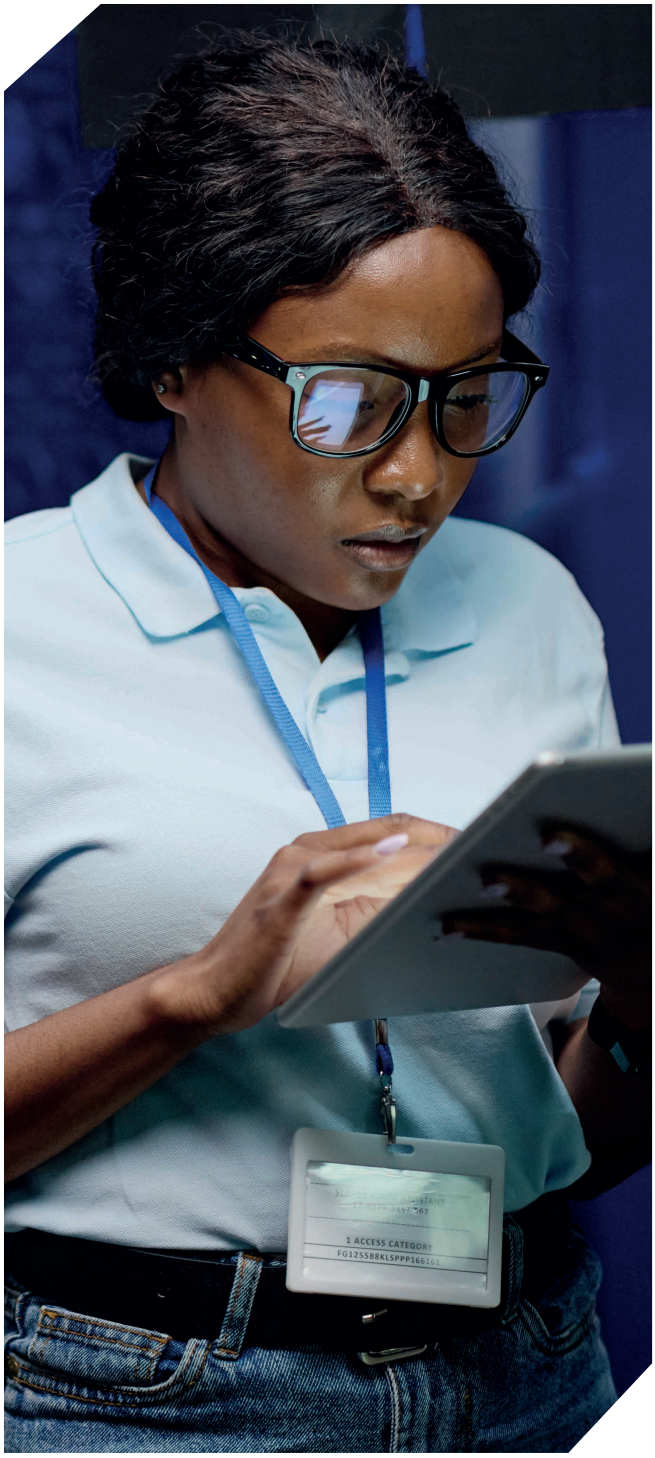
To harness the benefits of increased Internet coverage and usage, targeted governmental actions to promote NGSO systems are needed. The region needs to include NGSOs in its connectivity mix and reduce barriers to their deployment. These actions must be supported by strong regional partnerships as well as private sector involvement that can promote the development of NGSO constellation solutions. Importantly, efforts to improve coverage must also be complemented by strategies to address other Internet usage barriers, such as device availability, affordability, and digital literacy. Specifically, this study proposes the following key actions:

Enhance regulatory frameworks for managing satellite regulation and enable competition. To align with fast-paced technological trends, SADC governments could consider promoting and expediting harmonized licensing frameworks within the region to provide regulatory certainty and reduce administrative barriers for satellite operators.

Promote satellite as part of the connectivity ecosystem by modernizing epfd requirements. Current epfd (Equivalent Power Flux Density) rules, developed and adopted when satellites were far less advanced, are now dated. A global push to adjust these limits based on robust assessments would enable satellite-based networks to become more easily scalable and provide the region another technology solution to grow connectivity.

Promote broader digital adoption amongst consumers through expanded device and Internet usage initiatives. Promoting device availability and affordability through targeted import policies or programs to support adoption of Internet-enabled devices can unlock latent consumer demand.

Foster digital literacy and inclusive policies to encourage widespread digital adoption and engagement. Driving digital literacy through skilling programs can support SADC populations to unlock the productivity benefits created by digital technologies.



Chapter 1: Broad and meaningful Internet access is key to sustainable development in the SADC

Connectivity underpins the SADC's long-term growth vision

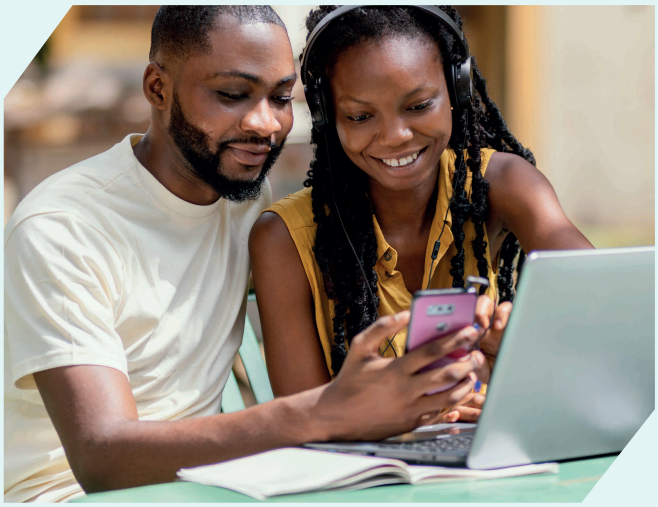
The SADC's population of more than 410 million contributes nearly a third of Africa's GDP.[7] To uplift the region's economy, the community's 2050 Vision sets out the region's aspirations for a peaceful, inclusive, competitive, middle- to high-income industrialized future, and the Regional Indicative Strategic Plan (2020 to 2030) outlines what must happen to meet this goal.[8] Digital connectivity and the ability to leverage the digital economy are indispensable to the success of these plans. Digital connectivity supports the flow of knowledge and data across borders, unlocking business opportunities, fostering innovation, and increasing productivity.

At the individual level, digital connectivity is critical for populations in the SADC to access digital banking and financial services, online public services, virtual education and training, as well as digital healthcare services. Connectivity also allows more micro, small, and medium enterprises (MSMEs) to access tools such as email and online banking, and could support them to access external markets through online commerce platforms, creating new revenue opportunities. The impact of increased digital connectivity demonstrates this – a 10% rise in mobile broadband connectivity in Africa could boost GDP by 2.5%.[9]

Improved Internet coverage and usage could create up to $16.9 billion worth of economic benefits per year for SADC countries

One important aspect of digital connectivity is ensuring universal and meaningful Internet access, which the ITU defines as having all individuals and businesses be able to access affordable connectivity that is good enough for an enriching and productive digital experience.[10] In the SADC region, Internet access is primarily through mobile devices (rather than fixed broadband). Across Africa, in 2023, there were 48 active mobile-broadband subscriptions per 100 people as compared to just one fixed-broadband subscription.[11] This report, therefore, explores how mobile broadband connectivity can be expanded to improve Internet coverage and usage by using NGSO systems as part of connectivity ecosystem to unlock growth opportunities for the region.

In particular, coverage is a significant issue in the SADC. While the global average 4G mobile network population coverage rate stands at around 90%, the average among SADC economies is only at around 77% as of 2023. The average geographical coverage rate is around 75% as of 2024, so that a significant part of the region remains outside of network coverage.[12]



[7] The SADC comprises 16 Member States, and they are: Angola, Botswana, Comoros, Democratic Republic of Congo, Kingdom of Eswatini, Kingdom of Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, United Republic of Tanzania, Zambia, and Zimbabwe. Sources include: United Nations, Department of Economic and Social Affairs, Population Division. (2024). *World Population Prospects 2024.* https://population.un.org/wpp/; and World Bank. (2025). *GDP (current $)* [Data set]. World Development Indicators. https://data.worldbank.org/indicator/NY.GDP.MKTP.CD

[8] OECD. (2023). *Sustainable investment policy perspectives in the Southern African Development Community*. OECD Publishing. https://doi.org/10.1787/02c9ef1d-en

[9] Mboob, I. (2023, April 3). Regional digital transformation can help power development in Africa. *World Bank Blogs*. https://blogs.worldbank.org/en/digital-development/regional-digital-transformation-can-help-power-development-africa

[10] As defined by the International Telecommunication Union (ITU)'s (2022) *Achieving universal and meaningful digital connectivity report.* Available at: https://www.itu.int/itu-d/meetings/statistics/wp-content/uploads/sites/8/2022/04/UniversalMeaningfulDigitalConnectivityTargets2030_BackgroundPaper.pdf

