BRIDGING THE DIGITAL DIVIDE IN INDIA VIA SATELLITE

WHITE PAPER | 2024

SIAINDIA
An association for space industry

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Executive Overview

Satellite technology is emerging as a powerful tool in bridging the digital divide. Globally, satellites are proving to be a powerful solution to bring high-speed internet access to some of the most far-flung corners serving as a lifeline to underserved communities, empowering them to participate in the digital world and enjoy the benefits of online communication, commerce, and information access.

As per ITU, by mid-2022, a third of the world's people (2.6 billion) do not use the Internet. Many of them live in least developed countries (LDCs), landlocked developing countries (LLDCs), and small island developing states (SIDS). India and many Asian countries fall into this category, making the mission to bridge the digital divide a top government priority for these nations, closely aligning with the ITU's mission of "Digital Inclusion for All.

By leveraging satellite infrastructure, ITU is committed to extending connectivity to unconnected and underserved populations and remote regions, thereby contributing significantly to the achievement of the United Nations Sustainable Development Goals (SDGs). ITU's mission is to guarantee that all the world's people can use and benefit from digital information, products and services, equally and equitably. ITU members' Connect 2030 Agenda focuses on how technological advances can accelerate the achievement of the United Nations Sustainable Development Goals (SDGs) by 2030.

International Telecommunication Union General Secretary Doreen Bogdan-Martin has recently urged support for the UN's Sustainable Development Agenda, highlighting the satellite industry's role in connecting the one-third of humanity still offline and highlighted the extraordinary technological progress in the satellite industry globally, creating a market worth hundreds of billions of dollars annually. According to her, at least 40 per cent of the UN Sustainable Development Goals rely on Earth observation, remote sensing, and global navigation satellite systems.

Bridging the digital divide between urban and remote/rural areas in India presently needs enormous efforts due to high costs of serving hard-to-reach and thinly populated areas and low return to the investors. Whereas, satellite technology is a cost-effective and instantly deployable technology in efficiently providing space-enabled broadband connectivity, where traditional infrastructure is lacking. Such a satellite based broadband facilitates access to education, healthcare, disaster management, and several other economic opportunities in remote and rural areas. Through initiatives like Connect-2030, ITU members work to ensure universal access to the internet, digital skills, and devices regardless of location or socio-economic status. By harnessing satellite technology, ITU and its partners aim to build resilient communities and promote inclusive development worldwide. Through strategic partnerships and innovative solutions, ITU continues to advance its mission of connecting the world and ensuring that no one is left behind in the digital era.

SIA-India, in continuation with the ongoing endeavour to champion the cause of 'connecting the unconnected', has pledged under ITU's Partner to Connect [P2C] to 'Foster implementation of ITU guidelines and recommendations on National Emergency Telecommunication Plan

(NETP) and Last Mile Connectivity Guidelines' with a focus on 'Access & Adoption' by mobilising the resources needed to connect those who are still offline.
The recently concluded WRC-23 had made important decisions, allocating more spectrum to satellite transmissions, and establishing "a more stable and transparent regulatory framework for space services."

This white paper delves into various aspects related to broadband initiatives in India and the significant role of the space sector in enhancing connectivity. It highlights the growth drivers such as digital initiatives, the rise of IoT and remote work, and technological advancements like low-earth orbit satellites. The challenges of high costs and latency issues, the regulatory aspects such as spectrum and licensing, and Radio Frequency Interference prevention. It also covers topics such as current government initiatives like Digital India and the Right to Broadband plan, challenges faced, and the effectiveness of existing policies. Additionally, it explores the potential of satellite technology to address broadband connectivity gaps, its impact on GDP growth, and NTN Satellite Technologies' contribution to Vision 2030 goals.

The paper also discusses recent reforms in the Indian space sector, including initiatives to promote innovation and private-sector participation.

Lastly, it outlines SIA-India's commitment to supporting broadband connectivity targets and provides recommendations for collaboration and further leveraging satellite technology to achieve these goals.

[1]https://www.itu.int/en/mediacentre/backgrounders/Pages/digital-inclusion-of-all.aspx

[2]https://www.satellitetoday.com/government-military/2024/03/21/itu-chief-bogdan-martin-tasks-the-satellite-industry-with-expanding-internet-access/

Introduction: Broadband Penetration and Digital Connectivity in India

The Government of India has embarked on various initiatives to enhance broadband penetration and digital connectivity across the country. India with robust, affordable, sustainable and inclusive internet connectivity is considered a fundamental pillar of a digital society and a cornerstone of resilient communities. Despite commendable efforts, challenges persist, especially in remote and rural areas where traditional terrestrial infrastructure remains inadequate.
Globally, governments, policymakers, and corporations are increasingly turning to satellite technologies to expedite internet solutions, and India is no exception. Despite significant progress in terrestrial connectivity, with policies supporting widespread access to mobile and data services, there remain challenges in reaching remote and rural areas.
Most digital and broadband policies in India emphasise on Optical Fiber to expand connectivity to homes, enterprises, towns, and rural clusters overlooking the fact that many Indian remote areas, island states, and villages cannot be reached by fiber. Last-mile connectivity to these underserved areas poses significant challenges, with high infrastructure costs, and difficulties in O&M of Optical Fiber cables in tough terrains, outweighing the benefits of bandwidth provided by OF cables.

