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The Role of Space-Based Internet in Bridging the Digital Divide in Africa

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ABSTRACT

The digital divide remains a major challenge in Africa, particularly in rural and underserved communities where access to reliable and affordable internet services is limited. This study makes use of the review research method to examine the role of space-based internet in bridging this gap by extending connectivity to areas that are difficult to reach through conventional terrestrial networks. A review and explanatory research approach were adopted, drawing on existing literature on satellite internet, digital connectivity, and its applications across Africa. The findings indicate that space-based internet can expand connectivity in rural communities and provide access to digital services that are increasingly important for social and economic development. It can support e-education by connecting schools and learning centres, enable telemedicine in remote health facilities, and provide farmers with timely agricultural information. It also supports disaster response, as well as supporting digital financial inclusion and economic opportunities. The study concludes that space-based internet can complement terrestrial infrastructure and serve as an important tool for expanding digital inclusion, improving access to digital services, and connecting underserved African communities to the global information society.

KEYWORDS: *Agriculture, Digital connectivity, Disaster response, Internet, Rural areas, Telemedicine.*

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1. INTRODUCTION

Internet connectivity is essential for education, healthcare, employment, financial services and participation in the digital economy. However, Africa continues to experience a significant digital divide, particularly between urban and rural communities where limited infrastructure, electricity, difficult terrain and high deployment costs restrict reliable and affordable internet access. Space-based internet offers a potential solution because satellite systems can provide wide-area connectivity without the use of extensive terrestrial infrastructure. The emergence of low Earth orbit (LEO) satellites has further improved this potential through wider coverage and lower latency. Recent research has also highlighted the growing role of satellite communication in supporting ICT applications beyond traditional broadcasting, making it particularly relevant for connecting remote and underserved African communities (Ale et al., 2025). The development of satellite technology has improved the potential of space-based internet, but technical and environmental challenges remain. Small satellites offer advantages such as lower costs, shorter development periods and diverse applications, although their performance can be affected by technical and operational limitations (Adeleke et al., 2026). Also, atmospheric and propagation conditions

can also affect satellite-to-ground communication, influencing signal quality and reliability. Therefore, effective deployment of space-based internet requires consideration of satellite performance, ground infrastructure, user equipment and environmental conditions (Ayegba et al., 2026). As reported, low Earth orbit (LEO) satellites offer a promising solution for extending connectivity to rural and geographically difficult areas, although affordability remains a challenge (Falowo & Falowo, 2026). Internet infrastructure in Africa also remains concentrated largely in urban areas, leaving many rural communities underserved. LEO satellites can complement terrestrial networks by providing relatively low-latency connectivity to remote and difficult-to-reach communities (Barasa, et al., 2024). Satellite internet has considerable potential to improve connectivity in rural communities, and will enable adequate satellite connectivity, thus effectively reducing the digital divide (Okello, 2024). Furthermore, LEO satellite services can improve internet availability, reliability and participation in remote communities (McMahon et al., 2025), implying that space-based internet is increasingly important to Africa's digital transformation and inclusive development. While terrestrial networks remain essential in populated areas, satellite connectivity can complement them by reaching remote and underserved communities where conventional infrastructure is unavailable or costly to deploy. A hybrid approach combining satellite and terrestrial networks can therefore provide broader and more resilient connectivity. The study therefore provides an integrated examination of how space-based connectivity can contribute to expanding digital inclusion and connecting underserved African communities to the wider global information society. Although existing studies have examined satellite communication, LEO satellite technology and specific applications such as education, healthcare and agriculture, fewer studies provide an integrated assessment of how space-based internet can contribute to bridging Africa's digital divide across multiple socioeconomic sectors. This study addresses this gap by synthesising recent evidence on the role of satellite-based connectivity in rural access, education, healthcare, agriculture, emergency communication and financial inclusion.

1.1. Objectives of the Study

The objectives of this study are to:

1. Examine the role of space-based internet in extending connectivity to rural and underserved communities in Africa.
2. Assess its contribution to education, healthcare, agriculture, financial inclusion and emergency communication.
3. Identify the major technical, economic and infrastructural challenges limiting satellite internet adoption.
4. Examine how space-based internet can complement terrestrial networks in achieving broader digital inclusion.