[11] ITU (2023). Measuring digital development. ITUPublications. https://www.itu.int/itu-d/reports/statistics/wp-content/uploads/sites/5/2023/11/Measuring-digital-development-Facts-and-figures-2023-E.pdf

[12] Sources include: Based on data from the International Telecommunication Union (n.d.), DataHub, "Population coverage, by mobile network technology." Available at: https://datahub.itu.int/data/?i=100095&s=19306; Southern African Development Community (SADC), *ICT Observatory*. Available at: https://ictobservatory.sadc.int/?year_filter=2024

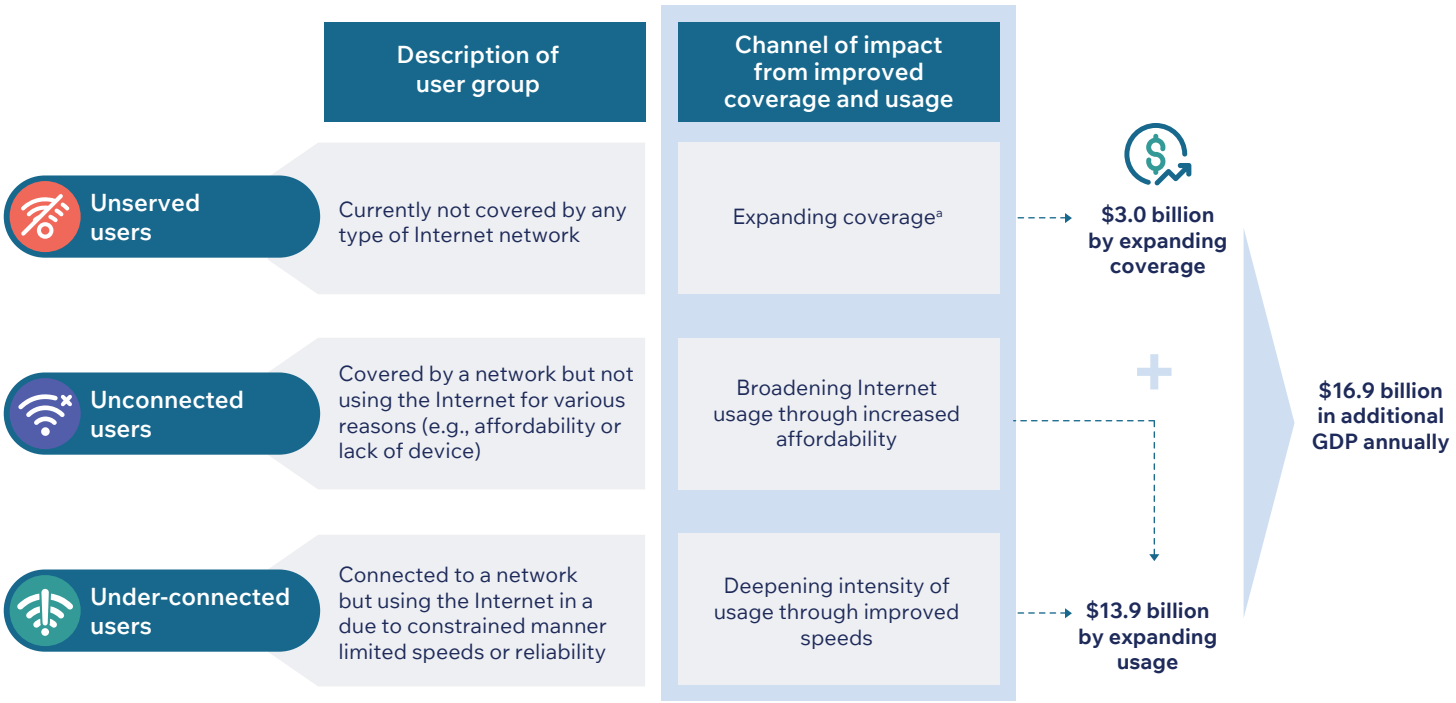
However, providing coverage alone is not sufficient to unlock the benefits of connectivity if users do not (or cannot) actively connect to the Internet due to issues such as costs and slow connections. Despite improvements in infrastructure, actual adoption or usage often lags far behind. Globally, the number of people living within areas with Internet coverage but not using it (i.e., the usage gap) is nine times larger than those who live outside coverage areas (i.e., coverage gap). As of the end of 2023, 39% of the global population (3.1 billion people) lived in areas with mobile broadband coverage, yet they did not use the Internet.[13] Among SADC economies, the share of population accessing the Internet (i.e., those who have coverage and are using it) varies widely, from 20% in Mozambique to 87% in Seychelles, underscoring the urgent need to boost broadband adoption and meaningful usage across the region.

With much more room to broaden coverage and deepen usage within the SADC, significant economic value remains to be unlocked. Still, relatively few studies describe the size of the prize. Against this backdrop, this study aims to estimate the impact of a future where the SADC achieves full Internet coverage for all its population and improved Internet usage across three different user groups – ***unserved***, ***unconnected***, and ***under-connected users.*** For each group, progress towards improved Internet coverage and usage can bring benefits (Exhibit 1). Overall, this progress is expected to unlock $16.9 billion worth of economic benefits for the SADC region annually, equivalent to 2% of the region's 2024 GDP. Box 1 details a breakdown of the benefits attributable to expanding Internet coverage and usage.[14]

Exhibit 1

Improved Internet coverage and usage could create up to $16.9 billion worth of economic benefits per year for SADC countries through 3 channels

How improved coverage and usage can impact SADC countries for three different groups of users and the channels of impact



[a] For the purposes of this analysis, we assume Internet network coverage is expanded to cover the entire SADC population to outline the scale of potential impact.

[13] GSMA. (2024). *The State of Mobile Internet Connectivity Report 2024.* https://www.gsma.com/r/wp-content/uploads/2024/10/The-State-of-Mobile-Internet-Connectivity-Report-2024.pdf
[14] We used mobile broadband as the counterfactual, since that will be the most likely pathway for Internet access without satellite broadband in the SADC context.

Box 1: Approach to estimate the economic benefits of increased broadband coverage and usage

We estimate the economic benefits of increased broadband coverage and usage by measuring the economic uplift attributed to three key user groups outlined in this section – unserved, unconnected, and under-connected populations. To do this, we estimated the potential increase in Internet usage for these three groups and the consequent rise in GDP based on impact estimates from publicly available literature.

Our analysis suggests that this projected GDP growth due to broadband usage from new coverage, increased adoption, and increased usage could generate over $16.9 billion in additional GDP annually across SADC countries, equivalent to 2.0% of the region's estimated GDP in 2024.

Around 18% of this impact, or $3 billion, will come from **expanding Internet coverage** to "unserved" populations and bringing some of these individuals online. This is based on the assumption of expanding Internet coverage to sections of the population who remain outside of basic Internet coverage and adjusting based on rural density, terrain, and future population growth. As a result, we estimate an additional 42.3 million users to be covered by the network.

Another 82% of the impact, or $13.9 billion, will come from increasing usage within existing covered areas through affordability and quality improvements, leading to **increased Internet usage** for "unconnected" and "under-connected" users. This estimate is based on the assumption that if the affordability and quality of broadband Internet increases, the number of users in areas with existing coverage will increase. All users (including those in newly covered areas) will use the Internet more frequently and for more complex services such as digital financial services or job searches, driving an increase in productivity that is reflected in economic contribution gains.[15]

Efforts at promoting Internet coverage and usage will benefit three key user groups

(i) **Expanding coverage for unserved users to access digital services.** *This refers to those living in areas currently not covered by any Internet network.*

Despite advancements in developing connectivity infrastructure, a noticeable share of the SADC population remains outside Internet coverage areas, with an average of 10% still not connected to 3G mobile networks.[16] Expanding broadband coverage to these communities is therefore a critical step for the SADC to bring a larger share of the population online and access digital services, such as healthcare and financial services. **Box 2** shows how increased network coverage can support rural communities to access digital health services.

[15] Deloitte LLP. (2012). T*he impact of mobile telephony on economic growth: A report for the GSM Association* [Report]. https://www.gsma.com/solutions-and-impact/connectivity-for-good/public-policy/wp-content/uploads/2012/11/gsma-deloitte-impact-mobile-telephony-economic-growth.pdf

[16] Based on data from the International Telecommunication Union (n.d.), DataHub, "Population coverage, by mobile network technology." Available at: https://datahub.itu.int/data/?i=100095&s=19306

Box 2: Leveraging white space technology for rural healthcare in Botswana[17]

Botswana's healthcare system has long struggled with significant challenges, such as extended waiting times, patient backlogs, and inconsistent medicine availability — issues that are especially acute in rural areas.[18] To advance healthcare access for the underserved rural populations in Botswana, Project Kgolagano was launched through a partnership between Vista Life Sciences, Microsoft, Botswana Innovation Hub, Global Broadband Solutions, and the Botswana-University of Pennsylvania Partnership—a collaboration involving the Government of Botswana, the University of Botswana, and the University of Pennsylvania (UPenn). This project marked the nation's first deployment of White Space[19] telemedicine, a promising technology that leverages unused TV spectrum to deliver cost-effective, faster, and wider-reaching Internet connectivity to previously unserved areas.