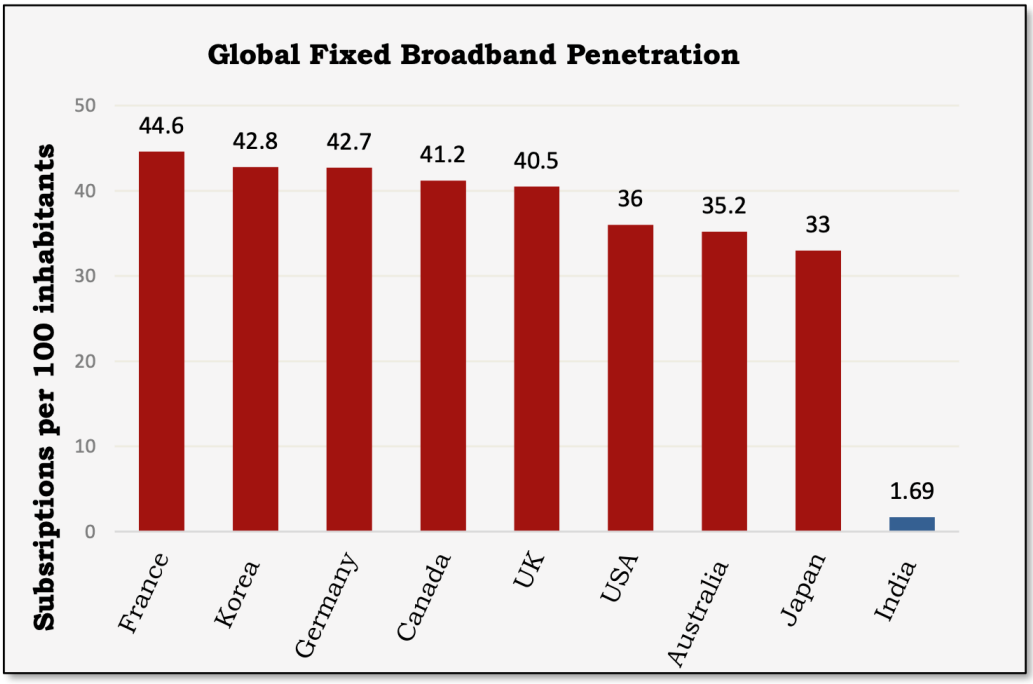
In India, satellite connectivity, therefore, assumes paramount importance, especially given the country's extensive hilly terrains, disaster-prone areas, archipelagos, and remote islands. India is one of the most disaster-prone countries in the world, close to 1300 islands in India with fragmented and unreliable internet connectivity. Despite significant strides in undersea fiber optic infrastructure, as of February 2024, India predominantly relies on 17 undersea fiber cables for internet delivery. However, several regional conflicts damaging undersea cable systems in the Red Sea highlight the vulnerabilities in India's internet and overseas telecom connectivity. Furthermore, disruptions underscore choke points in subsea connections between Europe and Asia, particularly concerning for India due to its limited connections and regulatory constraints.

Most of India is exposed to recurrent natural hazards such as floods, cyclones, earthquakes, landslides, and droughts. As per the UNICEF, India is among the world's most disaster-prone countries with 27 of its 29 states and seven union territories exposed to recurrent natural hazards. The United Nations Office for Disaster Risk Reduction (UNDRR) emphasizes the importance of early warning systems in reducing the impact of disasters. Providing early warning, 24 hours in advance, can decrease the damage caused by a disaster by 30%.

[3]https://www.thehindu.com/sci-tech/technology/subsea-cable-disruptions-expose-key-telecom-vulnerability/article67900070.ece#:~:text=The%20damage%20to%20the%20three,through%20the%20region%20is%20impacted.
[4]https://www.unicef.org/india/what-we-do/disaster-risk-reduction

Digital Connectivity Woes

As per the latest TRAI report 2024, around 55% of rural India remains digitally unconnected and the rural broadband penetration is a mere 29.3%.[5]Nearly 665 million Indians or 45% of the rural population did not have access to the internet as of 2023. [6]
India ranks lowest in the fixed broadband penetration rate in the world at only 1.69 per hundred inhabitants. North-East regions have the lowest penetration of broadband.[7] In a significant move, the Department of Telecommunications (DoT) adopted Telecom Regulatory Authority of India (TRAI) recommendations in 2023, updating the definition of broadband for telecom operators. The minimum speed requirement was increased to 2Mbps from 512Kbps, a standard in place since 2013. This update is expected to further reduce the number of broadband users, both in urban and rural areas. In India considering the population density the existing 4G networks may struggle to sustain 2 Mbps speeds, especially in areas with high device density or where users are far from base locations.[8] 5G on the other hand is mostly an urban phenomenon.



5.https://www.unicef.org/india/what-we-do/disaster-risk-reduction
6.https://www.trai.gov.in/sites/default/files/PR_No.18of2024.pdf
7.https://www.business-standard.com/india-news/use-of-indian-languages-key-for-increasing-internet-access-in-india-report-124031000395_1.html https://www.trai.gov.in/sites/default/files/QPIR_23042024_0.pdf
8.https://www.trai.gov.in/sites/default/files/Recommendations_31082021.pdf
9.https://www.drishtiias.com/daily-updates/daily-news-analysis/dot-updates-definition-of-broadband/print_manually

Source: OECD statistics for June 2020, TRAI Dec 2020

Indian Telecom Services Performance Indicator Report dated 9th February 2024 for the Quarter July-September 2023

Total Internet Subscribers (both broadband and narrowband) per 100 population	65.89
Urban Internet Subscribers per 100 population	110.03
Rural Internet Subscribers per 100 population	41.72

Source: Indian Telecom Services Performance Indicator Report

Worrying gaps in connectivity and internet access are pervasive in rural and remote areas resulting in a glaring digital divide. This lack of ICT resources, including internet connectivity, internet-enabled devices, and digital literacy skills, systematically limits participation in a digital society and access to digital services, especially among marginalised groups in the country.

To bridge the digital divide, a workable and viable policy intervention is inevitable. Terrestrial technologies alone cannot achieve any significant change in the statistics. The right mix of fixed-line, satellite, Wi-Fi and other NTN technologies is urgent and imperative. Further, any policy would have to account for the difference in dynamics of providing connectivity in rural and remote areas from those of urban areas. Policymakers must also acknowledge the unique challenges of rural and remote connectivity compared to urban areas.