2. Methodology

This study adopted a review research method to examine the role of space-based internet in bridging the digital divide in Africa. Literature was identified through academic databases and relevant institutional sources using keywords such as "space-based internet," "LEO satellites," "digital divide in Africa," "satellite broadband," "rural connectivity," and "digital inclusion." The reviewed literature was selected based on its relevance to rural connectivity, affordability, education, healthcare, agriculture, disaster response, and digital financial inclusion. Recent research works published mainly between 2024 and 2026 were analysed and compared to identify the contributions of space-based internet to underserved communities. The review focused on studies that provided evidence on the ability of satellite-based technologies to complement terrestrial networks and extend connectivity to geographically isolated and poorly served populations. The findings from the selected literature were thematically organised according to the major roles identified in the study, and evidence from different authors was synthesised to explain each role. The approach also enabled comparison of findings across different African contexts and applications of space-based connectivity. This method provides an evidence-based assessment of how space-based internet can complement terrestrial infrastructure and contribute to wider digital inclusion, improved access to digital services, and socioeconomic participation across Africa.

3. Results and Discussion

This section discusses the role of space-based internet in bridging the digital divide in Africa.

3.1. Connecting Rural and Unserved Communities

Space-based internet helps bridge the digital divide by providing connectivity to rural and underserved African communities where terrestrial networks are limited or unavailable. Satellite-based systems can deliver internet services without requiring extensive fibre-optic cables or cellular infrastructure. This makes it possible to connect communities located in

remote areas, including regions with difficult geographical conditions. Improved connectivity allows residents to access online information, communication platforms, government services, and digital markets. It also creates opportunities for social and economic participation that may otherwise be restricted by geographical isolation.

Falowo and Falowo (2026) examined low mobile internet penetration in Sub-Saharan Africa, which stood at only 29% in 2024 against a global average of 58%. They identified limited network availability, affordability barriers, digital skills gaps and weak infrastructure as major constraints, especially in rural zones. The authors present LEO satellites as a practical solution capable of reaching sparsely populated and geographically difficult areas where terrestrial networks struggle. They document the expanding presence of Starlink and Eutelsat services and affirm LEO's potential to reduce the coverage gap while noting remaining challenges such as cost.

Barasa, Ruiters and Humphrey (2024) reviewed Africa's connectivity landscape and the contribution of LEO satellites to closing remaining gaps. They observe that infrastructure remains heavily concentrated in urban centres, leaving hundreds of millions beyond the practical reach of fibre or reliable mobile networks. LEO constellations are presented as a flexible, relatively rapid-to-deploy alternative that can complement subsea cables, terrestrial fibre and traditional satellites. The authors emphasise lower latency and the need for adaptive regulation, public–private partnerships and attention to affordability to realise this potential.

3.2. Lowering the Cost of Internet Access

Space-based internet can contribute to reducing the cost of extending internet connectivity to areas where conventional infrastructure is expensive to deploy. Terrestrial networks often require significant investment in fibre-optic cables, transmission equipment, and supporting infrastructure, particularly in sparsely populated communities. Satellite systems can cover large geographical areas using relatively limited ground infrastructure, making connectivity expansion more practical. As more satellite internet services become available, competition among providers can also increase the availability of affordable connectivity options. Lower access costs can encourage more individuals, schools, businesses, and community institutions to use internet services. In this way, space-based internet can support wider and more inclusive participation in Africa's digital economy.

The work by Padi, Nyapom and Scheid (2026) compared the cost-effectiveness of LEO, MEO and GEO satellite systems for broadband backhaul in developing-country settings, including Sub-Saharan Africa. Their analysis found LEO services to be more affordable than MEO and GEO alternatives. Starlink deployments delivered 50–250 Mbps with sub-50 ms latency, supporting real-time applications at lower ongoing cost than higher-orbit systems. The authors conclude that LEO technology offers the most cost-effective route for extending reliable broadband to underserved remote communities.

Also, Osoro (2025) developed geospatial techno-economic models to evaluate the cost of connecting the unconnected poverty-line population in Sub-Saharan Africa. The study assessed mobile, fixed-fibre and LEO satellite options for areas with very low population density (under 21 people per km²). It was reported by them that LEO systems can deliver usable capacity in the most remote settlements at a lower infrastructure deployment cost than extending fibre into sparse regions. Although LEO carries higher per-user emissions, the modelling indicates it is economically more viable than fibre for serving frontier populations living below the extreme-poverty line.