By enabling broadband connectivity via White Space, this initiative directly addresses the historical limitations of rudimentary rural healthcare, primarily caused by a shortage of skilled health professionals and logistical barriers to medical access. Remote patients are now able to leverage this connectivity to access telemedicine, which offers them more immediate access to specialized medical services despite geographical barriers. By linking them with experienced doctors in the urban centers, they get to access diagnosis and management of specialized healthcare needs prevalent in the rural areas, such as maternal health, HIV, cervical cancer, and Tuberculosis. This contributes to bridging the digital divide and improving health outcomes among previously marginalized communities.

(ii) **Broadening Internet usage to unconnected users who face barriers.** *This includes those living in areas covered by a network but not using the Internet due to a lack of devices, limited affordability, or digital illiteracy.*

The lack of affordable broadband remains a key challenge in Southern Africa.[20] The extent of the issue varies across the SADC. South Africans enjoy 1GB of broadband at 1.4% of their gross national income (GNI), while those in the Democratic Republic of Congo (DRC) are estimated to pay more than 20% of their GNI.[21] The high cost of broadband limits growth opportunities for businesses and workers, creating a vicious cycle where the digital divide persists within and across SADC countries. Alongside efforts to make broadband more affordable, promoting smartphone adoption (with only around half (53%) of the population in the SADC using smartphones) and strengthening digital literacy will also bring more unconnected users online.[22]

(iii) **Deepening intensity of Internet usage for under-connected users.** *Those who are connected to a network and using the Internet today in a constrained manner due to low connectivity speeds or a lack of access to reliable Internet.*

For those who are already connected to and using the Internet, there are benefits to be gained from deepening the intensity of usage as broadband services become more affordable and the quality improves. However, limited availability of relevant local content, concerns around safety and security, and more importantly, the lack of reliable and affordable connectivity contribute to underuse.

[17] Sources include: Chavez, A., Littman-Quinn, R., Ndlovu, K., & Kovarik, C. L. (2015). Using TV white space spectrum to practise telemedicine: A promising technology to enhance broadband Internet connectivity within healthcare facilities in rural regions of developing countries. *Journal of Telemedicine and Telecare, 22*(4), 260–263. https://doi.org/10.1177/1357633X15595324; Mokobi, T. (2016, March 4). *Project Kgolagano harnesses telemedicine to plug the gaps in national healthcare service delivery.* LinkedIn. https://www.linkedin.com/pulse/project-kgolagano-harnesses-telemedicine-plug-gaps-national-mokobi; and James, J. (2015, March 31). Botswana receives first white space telemedicine service to reach rural populations. Social Good Moms. https://socialgoodmoms.com/2015/03/31/botswana-receives-first-white-space-telemedicine-service-to-reach-rural-populations/

[18] Sunday Standard Reporter. (2023, April 4). *Botswana's poor healthcare system.* Sunday Standard. https://www.sundaystandard.info/botswanas-poor-healthcare-system/

[19] White Space refers to wasted, unused spectrum that was previously present in TV radiofrequency channels but is now usable to provide broadband Internet access

[20] The Broadband Commission's 2025 Targets recommend that entry-level broadband services should be made affordable in low- and middle-income countries (LMICs) at less than 2% of monthly GNI per capita. See https://broadband.itu.int/advocacy-targets/2-affordability/

[21] Alliance for Affordable Internet. (2021). *Affordability Drivers Index: Democratic Republic of the Congo (2021).* https://adi.a4ai.org/affordability-report/data/?_year=2021&indicator=INDEX&country=COD

[22] GSMA (2024), *The Mobile Economy Sub-Saharan Africa 2024.* Available at: https://event-assets.gsma.com/pdf/GSMA_ME_SSA_2024_Web.pdf

With more affordable and better-quality broadband connectivity, there is potential for these users to unlock growth by going beyond basic tasks and applications to engage in high-value digital activities more frequently. For example, leveraging generative AI applications or accessing real-time video conferencing would require high connection speed and fidelity. More intensive usage enables businesses to transition from basic Internet use to full digital transformation. Instead of simply maintaining a social media presence or operating a basic e-commerce store, firms can adopt cloud-based enterprise software, use data analytics and AI to inform decisions, and optimize supply chains.

Improved broadband access provides economic opportunities for different communities

Improved broadband access not only creates economic growth across SADC but also fosters new opportunities for different groups. Past studies have consistently shown that broadband access positively impacts educational outcomes, healthcare access, and national economic productivity.[23] **Box 3** provides an example of how improving broadband coverage and usage can support greater digital inclusion and improve outcomes for women in South Africa.

For businesses, Internet access enhances the productivity of firms and their employees. It lowers search and information costs for consumers and producers, enables new and improved transactions, and stimulates more trade and competition.[24] It underpins the growth of the digital economy, encouraging innovation, improving firm competitiveness, and deepening integration into global markets.[25] **Box 4** provides an example of how improving Internet usage can benefit key industries in SADC countries, including mining communities.

Box 3: Increasing economic opportunities for women through enhanced connectivity in South Africa[26]

In South Africa, women continue to face greater barriers to economic opportunities, as reflected in higher unemployment rates. In 2024, the unemployment rate for women stood at approximately 35% compared to 31% for men.[27] This economic disparity may be attributed mainly to the digital divide faced by women in South Africa, where only 33.2% of women have Internet access at work compared to 66.8% of men.[28] The uneven access to the Internet limits women's ability to access job opportunities, upskill, and participate meaningfully in the economy.

The "Maru a Mokopane" project, launched by Ivanplats – a South African subsidiary of mining company Ivanhoe Mines – exemplifies the potential of expanded Internet connectivity for women. The program provides free Wi-Fi access through 20 hotspots in the host communities, leading to women making up 42% of the 30,400 registered users in 2024. Community surveys and interviews conducted by Ivanplats with beneficiaries shows how this project has created tangible economic benefits for the community.[29] In particular, access to online platforms has enabled women to search and apply for employment opportunities through job portals, to expand their businesses through digital marketing and online networking, and to pursue further education and certifications through online educational platforms, all of which opens up new pathways for economic advancement.

[23] Sources include: Czernich et al. (2011), Broadband Infrastructure and Economic Growth. https://onlinelibrary.wiley.com/doi/10.1111/j.1468-0297.2011.02420.x; Ford and Koutsky (2005), Broadband and Economic Development: A Municipal Case Study from Florida. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=925973; Koutroumpis (2019), The economic impact of broadband: Evidence from OECD countries. https://ideas.repec.org/a/eee/tefoso/v148y2019ics004016251930112x.html

[24] GSMA. (2024). *The State of Mobile Internet Connectivity Report 2024.* https://www.gsma.com/r/wp-content/uploads/2024/10/The-State-of-Mobile-Internet-Connectivity-Report-2024.pdf

[25] World Bank. (2019). *Connecting Africa through broadband: A strategy for doubling connectivity by 2021 and reaching universal access by 2030.* https://documents1.worldbank.org/curated/en/131521594177485720/pdf/Connecting-Africa-Through-Broadband-A-Strategy-for-Doubling-Connectivity-by-2021-and-Reaching-Universal-Access-by-2030.pdf

[26] Sources include: Mining Review Africa. (2019, October 10). *Ivanplats provides unlimited opportunity to 150,000 people.* https://www.miningreview.com/top-stories/ivanplats-unlimited-opportunity/; Cooper, T., Ramdoo, I., & Tekinbas, E. (2024, November). *Leveraging digital infrastructure for mining community resilience.* International Institute for Sustainable Development. https://www.iisd.org/system/files/2024-11/leveraging-digital-infrastructure-mining.pdf; and Ivanhoe Mines. (2017, December). *Platreef community commitment scorecard.* https://www.ivanhoemines.com/site/assets/files/1510/platreef_scorecard_december_2017.pdf

[27] Sources include: Statista. (n.d.). *Unemployment rate by gender in South Africa.* https://www.statista.com/statistics/1129142/unemployment-rate-by-gender-in-south-africa/; and Statistics South Africa. (2023, August 9). *Equality in the job market still eludes women in SA.* https://www.statssa.gov.za/?p=16533

[28] Shiferaw, Y., A., (2024). A spatial analysis of the digital gender gap in South Africa: Are there any fundamental differences? Technological Forecasting and Social Change, 204. https://www.sciencedirect.com/science/article/pii/S0040162524002397#

[29] Sources include: Ivanhoe Mines. (2017, December). *Platreef community commitment scorecard.* https://www.ivanhoemines.com/site/assets/files/1510/platreef_scorecard_december_2017.pdf; and Mining Review Africa. (2019, October 10). *Ivanplats provides unlimited opportunity to 150,000 people.* https://www.miningreview.com/top-stories/ivanplats-unlimited-opportunity/

Box 4: Connecting mining communities in the Democratic Republic of the Congo (DRC) to the Internet[30]

The DRC is widely recognized for its abundant natural resources; an estimated 500,000 to 2 million people rely on mining activities for employment.[31] Miners often work long hours in harsh physical conditions and face low wages that impact their ability to purchase necessities. In a country where the Internet penetration rate is only 30%, these workers often lack access to critical information, including health and safety updates.