A more prudent strategy involves adopting a technology-neutral broadband policy and funding scheme that encourages diverse service providers. This approach not only promotes inclusivity but also stimulates ancillary industries, fosters skill development, generates employment opportunities, attracts significant foreign investment, and boosts GDP growth.

[9]High-altitude platforms (HAPs), Stratospheric balloons, Unmanned aerial vehicles (UAVs) Low Earth Orbit (LEO) constellations

Broadband Initiatives by the Government of India

Overview of current broadband initiatives, including Digital India and the Right to Broadband plan.

India's broadband initiatives have undergone a remarkable transformation in recent years, propelled by ambitious initiatives such as Digital India[10] and the Right to Broadband plan .[11] Spearheaded by the Government of India, Digital India represents a visionary program aimed at leveraging technology to bridge the digital divide and empower citizens across the country. Through a comprehensive framework encompassing infrastructure development, digital literacy, and e-governance, Digital India seeks to transform India into a digitally empowered society and knowledge economy.

Central to Digital India is the goal of providing affordable and accessible broadband connectivity to all corners of the nation, including rural and remote areas. "National Broadband Mission" or "Rashtriya Broadband Abhiyan"[12] aims to achieve "Broadband for All" as part of the National Digital Communications Policy – 2018 (NDCP-18). This initiative recognises the transformative potential of broadband internet in driving socio-economic development, enhancing access to education and healthcare, affordable communication and fostering entrepreneurship and innovation.

Assessment of the effectiveness of existing policies and programs

In India, the NDCP aims to digitally empower the economy and society through the establishment of ubiquitous, resilient and affordable digital communication infrastructure and services. Under this policy, the following broadband initiatives were taken through USOF funding and Public-Private Partnerships[13]:

Sr No.	Initiative	Target	Achievement
1.	BharatNet	Connect all 6.5 Lakh villages across India with high-speed internet access	Only about 1,99,655 out of the targeted 6,55,968 villages have been connected so far.[14]Approximately 69.56% of the villages are not covered. Number of GPs Connected on OFC & Satellite = 2,11,661 (2,06,709 + 4,952) Among the 2,11,661 GPs currently "connected," a significant percentage still lack reliable and usable Internet access.

[10]https://www.digitalindia.gov.in/
[11]https://www.trai.gov.in/sites/default/files/Recommendation26082020.pdf
[12]https://dot.gov.in/sites/default/files/National%20Broadband%20Mission%20-%20Booklet_0.pdf?download=1
[13]https://dipa.co.in/contentpdf/ci/Broadband 2022 - Unlocking a trillion dollar digital economy.pdf
[14]https://bbnl.nic.in/

Sr No.	Initiative	Target	Achievement
2.	GramNet	GramNet aims to provide Wi-Fi in all villages with speeds between 10 Mbps and 100 Mbps, enhancing digital inclusion and access to online services by 2022[15]	Later Named as JanWiFi Wi-Fi Installed in GPs - 1,04,574 Wi-Fi Active in GPs - 6,243[16]
3.	NagarNet	Establishing 1 Million public Wi-Fi Hotspots in urban areas.[17]	India has significantly missed its public Wi-Fi hotspot target, reaching only 0.5 million[18] out of the 10 million[19] planned for 2022. [These schemes later became PM-WANI]
4.	JanWiFi	Establishing 2 Million Wi-Fi Hotspots in rural areas.[20]	
5.	Fibre First Initiative [Part of BharatNet Now]	To take fibre to the home, to enterprises and key development institutions in Tier I, II and III towns and to rural clusters.	During January-March 2023, Brazil added 1.36 million FTTH/B connections, China added 14.6 million, the USA added 1.75 million, while India added only 0.81 million[21]
6.	Strengthening Satellite Communication Tech	Reviewing SatCom policy, making available new spectrum bands, streamlining administrative processes for assignment and allocations, clearances and permissions related to satellite communication systems, etc.	Under the BharatNet project, the Satellite-based digital/broadband connectivity has been provided at more than 6000 sites out of the planned 6929 sites, although the total planned sites should be much larger.

[15] https://pib.gov.in/newsite/PrintRelease.aspx?relid=192821
[16] https://bbnl.nic.in/
[17] https://broadbandindiaforum.in/wp-content/uploads/2020/12/Liberalized-Public-Wi-Fi-Hotspots.pdf
[18] https://www.business-standard.com/technology/tech-news/india-misses-its-10-million-target-of-public-wifi-coverage-by-end-of-2022-123070600270_1.html
[19] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1825156
[20] https://broadbandindiaforum.in/wp-content/uploads/2020/12/Liberalized-Public-Wi-Fi-Hotspots.pdf
[21] https://www.voicendata.com/ftth-wi-fi-solution-for-indias-digital-economy/

BharatNet Status[22]

BharatNet, one of the world's largest rural telecom projects, aims to connect approximately 2.5 lakh Gram Panchayats (GPs) in over 600,000 villages in India with high-speed internet through optical fibre cables. Approved by the Union Cabinet on 25.10.2011, the project is executed by Bharat Broadband Network Limited (BBNL) in three phases:
As per the latest data from the govt, Phase-I: Completed with over 1 lakh GPs connected by December 2017, expanded to 1.25 lakh GPs by July 2017.
Phase-II: Includes multiple implementation models covering states like Chhattisgarh, Gujarat, Jharkhand, Andhra Pradesh, Maharashtra, Odisha, Telangana, Madhya Pradesh, Uttar Pradesh, Sikkim, Punjab, and Bihar.
Wi-Fi Hotspots: 104,574 installed.