3.3. Enabling E-Education in Remote Areas

Space-based internet can improve access to education by connecting schools, universities, and e-learning centres in remote and underserved African communities. Reliable internet access allows students and teachers to use online learning platforms, virtual classrooms, digital libraries, and other educational resources. This reduces the educational gap between learners in urban areas with strong connectivity and those in rural communities. Teachers can also access online training materials and collaborate with educators from other locations. Students in isolated areas can therefore participate in learning opportunities without having to relocate to major cities. In this way, space-based internet supports more inclusive and geographically accessible education across Africa.

According to Ngcobo and Gupta (2026), low-cost and energy-efficient technologies such as LoRa can help bring digital learning to rural African communities that still lack reliable broadband. The authors also note that pairing these technologies with satellite links creates a hybrid system capable of reaching places ordinary networks cannot. The authors explain that such approaches support asynchronous learning, smart classrooms, and the delivery of educational content even in off-grid settings. Their work positions satellite connectivity as an important part of making e-learning more inclusive across remote parts of the continent.

According to Adefuye, et al (2025), access to and use of satellite communication devices have a clear positive effect on the academic performance of undergraduates in Ogun State, Nigeria. Their survey of educational technology students showed that actual utilisation of the devices contributed more to improved learning outcomes than mere access alone. The study highlights that when students can connect reliably through satellite systems, their engagement and performance rise. It adds further evidence that space-based connectivity can support better educational results in African higher-education settings. These studies show that satellite internet is helping to open doors to digital learning and improve outcomes for students in communities that have long been left behind by terrestrial networks.

3.4. Supporting Telemedicine and Health ICT

Space-based internet can extend digital healthcare services to rural communities where hospitals and health facilities have limited access to terrestrial broadband infrastructure. Through satellite connectivity, rural clinics can communicate with medical specialists and participate in remote consultations. Health workers can also access electronic patient databases, medical information, and other digital healthcare resources. This connectivity can improve communication between remote health facilities and larger hospitals located in urban centres. It also provides opportunities for patients in underserved communities to receive specialist support without travelling long distances. Consequently, space-based internet can strengthen the use of telemedicine and health information technologies in remote African communities.

As reported by Agbeyangi and Lukose (2025), telemedicine is steadily expanding across Sub-Saharan Africa, with South Africa, Kenya and Nigeria leading adoption. In the work by these authors, a systematic review of 53 studies shows that South Africa focuses on specialist teleconsultations and chronic-disease management, Kenya has strong mobile-health integration for maternal care, and Nigeria is advancing remote diagnosis and teleconsultation tools. Their findings confirm that telemedicine, supported by improved connectivity, is a practical route to reaching underserved rural populations.

In the work by Morris et al. (2025), the researchers tested ways to optimise a satellite-based telemedicine network for a rural community in Igu Village, Abuja, Nigeria. As reported by the authors, they used Nigeria's NigComSat-1R satellite and particle-swarm optimisation to improve signal quality, reduce errors and increase data speeds under local weather conditions. The work shows that the optimised link cut bit-error rates dramatically, kept latency under 250 milliseconds and more than doubled throughput. These results demonstrate that carefully designed satellite systems can deliver the stable, high-quality connection needed for real-time telemedicine in remote African settings.

These studies confirms that space-based internet can play a practical role in extending quality healthcare and telemedicine services to communities that have long struggled with connectivity barriers.

3.5. Boosting Agriculture

Space-based internet can support agricultural development by providing farmers in rural areas with access to timely digital information and communication services. Internet connectivity can help farmers obtain information on weather conditions, farming practices, markets, and agricultural inputs. Farmers can also communicate with agricultural experts and access online platforms that support decision-making. Improved connectivity can make it easier for rural farmers to participate in digital agricultural markets and reach potential buyers. This can reduce the information gap between farmers in remote communities and agricultural stakeholders in urban areas. Therefore, space-based internet can contribute to more informed and digitally connected agricultural communities across Africa.