As part of its efforts to improve workplace engagement, the Kamoto Copper Company worked with Vodacom Business and Standard Bank to roll out an initiative to improve workers' digital access. Under the initiative, the Umoja App – a digital workplace tool that includes payroll details, online training modules, security updates relevant to the mining environment, and employee feedback channels – was developed and rolled out to employees. To access the app, the initiative also provides all full-time employees with smartphones, data bundles, and solar chargers. This allows workers to use the device and data at home and share them with others in their household. This provides families with access to online education, health information, markets, and the ability to transact financially, and brings broader gains to the mining community.

Infrastructural challenges must be addressed to reap the benefits of digital connectivity

Despite the potential benefits of improved broadband coverage and usage, there are significant challenges in achieving this today. One of the main obstacles in improving broadband coverage in the SADC region is inadequate investment in infrastructure due to the lack of commercial viability. A combination of low population density that hinders scale, low resident incomes that subdue demand, and terrain that obstructs wireless signals, observed in countries such as the DRC and Madagascar, all contribute to creating this challenging environment.[32] For example, most of the "unserved" population lives in rural and hard-to-reach areas where deploying infrastructure, such as fiber optic cables or constructing numerous cell towers, remains challenging and economically unviable.

Landlocked countries—Botswana, Eswatini, Lesotho, Malawi, Zambia, and Zimbabwe—also face significant limitations as they have even fewer infrastructure options, given constraints in setting up access points to submarine sea cables. Small island states such as Comoros and Madagascar face geographic isolation, limited economies of scale, and disproportionate costs of submarine cable deployment and maintenance. Altogether, these factors create limited commercial interest in infrastructure investments and consequently drive up the price of broadband in the SADC region. It is therefore critical to find solutions to address these infrastructural challenges to support the SADC's move towards reaping the benefits of universal and meaningful Internet access.

[30] Sources include: Cooper, T., Ramdoo, I., & Tekinbas, E. (2024, November). *Leveraging digital infrastructure for mining community resilience.* International Institute for Sustainable Development. https://www.iisd.org/system/files/2024-11/leveraging-digital-infrastructure-mining.pdf; and ITWeb Africa. (2022, December 9). *Umoja App for miners, a first-of-its-kind project in DRC.* https://itweb.africa/content/RgeVDqPRXj67KJN3

[31] Kamara, J., & Bumba, S. (2025, February 10). *Protecting miners' health in Democratic Republic of Congo.* Think Global Health. https://www.thinkglobalhealth.org/article/protecting-miners-health-democratic-republic-congo

[32] Mayer, R., Figueredo, K., Jensen, M., Kelly, T., Green, R., & Barra, A. F. (2009). *Costing the needs for spending on ICT infrastructure in Africa* (Background Paper 3, Phase II). World Bank. https://www.infrastructureafrica.org/system/files/BP3_ICT_spdg_summary_2.pdf

Chapter 2: NGSO satellite systems could support alternative pathways to increased connectivity

NGSO satellite systems could play a key role in enabling increased connectivity

Recent advancements in satellite technologies are positioning NGSO systems to become a viable part of the SADC's strategy in expanding Internet access and connectivity. In particular, there is potential for NGSO systems to partner with MNOs to expand connectivity, leveraging satellite systems as a backhaul solution. Box 5 provides an overview of the development of satellite technologies and the emergence of low-Earth orbit (LEO) satellites.

New NGSO systems offer extensive geographical coverage with minimal ground-based infrastructure.[33] In particular, the emergence of high-throughput satellite (HTS) and LEO constellations has made satellite connectivity an increasingly attractive solution to developing connectivity infrastructure in hard-to-reach areas.[34] These NGSO constellations can establish broadband coverage in regions while using a significantly smaller ground infrastructure footprint, primarily requiring user terminals and some gateway stations.[35] In highly remote or geographically challenging terrains, NGSO systems could be the only technically and financially feasible option for delivering broadband coverage, as traditional infrastructure like terrestrial fiber-optic networks or wireless networks often cannot reach these inland locations. LEO satellite solutions provide a unique capability to bridge these connectivity gaps where terrestrial options are impractical.

While high operational costs deterred usage in the past, new models such as managed network-as-a-service offerings and the increased supply of HTS networks are making satellite backhaul and connectivity more economical. This could potentially contribute to bringing down the cost of connectivity as a whole. The capacity of NGSO systems to achieve broad coverage with reduced ground infrastructure significantly lowers capital expenditure (CAPEX) associated with civil engineering works, such as trenching and cable laying, and the construction of physical network facilities. These costs can constitute up to 80% of the total cost of ownership (TCO) for fiber deployment. Notably, the cost per home of deploying Fiber-to-the-Home (FTTH) increases exponentially in sparsely populated areas.[36] Compared to fiber deployment LEO satellite deployment costs to end-users are much less sensitive to population density. This implies that for low-density regions where the cost per home passed with fiber is prohibitively high, NGSO-based solutions can offer a more economically attractive alternative.

[33] African Telecommunications Union. (2024, July). *Evaluating the impact of satellite communication on achieving sustainable development goals in Africa: Opportunities, barriers, and future pathways* (Version 3). https://atuuat.africa/wp-content/uploads/2024/07/V3-Empowering-Africa-SDGs-and-Satellite-Connectivity.pdf

[34] Sources include: Wyles, L. (2024, April 26). *Satellite is an increasingly cost-effective means for MNOs to reach remote mobile customers.* Analysys Mason. https://www.analysysmason.com/research/content/articles/remote-satellite-viability-nsi039/; and Preciado, E. (2022, January 11). Using CBH over satellite to bridge the digital divide in Mexico. Gilat Satellite Networks. https://www.gilat.com/using-cbh-over-satellite-to-bridge-the-digital-divide-in-mexico/

[35] Bamford, R., Hutchinson, G., & Macon-Cooney, B. (2021, March 2). *The progressive case for universal Internet access: How to close the digital divide by 2030.* Tony Blair Institute for Global Change. https://assets.ctfassets.net/75ila1cntaeh/5EwsYtqgYOXh8SjCkcKNGj/653ea680f47be555757553d652885f7e/The-Progressive-Case-for-Universal-Internet-Access-How-to-Close-the-Digital-Divide-by-2030.pdf

[36] Bokun, S., Ohlsson, A., Daly, A., Palerm, L., Jones, O., Kiritharan, N., & Wyles, L. (2025, February 24). *LEO satellite broadband: A cost-effective option for rural areas of Europe.* Analysys Mason. https://marketing.analysysmason.com/acton/attachment/3183/f-95d4dead-60af-4ba3-842b-e397c622473b/1/-/-/-/-/analysys_mason_leo_satellite_broadband_europe_feb2025.pdf

Box 5: Overview of satellite development and emergence of LEO satellites and NGSOs

Satellites have been used since the early 1960s to support global communications and connectivity. Most satellite networks rely on either geostationary orbit (GEO) satellites (which orbit at 36,000 kilometres above the Earth's equator) or LEO satellites (which orbit between 200 and 2,000 kilometres).[37]

GEO satellites have a large coverage area and are fixed above a single point so that an antenna on Earth can be pointed permanently at the known position in the sky and infrastructure costs are kept low, making them ideal for broadcasting, weather forecasting and satellite radio. However, due to their distance away from earth, GEO satellites have long signal travel times (around 600ms) and typically require higher transmission power and larger use terminals, limiting their effectiveness in meeting the needs of time-sensitive applications that involve real-time data transmission and high-speed processing, or those requiring the smallest or lowest power consumption user devices such as IoT.[38]

In contrast, LEO satellites have the potential to provide true global coverage with low latency and can support smaller use terminals. LEO satellites can support much faster connectivity compared to GEO satellites, but costs for satellite deployment are typically significantly higher. LEO satellites have a small field of view and can only provide coverage to a fraction of the surface of the Earth at a time. Low earth orbits are also non-geostationary, meaning they do not remain in a fixed position in the sky. Providing continuous coverage to a particular point on the Earth therefore requires a network of multiple LEO satellites, as well as more sophisticated user terminals that can track and maintain connectivity with these fast-moving satellites.

With demand for resilient global, high-speed connectivity increasing, and recent advancements in satellite technologies, the demand for LEO deployment has been growing while costs for deploying such infrastructure have been falling. New second and third generation LEO satellites are expected to have larger satellite antennas and inter-satellite links that can provide signals that are significantly faster, have reduced latency, can provide enhanced resiliency, and require fewer ground stations compared to current satellites. Through these technological developments, LEO satellites have the potential to support the growth of more communications applications.[39]

NGSO systems could save terrestrial deployment costs for universal coverage by at least $10.3 billion

By serving as a complement to terrestrial fiber-optic networks to bridge the connectivity gap,[40] NGSO systems can reduce costs associated with deploying new fixed broadband infrastructure, especially in areas where traditional terrestrial solutions are expensive or impractical. This could reduce terrestrial deployment costs for universal coverage by more than $10 billion.