The BharatNet initiative, funded by the Universal Service Obligation Fund (USOF) with a total approved budget of Rs 42,068 crores, has disbursed Rs 39,825 crore as of 31.12.2023. However, as of May 2024, only 5% of the installed 104,574 Wi-Fi hotspots are operational, highlighting challenges such as missed deadlines and escalating costs. Launched in 2011-12 to provide broadband connectivity to 2.5 lakh gram panchayats, the initiative has faced significant hurdles in achieving its connectivity goals. All this leading to the overall project outlay getting tripled from INR 20,100 crore to over INR 61,100 crore, with the cost of laying one km of Optical Fibre Cable (OFC) doubling in the past year.

As of now, the BharatNet project aims to connect 6,50,000 villages, but only one-third have fiber connectivity, leaving over 50% of rural India digitally disconnected. Fixed broadband penetration remains low at 2.8 per hundred inhabitants, placing India at a disadvantage compared to global benchmarks. During the COVID-19 pandemic, 70% of rural students lacked access to online education due to poor internet connectivity. India also ranks poorly in internet connections per capita among BRICS nations , reflecting a critical gap in digital infrastructure development.

The number of public Wi-Fi hotspots per million population is 175 times that of India in the UK, 50 times in the US, and 75 times in China.

BharatNet Overall Connectivity Status as of May 2024	
Total no. of villages as per census of India	6,55,968
No. of GPs connected on OFC	1,99,655
Total Villages remains to be covered:	4,56,313
Wi-fi hotspots installed in GPs	1,04,574
Wi-fi hotspots Active in GPs	6,243
Inactive wi-fi hotspots	98,331

[22]https://usof.gov.in/en/bharatnet-project
[23] https://www.trai.gov.in/sites/default/files/PR_No.18of2024.pdf
[24]https://www.financialexpress.com/business/industry-india-needs-rs-4-2-trillion-investment-for-broadband-push-3486499/
[25]https://www.statista.com/topics/3116/internet-usage-in-bric/#topicOverview

[26]According to Statista, a German market research agency

Analysis of Bharat Net Connectivity Issues in 8 Critical States/ UTs in India

Sr No.	State/Union Territory	Total GPs	Service-ready Gram Panchayats	Operational	Connectivity Ratio [%] (SR/ TGP*100)	Operational Rates [%] (Op/SR*100)
1.	Arunachal Pradesh	2108	1081	191	51.28	17.67
2.	Assam	2662	1640	486	61.61	29.63
3.	Manipur	3812	1479	18	38.80	1.22
4.	Meghalaya	6814	692	73	10.16	10.55
5.	Mizoram	840	495	57	58.93	11.52
6.	Nagaland	1293	230	17	17.79	7.39
7.	Tripura	1176	771	345	65.56	44.75
8.	Sikkim	199	54	13	27.14	24.07
9.	Jammu &Kashmir	4291	1113	400	25.94	35.94
10.	Uttarakhand	7795	2013	837	25.82	41.58

Source: PIB, Ministry of Panchayati Raj

The BharatNet connectivity status in ten critical states and union territories of India reveals a significant disparity between service-ready[27] Gram Panchayats (GPs) and those that are operational, highlighting the minimal operational percentages compared to the total service-ready GPs. The data indicates substantial challenges in moving from infrastructure readiness to functional connectivity, particularly in regions like Manipur and Nagaland, where the operational rates are strikingly low at 1.22% and 7.3% respectively. Arunachal Pradesh, despite having over half of its GPs where connectivity has reached, however, has an operational rate of only 17.67%. Assam shows a slightly better operational rate at 29.63%, yet this is still far from desired. Mizoram, Meghalaya, Sikkim, and Jammu & Kashmir similarly exhibit low operational rates, highlighting the widespread implementation difficulties. This trend emphasises the critical need for enhanced efforts to bridge the digital divide and realize the full potential of BharatNet in improving connectivity across India's remote and underserved areas.

Several key reasons contribute to the low connectivity ratio observed in various states and union territories in India, which broadly include geographic challenges, financial constraints limiting investment in infrastructure, policy and regulatory delays, and technical complexities

[27]Service-Ready refers to the number of Gram Panchayats where infrastructure is in place for connectivity.
Operational indicates the number of GPs where the connectivity is actually operational.
Connectivity Ratio [%]: This metric shows the percentage of GPs where infrastructure is ready compared to the total number of GPs.

Operational Rates [%]: This reflects the percentage of GPs where the connectivity is operational compared to those where the infrastructure is ready.

in deploying and maintaining broadband networks. Satellite internet offers a compelling solution by providing rapid deployment and comprehensive coverage, making it ideal for bridging the digital divide and delivering essential connectivity to underserved regions efficiently.

The government has identified approximately 7000 Gram Panchayats (GPs) situated in remote and hilly areas with poor connectivity scheduled to be connected via satellite media, with over 6,000 GPs already utilizing satellite VSATs. Despite these efforts, the total number of villages in these critical regions is around 200,000, and nearly 37,810 GPs are most suitable for VSAT connectivity. While satellite technology currently addresses connectivity for a minute percentage, the potential of satellite backhaul is substantial. The government is considering a 10% allocation for satellite backhaul as per the below data; however, given the unique feature and considerable capacity of satellite technology, a higher percentage should be considered to effectively address the connectivity challenges in these regions.

Increasing reliance on satellite backhaul could significantly enhance connectivity in remote and underserved areas, ensuring more comprehensive and reliable access to digital services.