As reported by Dompreh and Frimpong (2026), precision agriculture in Africa depends on reliable data flows, sensing technologies, and decision-support tools that often require stable connectivity. The authors outlined the technological, institutional, and educational conditions needed for precision agriculture to scale, emphasising the role of GNSS, GIS, and remote sensing. It was stated that without dependable internet-especially in remote farming areas-many of these digital tools remain out of reach for smallholders. Their analysis highlights how improved connectivity, including satellite options, is essential for turning precision-agriculture potential into practical benefits for African farmers.

According to Nyhof, et al (2025) who tested Starlink satellite connectivity for agricultural applications in areas with weak or no mobile coverage, Starlink provided a stable and reliable link in "0G" zones where terrestrial networks fail.

3.6. Supporting Disaster Response

Space-based internet can play an important role in maintaining communication during disasters and emergencies, particularly when terrestrial communication infrastructure is damaged or unavailable. Satellite-based connectivity can provide

communication links to affected communities and emergency response teams in remote locations. This can support the exchange of information between government agencies, relief organisations, and communities during emergency operations. It can also facilitate the coordination of rescue, relief, and recovery activities across affected areas. Because satellite connectivity does not depend entirely on local terrestrial networks, it can provide an alternative communication channel when conventional systems are disrupted. Consequently, space-based internet can strengthen digital communication and coordination during disasters across Africa.

As observed by Martin and Tsui (2025), the rapid uptake of low-Earth-orbit satellite services by humanitarian actors has created both opportunities and new risks in crisis settings. The study shows that while satellite internet can restore vital links when terrestrial systems fail, its use requires careful planning to protect affected communities and uphold humanitarian principles. Their analysis demonstrates the growing importance of satellite connectivity in modern emergency response across fragile contexts, including in Africa.

In the same way, Bhosale et al (2025) investigated the capacity of LEO satellite networks to serve as a national emergency failover when submarine cables or terrestrial infrastructure are disrupted. Their result indicates that LEO networks can provide meaningful failover connectivity during large-scale outages, although performance varies by geography and network configuration. These findings support the role of satellite systems as a resilient communications layer for disaster and emergency situations in African countries.

3.7. Supporting Digital Financial Inclusion and Economic Opportunities

Space-based internet can expand digital financial inclusion by giving remote communities reliable access to mobile money platforms, digital banking, online markets, and payment systems. With satellite connectivity, individuals and small businesses that previously lacked stable internet can send and receive money, pay for goods and services, access credit information, and sell products beyond their local area. This reduces dependence on cash-only transactions and opens new income-generating opportunities. In this way, space-based internet helps more people take part in the digital economy and supports broader economic inclusion across Africa.

As reported by Kaulu and Kaulu (2026), mobile phone ownership remains one of the strongest predictors of financial inclusion across Africa. In the work by these authors, analysis of data from 37 African countries shows that owning a mobile phone is associated with an 18.6 percentage-point higher likelihood of holding a formal bank account, even after adjusting for other socioeconomic factors. The work shows that digital access is a critical gateway to formal financial services and that infrastructure gaps continue to limit inclusion in many settings.

According to Elouaourti (2026) in their work that examines the barriers that still prevent many Africans, especially women and low-income groups, from using digital financial services, it was reported that education and ICT access significantly increase the likelihood of using digital finance, while involuntary exclusion continues to affect large parts of the population. These insights highlight the importance of improving connectivity infrastructure, including space-based solutions, so that more people can overcome the practical barriers to digital financial participation.

4. Conclusion

This work on the role of space-based internet in bridging the digital divide in Africa has been carried out using the review research approach. The review demonstrates that space-based internet can complement terrestrial infrastructure and support access to education, healthcare, agriculture, disaster response, digital financial services, and other economic opportunities. The findings further indicate that LEO satellite systems offer a practical means of extending connectivity to areas where conventional infrastructure is difficult or costly to deploy. However, achieving meaningful digital inclusion also requires attention to affordability, electricity, digital literacy, and supportive policies. It can be concluded that integrating space-based internet with existing terrestrial networks can strengthen digital inclusion and contribute to Africa's broader socioeconomic development.

5. Recommendations

Based on these reviews, it can be recommended that Governments should promote affordable satellite connectivity through supportive policies, public–private partnerships and stronger regulatory frameworks, while integrating satellite services with existing terrestrial networks.

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