In broadband deployment, the primary cost driver is the distance from the core network Points of Presence (PoPs), with last-mile access representing the most significant share of the average cost per home. Industry experts often reference a 1:3:10 investment ratio, where middle-mile infrastructure is three times more expensive than the backbone infrastructure on a per-user basis, and the last-mile can cost up to ten times more than the backbone.[41]

There is potential for NGSO systems to partner with MNOs to expand connectivity and capacity, leveraging the strengths of satellite connectivity to provide backhaul solutions for terrestrial networks. Harnessing NGSOs for backhaul could significantly lower the cost of MNOs expanding broadband coverage across the SADC region – potentially saving at least $10.3 billion when compared to the cost of ordinarily reaching those same remote

[37] Outlined by the ITU (2023), "WRS-22: Regulation of satellites in Earth's orbit." Available at: https://www.itu.int/hub/2023/01/satellite-regulation-leo-geo-wrs/

[38] Tony Blair Institute for Global Change (2024), *Bridging the Digital Divide in Africa: The Promising Role of LEO Satellites.* Available at: https://assets.ctfassets.net/75ila1cntaeh/yileuHTXuHmJpJaooZBOI/18651f2afd1252931b36c16a7ffc60a3/6C99uWYjbk2WrS58kxBHpF--152217122024

[39] BCG (2024), "Regulating the Next Generation of Satellites". Available at: https://www.bcg.com/publications/2024/regulating-the-next-generation-of-satellites

[40] Barasa, H., Ruiters, E., & Humphrey, T. (2024, December). *Bridging the digital divide in Africa: The promising role of LEO satellites.* Tony Blair Institute for Global Change. https://assets.ctfassets.net/75ila1cntaeh/yileuHTXuHmJpJaooZBOI/18651f2afd1252931b36c16a7ffc60a3/6C99uWYjbk2WrS58kxBHpF--152217122024

[41] Washington State Utilities and Transportation Commission. (2024, November 7). *Broadband connectivity analysis: Technical analysis for Washington State* [PDF]. https://app.leg.wa.gov/ReportsToTheLegislature/home/GetPDF?fileName=Attachment%203%20-%20Broadband%20Connectivity%20Analysis_17245543-dc9a-4625-94d1-9241b8eb95eb.pdf

customers using fiber backhaul for FTTx networks[42] – equivalent to savings of 7.6% on average and much higher for serving customers in even harsher terrain.[43] Assuming a build-out period of 15 years,[44] this amounts to $680 million annually, equivalent to 0.1% of aggregate GDP), with benefits potentially accruing more quickly for MNOs in a case of even faster deployment, including but not limited to shorter payback periods for capital expenditure and greater cash flow and return on investment.[45]

Beyond access and connectivity, NGSO systems can unlock new growth frontiers

More than bringing economy-wide gains from higher broadband coverage and usage, NGSO systems can also support new growth frontiers for the SADC region.[46]

- **SADC countries can save up to $5.4 billion in logistics costs and drive intra-regional trade growth through IoT deployment powered by NGSOs**

  Trade is a significant engine of growth for the Southern African region, with countries like Lesotho and Mozambique recording trade-to-GDP ratios that exceed 100%. However, intra-regional trade (i.e., trade between SADC countries) remains relatively muted, accounting for only 23% of total trade by countries in the region.[47] A key barrier to more intra-regional trade is the high logistics costs that undermine competitiveness and constrain growth. Globally, African countries incur the highest logistics costs as a percentage of GDP—nearly double that of advanced economies.[48] In the SADC, these elevated costs stem from inefficient infrastructure, poor route visibility, and limited connectivity across the supply chain.[49]

  Internet-of-Things (IoT) technologies provide a potential solution to this. IoT systems enable businesses to monitor their goods throughout inland transport routes, enabling firms to optimize fleet and asset management as well as track cargo in real-time. Studies show that real-time asset tracking in road logistics can reduce costs by 5% to 30%, primarily by reducing delays, improving coordination, and preventing cargo losses.[50] However, the deployment of IoT solutions is largely dependent on reliable Internet connectivity - something that is still lacking across large parts of the SADC region. Road freight often traverses vast rural or remote areas where terrestrial networks are underdeveloped or entirely absent.

  NGSO constellations can bridge this gap by providing continuous coverage across hard-to-reach areas. With improved connectivity, real-time monitoring becomes feasible across entire road journeys—not just in urban hubs. For SADC economies, this enhanced visibility could translate into road logistics savings of $5.4 billion in 2030 – savings that that can be instead channeled into scaling business operations, increasing productivity, and driving growth.[51] More importantly, the reduction of trade barriers and efficiency gains could potentially stimulate intra-regional trade. Past studies suggest that a 10% drop in transport costs for countries in Sub-Saharan Africa could increase both intra-regional and international trade by 25% and a one-day reduction in inland travel times could boost exports by 7% for Sub-Saharan Africa.[52]

[42] Fiber-to-the-X encompasses a wide range of fiber optic infrastructure designs, where "X" represents various endpoints including homes, buildings, and other termination points close to the user.
[43] For more details, please refer to Box A2 in the Appendix of this report.
[44] Others such as Oughton (2022) have used 10-year assessment periods, but this study uses a more conservative duration of 15 years to account for both consumer affordability and commercial feasibility considerations.
[45] As an optimistic case, if the last-mile is included, potential cost savings could reach $106.9 billion ($7.1 billion annually over 15 years, equivalent to 0.9% of aggregate GDP.
[46] The benefits of the three new growth frontiers can only be unlocked with regulatory support, and would require relevant regulator changes to enable these land-based mobility applications, as well as policies that drive technology adoption.
[47] World Bank. (2025). *World Development Indicators.* https://databank.worldbank.org/source/world-development-indicators;
[48] United Nations Conference on Trade and Development. (2015). *Review of maritime transport 2015* (UNCTAD/RMT/2015). United Nations. https://unctad.org/system/files/official-document/rmt2015_en.pdf
[49] Lowitt, S. (2017, December). *Cross-cutting logistics issues undermining regional integration across SADC.* Trade & Industrial Policy Strategies (TIPS). https://www.tips.org.za/research-archive/item/download/1473_91d4526dad0f252ee8ee21cd10a60705
[50] Macaulay, J., Buckalew, L., & Chung, G. (2015). Internet of Things in logistics: A collaborative report by DHL and Cisco on implications and use cases for the logistics industry. DHL Trend Research & Cisco Consulting Services. https://www.dhl.com/discover/content/dam/dhl/downloads/interim/full/dhl-trend-report-Internet-of-things.pdf
[51] For more details, please refer to Box A3 in the Appendix of this report.
[52] Sources include: Donaldson, D., Jinhage, A., & Verhoogen, E. (2017, March). *Beyond borders: Making transport work for African trade* (IGC Growth Brief Series 009). International Growth Centre. https://www.theigc.org/sites/default/files/2017/03/TransportGrowthBrief_FINAL_WEB.pdf; and Teravaninthorn, S., & Raballand, G. (2008). *Transport prices and costs in Africa: A review of the main international corridors.* World Bank.

- **Improving disaster management and response can mitigate $1.2 billion in infrastructure damage**

  The SADC region is one of the most vulnerable regions to the economic and human toll of climate-induced disasters.[53] Between 1979 and 2021, weather-related disasters across the region caused over $15 billion in damages, claimed 160,000 lives, and impacted more than 186.6 million people.[54] This has also taken a toll on economic development, reducing the GDP of affected countries by an estimated 0.4% to 0.7% on average since 1990.[55] In 2019, one of the most devastating tropical cyclones in history—Cyclone Idai—caused over $3 billion in damages across Madagascar, Malawi, Mozambique, and Zimbabwe.[56]

  As climate change accelerates, the frequency and severity of natural disasters in SADC are expected to intensify. Projections suggest that the annual cost of natural disasters in Africa, including the SADC region, could exceed $30 billion by 2030.[57] Improving disaster preparedness and response mechanisms is particularly critical for the regional and NGSO systems, alongside GEO satellites, can play a pivotal role in enabling such improvements (see Box 6).