Satellite Addressable Sites

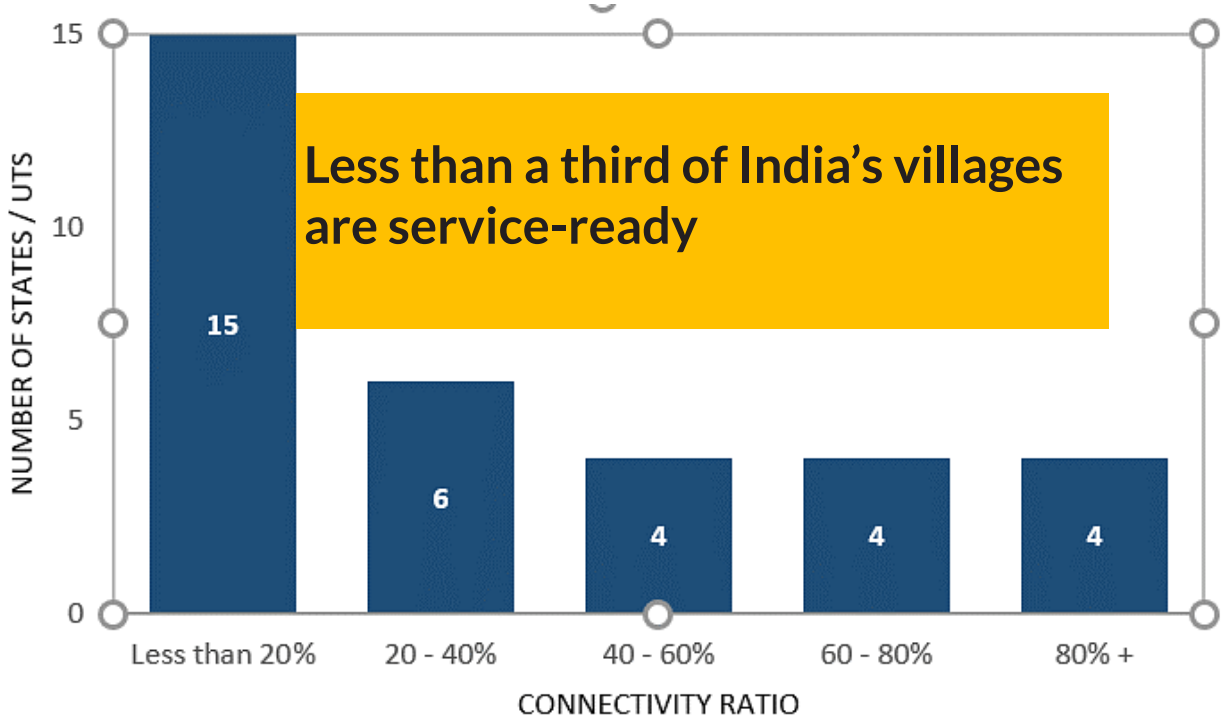
Region	States	Total GPs	Feasible by Fibre (%)	Estimated VSAT Sites
North East	7 Sister States & Sikkim	11960	25	8970
Maoist Affected	26 Districts in 8 States	7433	0	7433
Hilly States	J&K, Jharkhand, Uttarakhand	14572	25	10929
Islands	Lakshadweep	11	0	11
Other States	Remote Areas in Mainland	211336	95	10567
		Total	VSAT Sites	37,810

Source: Hughes Study: 2022

India's persistent efforts to bridge the digital divide have seen the implementation of several strategic policies over the years, including the 'Broadband Policy 2004', 'Digital India Programme 2015', 'National Broadband Mission 2019', and 'National Digital Communication Policy 2018'. **Despite these efforts, there remains a significant gap in the integration of non-terrestrial technologies in the connectivity architecture. These technologies, though included in Phase II of the BharatNet project, have not been given sufficient priority.**

The Challenges,Gaps and Roadblocks

One Generation has passed without getting the benefit of the BharatNet Project and the next generations are still waiting. The reality falls short of expectations, with less than a third of India's villages being deemed service-ready despite efforts to connect them.



Source: Rajya Sabha, analysis by Business Standard

CR = Ratio between no. of villages in a state/UTs that have been made service-ready by Bharat-Net, and the total number of villages in that state.

1. Limited Focus on Media Mix: The initiative has focused predominantly on laying optical fiber cable (OFC) routes, neglecting an optimal mix of media, including satellite, and other non-terrestrial networks (NTNs), which are essential for reaching remote and inaccessible areas.

2. Capital-Intensive Infrastructure: Building and maintaining fiber optic infrastructure requires substantial financial investment, which limits the project's scalability and sustainability, especially in rural and economically disadvantaged regions.

3. Infeasibility in Difficult Geographies: Many areas in India, such as hilly terrains and dense forests, islands present significant physical challenges for laying fiber optic cables and operational maintenance, making it difficult to establish reliable broadband connectivity in these regions.

4. Absence of GIS Mapping: The lack of Geographic Information System (GIS) mapping hampers accurate planning, monitoring, and execution of the network infrastructure, leading to inefficiencies and suboptimal deployment.

5. Right of Way Issues: Securing permissions for laying cables through various lands (public and private) involves complex legal and regulatory hurdles, causing delays and increasing costs.

6. Last-Mile Connectivity: Connecting the main network to the end users in rural and remote areas (last mile) is often challenging due to sparse populations and difficult terrains, leading to significant connectivity gaps.

7. Maintenance of OFC: The laid optical fiber cables require regular maintenance to ensure optimal performance, but inadequate maintenance can lead to frequent outages and degraded service quality.

8. Persistent Delays: Continuous delays in project implementation cause the technology used to become outdated, requiring frequent upgrades and resulting in increased costs and inefficiencies.

9. The optical Fiber cables are prone to frequent damage due to a large amount of infrastructure work (Road widening, gas pipelines/ electrical cables/ water pipeline laying) carried out by various national and state agencies. These OF cable also gets washed out due to natural calamities like Flash floods, landslides, snow etc.