According to the World Meteorological Organization, timely warnings can reduce disaster-related losses by 20%, prevent $13 billion in asset losses annually, and generate well-being gains equivalent to a $22 billion increase in global income.[58] This study estimates that implementing a more responsive and broader communications network could mitigate losses worth up to USD$1.21 billion of infrastructure damage brought about by natural disasters.[59]

Box 6: How NGSO and GEO satellites offer different capabilities in managing disasters

NGSO and GEO satellites offer complementary strengths in disaster management. NGSO satellites, with their low-earth and medium-earth orbits, provide frequent revisits and high-resolution imagery, enabling rapid detection and monitoring of evolving disasters like wildfires, flash floods, and earthquakes. Their low latency also ensures fast communication, allowing quicker emergency responses. In contrast, GEO satellites, offer continuous coverage of large areas, making them ideal for tracking slow-moving disasters like cyclones and monitoring weather patterns over extended periods. They provide valuable long-term forecasts which assist in mitigating the impact of large-scale disasters. Together, these satellites enhance both immediate disaster detection and sustained monitoring, significantly improving response times and disaster resilience.

[53] Sources include: Bari, M., & Dessus, S. (2022, November). *Adapting to natural disasters in Africa: What's in it for the private sector?* International Finance Corporation, World Bank Group. https://www.developmentaid.org/api/frontend/cms/file/2022/11/Working-Paper-Adapting-to-Natural-Disasters-in-Africa-1.pdf; and Bündnis Entwicklung Hilft & Institute for International Law of Peace and Armed Conflict (IFHV). (2023). *WorldRiskReport 2023: Focus – Diversity.* Berlin: Bündnis Entwicklung Hilft. https://weltrisikobericht.de/wp-content/uploads/2024/01/WorldRiskReport_2023_english_online.pdf

[54] Centre for Research on the Epidemiology of Disasters (CRED). (2025). EM-DAT: *The International Disaster Database.* Université catholique de Louvain. Retrieved April 30, 2025, from https://www.emdat.be/

[55] Bari, M., & Dessus, S. (2022, November). *Adapting to natural disasters in Africa: What's in it for the private sector?* International Finance Corporation, World Bank Group. https://www.developmentaid.org/api/frontend/cms/file/2022/11/Working-Paper-Adapting-to-Natural-Disasters-in-Africa-1.pdf

[56] Nhundu, K., Sibanda, M., & Chaminuka, P. (2021). Economic losses from Cyclones Idai and Kenneth and floods in Southern Africa: Implications on Sustainable Development Goals. In *Cyclones in Southern Africa* (pp. 289–303). Springer. https://doi.org/10.1007/978-3-030-74303-1_19

[57] Sources include: CARE Climate Change. (2022, November 3). *Climate loss and damage in Africa: Massive costs on the horizon.* https://careclimatechange.org/climate-loss-and-damage-in-africa-massive-costs-on-the-horizon/; and Markandya, A., & González-Eguino, M. (2019). Integrated assessment for identifying climate finance needs for loss and damage: A critical review. In R. Mechler, L. M. Bouwer, T. Schinko, S. Surminski, & J. Linnerooth-Bayer (Eds.), *Loss and damage from climate change: Concepts, methods and policy options* (pp. 343–362). Springer. https://link.springer.com/chapter/10.1007/978-3-319-72026-5_14

[58] Liu, E., Kull, D., & Chaponda, M. (2024, November 5). The triple dividends of early warning systems and climate services. World Meteorological Organization. https://wmo.int/media/news/triple-dividends-of-early-warning-systems-and-climate-services

[59] For more details, please refer to Box A4 in the Appendix of this report.

- **More than $180 million in additional economic activity can be created through environmental monitoring services**

  The SADC region is rich in natural capital, from dense forests and arable land to extensive coastlines and marine ecosystems.[60] Over 41% of the region's landmass is covered by forests, which act as carbon sinks and provide critical resources for local communities. Recognizing the value of these assets, several SADC countries are taking active steps to unlock finance for nature-based solutions. Seychelles, for instance, was the first country in the world to launch a sovereign blue bond, supporting marine conservation and sustainable fisheries.

  However, unlocking the full economic value of natural capital depends on the ability to measure, verify, and report on environmental outcomes—something that remains a major challenge across most SADC economies. Markets for carbon credits and blue bonds rely on robust environmental monitoring systems, but many critical ecosystems lie beyond the reach of terrestrial connectivity. This limits the region's ability to deploy real-time tracking, detect environmental crimes, and provide the data integrity needed to support large-scale investments.

  NGSO systems address this barrier by delivering continuous connectivity across remote landscapes. With this coverage, governments, conservation groups, and businesses can implement advanced monitoring tools such as IoT sensors and satellite-linked remote sensing platforms. NGSO systems can unlock new economic activity by paving the way to environmental monitoring across the SADC region. By supporting the deployment of IoT-enabled environmental monitoring technologies in hard-to-reach areas, NGSO systems are expected to create over $180 million in additional economic activity through the growth of the environmental monitoring services sector.[61]

[60] SADC Parliamentary Forum. (2024, March 21). *Statement from the Secretary General of the SADC-PF on the International Day of Forests, 21 March 2024.* https://www.sadcpf.org/index.php/en/media-release/press-release/758-statement-from-the-secretary-general-of-the-sadc-pf-on-the-international-day-of-forests-21-march-2024-statement-from-the-secretary-general-of-the-sadc-pf-on-the-international-day-of-forests-21-march-2024

[61] For more details, please refer to Box A5 in the Appendix of this report.

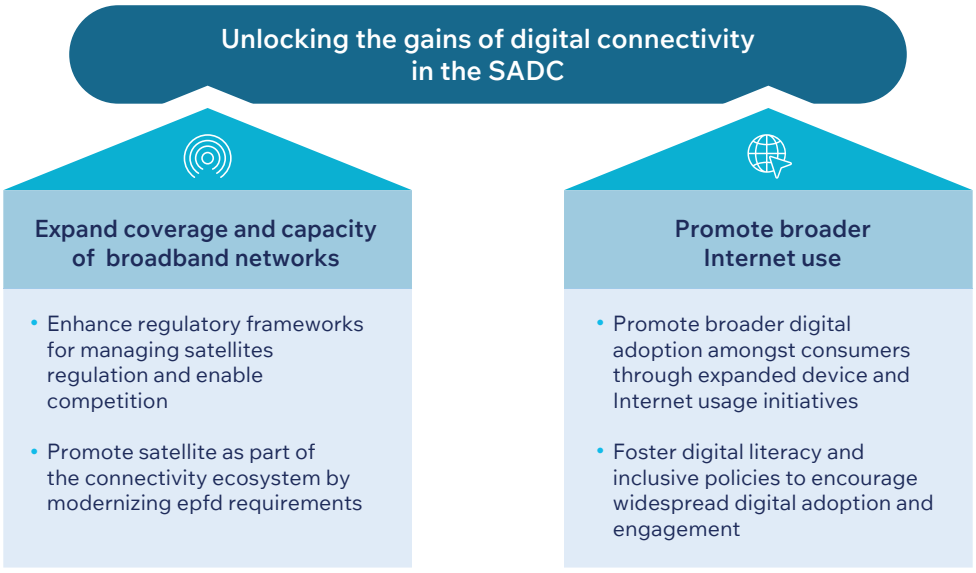
Chapter 3: Targeted governmental actions are key to unlocking the benefits of digital connectivity

Actions to improve broadband access can be broadly divided into two categories, (i) actions to expand coverage and capacity of networks; and (ii) actions to promote usage of the Internet. Exhibit 2 provides an overview of these two categories and specific actions that SADC governments could take.

By lowering the costs of coverage and potentially the cost of usage and quality of access, NGSO systems can provide a pathway to improved digital connectivity across the SADC. To support the deployment of NGSO systems and reduce barriers to access, strong governmental action built upon regional partnership and engagement with private sector players is critical.

Exhibit 2

NGSO systems can contribute to the vision of broad and improved Internet access in the SADC, but only if governments can lower barriers to satellites and Internet use



Actions to expand coverage and capacity of broadband networks by lowering barriers to NGSO connectivity

- **Enhance regulatory frameworks for managing satellite regulation and enable competition.** With new technologies regularly coming to the market, such as HTS networks, which can offer data capacity around a hundred times more than conventional satellites, regulators have taken efforts to ensure that regulatory approaches remain relevant. This includes adopting technology-neutral frameworks that simplify licensing models to streamline the authorization rules for satellite services, earth stations, and emerging technologies.[62]

  Some regulators, such as the United States' Federal Communications Commission (FCC), are moving to adjust technical limits for satellite technologies.[63] The European Conference of Postal and Telecommunications Administrations (CEPT) is facilitating the harmonization of European satellite services by developing regional frameworks through CEPT Decisions, which establish coordinated technical and regulatory measures to promote efficient spectrum management and cross-border interoperability. In South America, the Inter-American Telecommunication Commission (CITEL) adopted a blanket-licensing framework in 2024 to streamline approvals for fixed-satellite service (FSS) earth stations.[64]

  Taking reference from these developments, SADC governments could consider enhancing and expediting harmonizing licensing rules within the region to provide regulatory certainty and reduce administrative barriers for satellite operators. Examples of key first steps could take the form of leveraging established technical working groups (e.g., SADC Satellite Experts Committee) or fully using current mechanisms for cross-border cooperation coordinate satellite spectrum management or licensing (e.g., a SADC Shared Satellite System framework) which have been under development in partnership with other regional entities.[65]