10. Networks serving remote and rural areas are expected to have substantially higher costs in creating adequate terrestrial infrastructure and operations as well as low return on investment.

The Significance of the Space Sector in Broadband Connectivity

Satellite technology emerges as a transformative solution to bridge the digital divide plaguing rural India, especially in light of the challenges faced by initiatives like the BharatNet Project. While traditional terrestrial methods struggle with capital-intensive infrastructure and geographical barriers, satellite backhaul offers a feasible alternative. By providing ubiquitous connectivity to remote areas, satellite technology ensures network resilience and reliability, meeting the essential connectivity needs of rural communities.

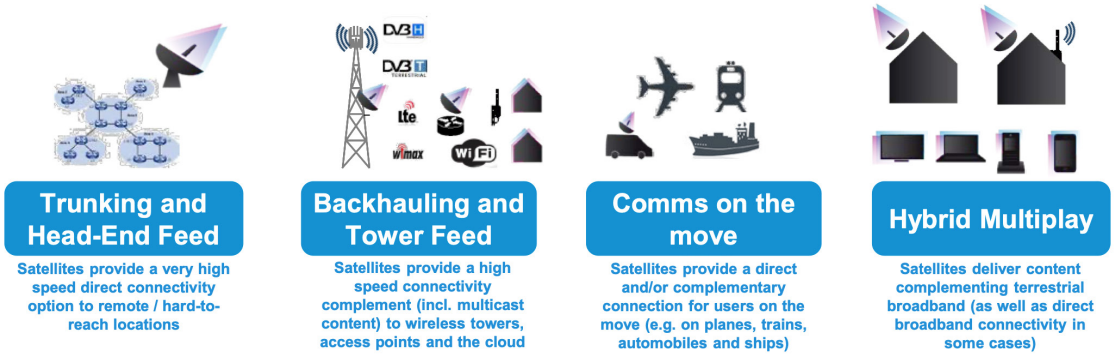
In addressing critical challenges such as agriculture, climate change, and internet accessibility, satellite communication emerges as a beacon of hope. Through its expansive reach, satellites facilitate remote sensing and data collection, empowering decision-makers to navigate agricultural landscapes, anticipate climate shifts, and allocate resources effectively. This invaluable data serves as the bedrock for informed decision-making in areas ranging from crop management to disaster mitigation.

Moreover, as the demand for reliable mobile communications grows, particularly with the evolution of 5G, satellite backhaul becomes indispensable in delivering cost-effective and wide-coverage mobile services. Recognized for its ability to overcome topographical barriers and complement terrestrial networks, satellites offer an essential technology mix for achieving comprehensive digital connectivity.

Recognising this, governments, industry leaders and associations have emphasized the need for an optimal mix of both terrestrial and non-terrestrial (NTN) technologies, including satellites, to achieve the vision of Digital India. Satellites offer wide coverage, complementing terrestrial networks, and are increasingly adopted by governments worldwide for rural connectivity. Given the extremely large cell sizes, satellite networks eliminate the need for terrestrial backbone and backhaul infrastructures and can speed up the pace. Additionally, satellite networks simplify network restoration and expansion, offering resilience, mobility, and security advantages. They can complement existing backhaul mechanisms, especially in remote areas, where they connect cellular base stations to the network, paving the way for an increased subscriber base and enhanced network coverage.

Use cases of satellite technology in delivering broadband services, particularly in remote and underserved areas

With the advancement in satellite technology (like High throughput satellites in GSO, low latency networks - MEOs and LEO Networks, satellites provide large bandwidth and higher data speeds which can cater to the requirements of the users for running high-speed data applications and for backhauling the 4G/5G/6G Mobile base-stations installed in rural/remote areas. The flat panel antennas at the user terminal to work with LEOs provide a simple and user-friendly installation and usage. Satellite technology offers versatile solutions for delivering broadband services in various scenarios, including:



1. Trunking and Head-end Feed: Satellite enables high-speed trunking of video, IoT data, and other content to a central site, facilitating further distribution to local cell sites. This ensures efficient data transmission and enables centralized management of content delivery.

2. Backhauling and Tower Feed: With satellite backhaul connectivity, individual cell sites receive high-speed data transmission, allowing for the aggregation of IoT traffic and multicast of content across large coverage areas. This ensures reliable connectivity for remote cell sites and efficient distribution of data.

3. Communications on the Move: Satellite technology provides high-speed backhaul connectivity to terminals on moving platforms such as planes, vehicles, trains, and vessels. This enables continuous communication and data transmission for passengers and operators,

supporting applications like video streaming, firmware updates OTA, and other non-video data transmission.

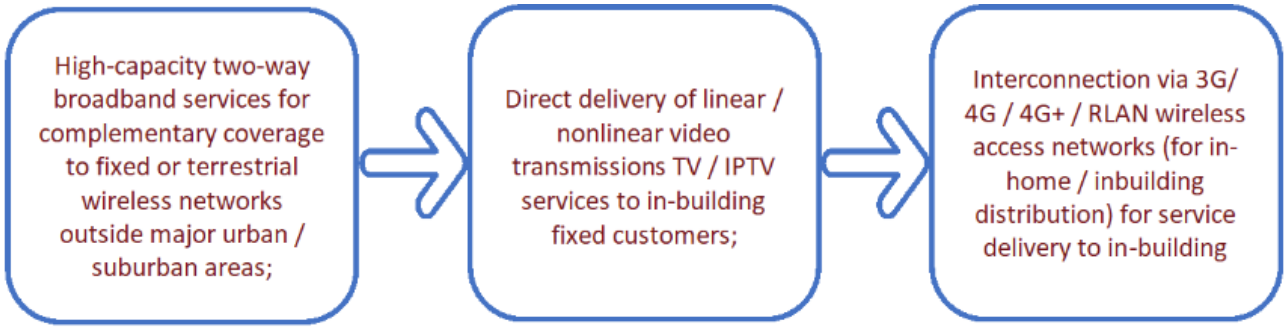
4. Hybrid Multiplay: Satellite broadband offers high-speed connectivity to individual homes and offices, supporting multicast delivery of content across large coverage areas. This enables efficient broadband connectivity and content distribution, including aggregated IoT data, enhancing user experience and network efficiency.