- **Promote satellite as part of the connectivity ecosystem by modernizing epfd requirements.** One critical aspect of updating rules to keep track with satellite development is modernizing epfd requirements. Current epfd (Equivalent Power Flux Density) rules, developed and adopted by the ITU when satellites were far less advanced, are now considered dated as they do not reflect major advances in technology.[66] Today, NGSO systems are capable of emitting far narrower beams than were anticipated 25 years ago, allowing significant reuse of spectrum that increases capacity and drives down cost of service. However, NGSO broadband providers continue to be limited by rules that support old contexts – despite studies demonstrating that increases in epfd do not affect the operation of most NGSO systems.[67] A global push to adjust such limits based on robust assessments would enable satellite-based systems to become more easily scalable by reducing the scope of exclusion zones and transmission limits, and lead to potential cost reductions for NGSO satellite systems, thereby enabling them to provide broadband connectivity to a significant part of the global population who remain unconnected today.[68]

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[62] Independent Communications Authority of South Africa. (2024, August 14). Notice 2678 of 2024: *Consultation on the proposed new licensing framework for satellite services.* Government Gazette No. 51044. https://www.gov.za/sites/default/files/gcis_document/202408/51044gen2678.pdf

[63] Rainbow, J., & Werner, D. (2025, April 7). FCC moves to update satellite power limits amid push for adaptive regulations. SpaceNews. https://spacenews.com/fcc-moves-to-update-satellite-power-limits-amid-push-for-adaptive-regulations/

[64] Inter-American Telecommunication Commission. (2024). Recommendation PCC.II/REC.69 (XLIII-24): Guidance for blanket licensing regimes for fixed-satellite service earth stations. https://www.oas.org/citelevents/en/Documents/DocumentsFile/2804

[65] Sources include: African Telecommunications Union. (2024, June). Evaluating the impact of satellite communication on achieving sustainable development goals in Africa: Opportunities, barriers, and future pathways. https://atuuat.africa/wp-content/uploads/2024/07/V3-Empowering-Africa-SDGs-and-Satellite-Connectivity.pdf; Space in Africa (2021), "SADC Satellite Expert Committee meet to deliberate on shared satellite framework." Available at: https://spaceinafrica.com/2021/01/25/sadc-satellite-expert-committee-shared-framework/

[66] Furchtgott-Roth, H. (2023, November 30). *The economic benefits of updating regulations that unnecessarily limit non-geostationary satellite orbit systems: Part II* (SSRN Scholarly Paper No. 4649941). Social Science Research Network. https://doi.org/10.2139/ssrn.4649941

[67] Federal Communications Commission. (2024, April 22). DA 24-376A1: *Order granting modification of Kuiper Systems LLC's non-geostationary orbit fixed-satellite service authorization.* https://docs.fcc.gov/public/attachments/DA-24-376A1.pdf

[68] Furchtgott-Roth, H. (2023, August 11). *The economic benefits of updating regulations that unnecessarily limit non-geostationary satellite orbit systems.* SSRN. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4538619

Actions to promote broader usage of the Internet

- **Promote broader digital adoption amongst consumers through expanded device and Internet usage initiatives.** Smartphone penetration in rural areas of Southern Africa remains relatively low due to inaccessible prices or lack of ability to purchase them, all of which dampens demand and scalability of satellite services.[69] Promoting device availability *and* affordability through targeted import policies or subsidy programs for Internet-enabled devices can unlock latent consumer demand, especially for users who may require Internet usage for accessing critical services.

  Beyond subsidies and imports, alternative device financing mechanisms have also begun to emerge such as buy-now pay-later schemes (BNPL) to promote affordability.[70] Working with financial institutions in this way to promote micro-financing solutions could also indirectly enable device access.

- **Foster digital literacy and inclusive policies to encourage widespread digital adoption and engagement.** Creating a more digitally literate and savvy population would also encourage consumers to integrate Internet connectivity into their daily lives and reap the benefits from improved digital adoption. Digital skilling programs and programs to improve understanding of online safety could support firms and workers to use digital technology more effectively and improve productivity.

  At the same time, shifting essential public services and communication onto digital platforms would also incentivize the broader population to adopt digital tools and data use. Targeted capacity-building programs for public agencies and resources for technology support and digital product development would lay the foundation for a more digitalized government, and thus a more digitally-engaged populace.

[69] GSMA. (2024, November). *The Mobile Economy Sub-Saharan Africa 2024.* https://event-assets.gsma.com/pdf/GSMA_ME_SSA_2024_Web.pdf
[70] Pravinkumar, M. (2024, December 17). *Device financing – a catalyst for smartphone growth in Africa.* Canalys. https://www.canalys.com/insights/device-financing-catalyst-for-smartphone-growth-africa

Appendix

Box A1: Approach to estimating the aggregate GDP impact of improved broadband coverage coverage and usage

For the purposes of this study, we assume that improved broadband coverage and usage is brought about by expanding telecommunication networks through integrating non-geostationary satellite orbit (NGSO) constellations into current infrastructure. As explained in Chapter 2, integrating NGSO constellations into current terrestrial infrastructure networks are able to reduce costs and extend coverage for mobile network operators (MNOs). This will enable more affordable data plans and improved network performance – specifically, lower latency and higher speeds. These enhancements will expand broadband coverage and usage to promote digital and financial inclusion, support digitally driven enterprise growth (e.g., e-commerce), boosting productivity in key sectors such as mining and agriculture, and lowering barriers to trade and transactions.

We estimate the economic impact by referencing established empirical relationships between Internet traffic growth and economic growth from literature. Broadband traffic expansion occurs in newly covered areas (Channel 1, or for "unserved" users) and existing covered areas (Channels 2 and 3, or for "unconnected" or "under-connected" users).

In newly covered areas, NGSO systems are assumed to expand Internet coverage to reach 21% of the unserved population, based on global benchmarks.[71] This figure is adjusted for each country based on rural density, terrain, current usage gaps and future population growth. As a result, we project 42.3 million additional users will be connected through NGSO connectivity by 2030. In existing areas, NGSO-enabled backhaul is assumed to reduce data plan prices by 10% in 2030 (GSMA; Intelsat; Oughton; ITU; Gilat). Using established price-elasticities for mobile broadband penetration (RTI International), we estimate that 40.9 million additional users will be connected in areas with existing coverage.

For both newly covered and existing areas, we assume broadband usage will reach 18GB per user per month in 2030, leveraging regional forecasts (GSMA).

Combining user growth and usage-per-user increases, we estimate a 429% increase in total broadband traffic between 2024 and 2030. Drawing on empirical studies (Deloitte; Kathuria; Analysys Mason), we apply an estimated 0.5% increase in GDP-per-capita for every 100% increase in Internet traffic. Applying this to our traffic growth estimate yields a projected $16.9 billion increase in GDP in 2030, equivalent to 2.0% of 2024 GDP.

[71] Sources include: Analysys Mason. (2025). *LEO satellite broadband: A cost-effective option for rural areas of Europe.* https://marketing.analysysmason.com/acton/attachment/3183/f-95d4dead-60af-4ba3-842b-e397c622473b/1/-/-/-/-/analysys_mason_leo_satellite_broadband_europe_feb2025.pdf; and World Bank. (2019). *Connecting Africa through broadband: A strategy for doubling connectivity by 2021 and reaching universal access by 2030.* https://documents1.worldbank.org/curated/en/131521594177485720/pdf/Connecting-Africa-Through-Broadband-A-Strategy-for-Doubling-Connectivity-by-2021-and-Reaching-Universal-Access-by-2030.pdf

Box A2: Approach to estimating savings in terrestrial infrastructure deployment costs from using NGSO systems

Cost savings are estimated by calculating the number of unconnected users addressable via NGSO satellites, multiplied by the reduction in infrastructure deployment cost per user from leveraging NGSO systems, net of relevant CAPEX to establish these systems.

Using global benchmarks,[72] we assume NGSO systems can reach 21% of the population. This figure is then adjusted by country based on rural density and terrain, without considering satellite capacity constraints, yielding an NGSO-addressable share ranging from 10.4% (Botswana) to 31.3% (Malawi), or a sum of 83.8 million users across the region. Based on recent African infrastructure studies,[73] FTTH deployment capex ranges from $1,400-$4,000 per household – this report uses this range as a proxy for deploying terrestrial infrastructure to connect to these end-users. Adjusting for household size and share of populations living in rural areas,[74] we estimate an average cost of $96-$2,499 per user across SADC countries, and that 21% ($21-$536) of this per-user cost is attributed to backhaul and 93% ($89-$2,321) when including the last-mile. The low end of the range assumes only the use of NGSO systems for backhaul, and the high end assumes the use of NGSO systems for both backhaul and last-mile.

NGSO CAPEX is estimated to be at $178 per user[75], excluding end-user terminals. We assume terminals are priced at $200 each by 2030[76] and that each serves 4 users resulting in a total NGSO CAPEX of $228 per user. No user acquisition is assumed for countries with FTTH costs per user that are below this NGSO threshold.