5. The TN and NTN integration offers great opportunities not only for reliable and global cellular coverage without any gaps but also to meet the full spectrum of anticipated future demands of 5G/6G networks such as devices on the move, M2M connections and Internet of Things (IoT) devices etc, which are proliferating in a large scale.

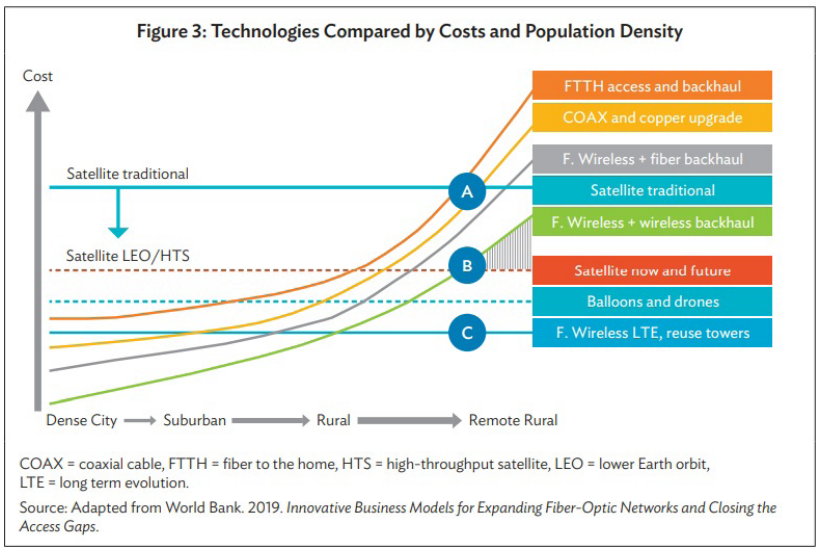
6. Load Balancing and Redundancy: By distributing network traffic between satellite and terrestrial links, operators can optimize bandwidth usage and ensure network reliability. During peak usage periods or in areas with high demand, satellite connections can offload traffic from terrestrial networks, reducing congestion and improving performance.

7. Disaster Management and Emergency Response: Satellite broadband plays a crucial role in disaster management and emergency response scenarios by providing resilient and rapidly deployable connectivity to affected areas.

Currently, Satellites can deliver very high data (> 100 Mbps – 1 Gbps) in broadcast mode to outdoor radio access points



Cost-benefit analysis



The burgeoning demand for next-generation high-throughput satellites (HTS) in the APAC region is poised to revolutionize cost structures, rendering satellite connectivity increasingly competitive. Forecasts indicate that satellite broadband will emerge as a dominant segment, constituting 50%–70% of total demand. The advent of high-throughput satellites is expected to provide an immediate and sustainable boost to rural businesses' competitiveness, fostering permanent transformations in rural areas and substantially meeting communication needs by 2027. The National Digital Communications Policy (NDCP) of 2018 advocates simplifying compliance requirements for VSAT operators and rationalizing charges related to satellite transponder, spectrum, and WPC. The deployment of satellite Very High Throughput Satellites (VHTS) and Ultra High Throughput Satellites (UHTS) is poised to confer significant cost advantages.

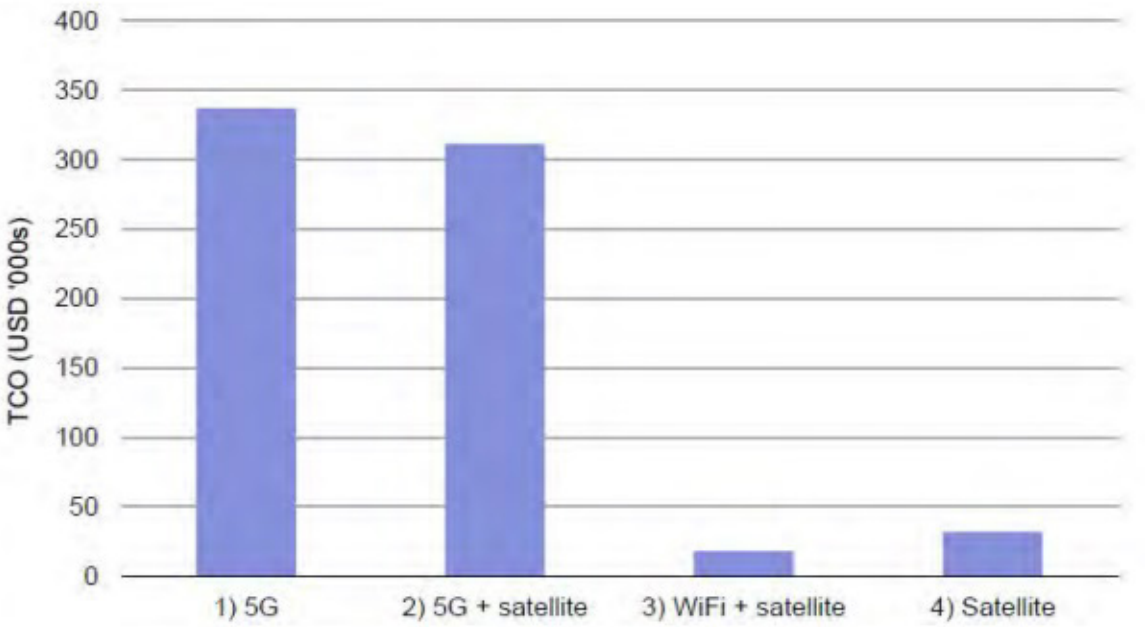
Satellites can provide feasible connectivity in challenging geographies like the mountainous Himalayan region and remote areas of Ladakh or Andaman and Nicobar Islands. Satellite backhaul can quickly enhance a network's capability to handle ever-growing data traffic. The technology can also be used to provide the internet on oceans and it is believed to be the most reliable cost-effective network in the unfortunate occurrence of a natural disaster.