Taken together, leveraging NGSO systems for backhaul is expected to yield $10.3 billion in backhaul infrastructure investment cost savings, or $680 million annually over 15 years (equivalent to 0.1% of 2024 GDP). If NGSO systems are also used for last-mile connectivity, savings could reach $106.9 billion, or $7.1 billion annually over 15 years (equivalent to 0.9% of 2024 GDP).

[72] Sources include: Bokun, S., Ohlsson, A., Daly, A., Palerm, L., Jones, O., Kiritharan, N., & Wyles, L. (2025, February 24). *LEO satellite broadband: A cost-effective option for rural areas of Europe.* Analysys Mason. https://marketing.analysysmason.com/acton/attachment/3183/f-95d4dead-60af-4ba3-842b-e397c622473b/1/-/-/-/-/analysys_mason_leo_satellite_broadband_europe_feb2025.pdf; and World Bank. (2019, October 17). *Connecting Africa through broadband: A strategy for doubling connectivity by 2021 and reaching universal access by 2030.* https://documents1.worldbank.org/curated/en/131521594177485720/pdf/Connecting-Africa-Through-Broadband-A-Strategy-for-Doubling-Connectivity-by-2021-and-Reaching-Universal-Access-by-2030.pdf

[73] Sources include: Sibthorpe, C. (2023, January). *Accelerating rural connectivity: Insights from the GSMA Innovation Fund for Rural Connectivity.* GSMA. https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/wp-content/uploads/2023/01/Accelerating-Rural-Connectivity.pdf; Ding, R. (2017). *Fiber networks: Faster payback means better connected. Huawei.* https://carrier.huawei.com/~/media/cnbg/downloads/industry-perpectives/06-fiber-en.pdf; and Zibi, G. (2016). *The African FTTH boom: Last mile fibre dynamics, economics and outlook in African markets* (Investor Report). Xalam Analytics. https://xalamanalytics.com/wp-content/uploads/woocommerce_uploads/2018/01/The-Xalam-Analytics-Africa-FTTH-Report-Dec-2016-Final.pdf

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[75] Osoro, O. B., Oughton, E. J., Wilson, A. R., & Rao, A. (2023). *Sustainability assessment of Low Earth Orbit (LEO) satellite broadband megaconstellations.* https://scispace.com/pdf/sustainability-assessment-of-low-earth-orbit-leo-satellite-44vso7pz7v.pdf

[76] Werlé, T., Pandey, U., Rejeb, F., & Maalouf, M. (2021, June 1). *LEO satellites: A technology to revolutionize global connectivity? Boston Consulting Group.* https://www.bcg.com/publications/2021/leo-satellites-unlock-connectivity-opportunity

Box A3: Approach to estimating cost savings from real-time asset tracking

Four components made up the estimating of cost savings: logistics costs, GDP growth rates, IoT adoption rates, and percentage of cost savings enabled by real-time tracking through IoT.

We first estimate the logistics costs in 2030 by multiplying the logistics cost as a share of GDP with the GDP of economies. We estimated the average logistics costs as a share of GDP for all SADC countries as 11.34% in 2030 based on historical change from 1985 to 2014 for African countries.[77] We then projected the 2030 GDP for each country using the projected annual growth rates ranging from 3.4%-13.0%.[78] The assumption is that as economies of SADC grow, trade between countries will grow in tandem, resulting in proportional increase in logistics costs.

Next, we estimate the IoT adoption rates, using the historical adoption rates of cloud computing as a proxy. This ranges from 6% for Democratic Republic of Congo to 34% for South Africa.[79] As cloud computing and IoT are advanced technologies, the assumption is that countries with higher adoption of cloud computing will also exhibit greater willingness to adopt IoT.

Lastly, we estimated the average percent cost savings on logistics enabled by real-time tracking through IoT as 16.3%. This relies on inputs from literature review and industry studies which are then averaged.[80]

By multiplying the projected logistics costs, adoption rate of IoT, and the average logistics cost savings enabled by real-time tracking through IoT, we estimate the cumulative logistics costs saving in 2030 for SADC countries to be $ 5.4 billion.

Box A4: Approach to estimating infrastructure damage mitigated from improved disaster management and response

We first estimated the expected infrastructure damage by natural disasters in 2030. To do this, we used historical growth rates in both the frequency and average impact of natural disasters in the region.[81]

For 2030, we project (excluding rare extreme events—such as Cyclone Idai in 2019—which could cause much larger impacts) the frequency of natural disasters to range from 0.4 to 9 events per country; and average infrastructure damage per disaster to range from $688,000 to $349 million.

Next, we estimated how much better early warning systems and improved disaster response could reduce these impacts.[82] Based on literature reviews and industry studies, we applied an average reduction rate of 39% for infrastructure damage to estimate that enhanced early warning systems and improved disaster response could mitigate about $1.2 billion in infrastructure damage.

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[79] Sources includeTelecom Advisory Services. (2023, September). *The contribution of cloud to economic growth: Focus on Sub-Saharan Africa*. Amazon Web Services. https://www.teleadvs.com/the-contribution-of-cloud-to-economic-growth-focus-on-sub-saharan-africa2/; United Nations Conference on Trade and Development. (2023). *Frontier Technology Readiness Index, annual*. UNCTADstat. https://unctadstat.unctad.org/datacentre/reportInfo/US.FTRI; and World Bank. (2016). *World Development Report 2016: Digital Dividends*. Washington, DC: World Bank. https://www.worldbank.org/en/publication/wdr2016/Digital-Adoption-Index

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Box A5: Approach to estimating additional economic activity enabled from environmental monitoring services

We first estimated the size of the environmental monitoring services sector in 2030 by using environmental expenditure as a share of GDP.[83] For countries without available data, we made a conservative assumption by using the lowest value observed among countries that do have data. This reflects the expectation that, since the sector is still in its early stages, its growth will likely remain limited by 2030.

For countries with existing data, we projected modest growth in the sector by applying each country's expected GDP growth rate.[84] Given the sector's nascency, we assume it will grow broadly in line with the overall economy. Based on this approach, we estimate that environmental expenditure as a share of GDP across the region in 2030 will range from 0.005% to 0.25%. We also projected the size of each country's economy in 2030 using expected annual GDP growth rates, which range from 3.4% to 13.0%.[85]

Next, we estimated the share of environmental monitoring services that could be attributed to IoT technologies. Based on global industry reports, we used a benchmark estimate of 12.2%. Due to limited local data, we applied this same global share to the SADC region.[86]

By multiplying the estimated size of the environmental monitoring services sector by IoT's share, we estimate that IoT technologies could enable more than $180 million in additional economic activity in environmental monitoring services by 2030.

[83] International Monetary Fund. (n.d.). *Environmental Protection Expenditures.* IMF Climate Change Indicators Dashboard. Retrieved April 30, 2025, from https://climatedata.imf.org/datasets/d22a6decd9b147fd9040f793082b219b_0/about

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Access Partnership

accesspartnership.com

Follow us

Our offices

Europe

London

The Tower, Buckingham Green
Buckingham Gate
London, SW1E 6AS
United Kingdom

+44 20 3143 4900
london@accesspartnership.com

Brussels

8th Floor, Silversquare Europe
Square de Meeûs 35
B-1000 Brussels
Belgium

brussels@accesspartnership.com

North America

Washington DC

1300 Connecticut Avenue NW,
Suite 250
Washington, DC 20036
USA

+1 202 503 1570
washingtondc@accesspartnership.com

Asia

Singapore

Asia Square, Tower 2
#11-20
12 Marina View
Singapore 018961

+65 8323 7855
singapore@accesspartnership.com

Jakarta

Revenue Tower 21st Floor
Unit 104 SCBD Lot 13, Jl. Jend. Sudirman
Kav. 52-53
Provinsi DKI Jakarta, 12190
Jakarta, Indonesia

+62 21 5020 0949

Kuala Lumpur

Common Ground Q Sentral
Level 39, Unit 39-02 (East Wing), 2A,
Jalan Stesen Sentral 2, Kuala Lumpur
Sentral, 50470
Kuala Lumpur, Malaysia

Bangkok

188 Spring Tower
11th Floor, Unit 106, Phayathai Road
Thung Phayathai, Ratchathewi,
10400Bangkok, Thailand

+ 66 (2)-8216148

Hanoi

19th floor, Tower 1
Capital Place Building
No 29 Lieu Giai Street
Ngoc Khanh Ward, Ba Dinh Diítrict
Hanoi, Vietnam

Manila

28F & Penthouse
World Plaza
5th Ave
Bonifacio Global City
Manila, 1634
Philippines

Middle East and Africa

Abu Dhabi

Al Wahda City Tower, 20th Floor
Hazaa Bin Zayed The First Street
PO Box 127432
Abu Dhabi, UAE

abudhabi@accesspartnership.com

Johannesburg

119 Witch-Hazel Avenue
Highveld Technopark
Johannesburg
Gauteng, South Africa