Trade-offs between Wireless, Fixed, and Satellite Backhaul Deployments

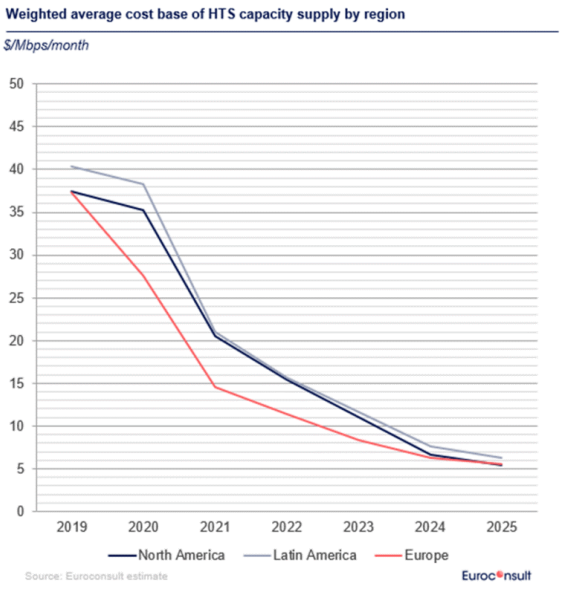
Considerations	Terrestrial Wireless	Fiber Optic	Copper	Satellite
Deployment Cost in Rural Areas	High	High	Medium	Low
Interference Risk	High	Low	Low	Medium
Coverage	5-30 km	<80 km	<15 km	Unlimited
Expediency of Deployment	Days to Weeks	Months to Years	Months to Years	Weeks
License Requirements	Yes	No	No	No
Mobile Connectivity	Medium	-	-	High
Reliability	Medium to High	High	Medium	High

It costs ten to twenty times more to connect the last 10-20% of the remote and distant population through terrestrial technologies as compared to that using satellite. The cost of the roll-out of terrestrial technologies increases exponentially with the degree of remoteness. Satellite-based broadband is most suited for such topographies," says the **ICRIER report.**

Satellite + Wi-Fi is Cheaper than Terrestrial 5G



The price for satellite bandwidth has been decreasing and this is likely to come down even further, enhancing the appeal of satellite communication technology to provide connectivity in rural areas. The price of satellite bandwidth for data services has dropped 77% over five years due to greater availability of launches and satellite constellations disrupting the market according to Euroconsult analysis 2024.[28]

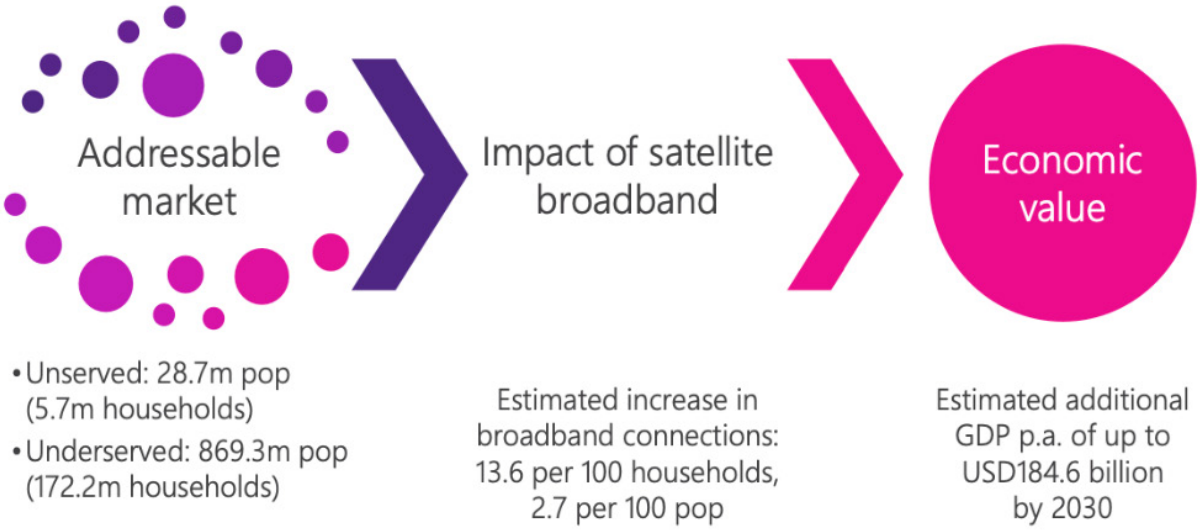


[28]https://spacenews.com/global-satellite-capacity-prices-tumble-in-starlinks-wake/

The average cost of supplying HTS capacity in North America has plummeted from around $40 a month per Mbps in 2019 to about $12 in 2023, according to Euroconsult.

A combination of terrestrial and satellite communication technologies can be used to ensure world-class broadband to people from all sections of society for the overall social and economic growth of the country.

Potential economic benefits of increased satellite broadband penetration on GDP growth



Globally, in the last two years, the launch of mega satellite constellations has seen a massive surge, and the race for satellite broadband has been one of the key reasons. As per a global report, it is estimated that an increase in broadband adoption in India as a result of satellite coverage in unserved and underserved regions will contribute USD72.0-184.6 billion to the national GDP by 2030.[29]

Moreover, satellites play a crucial role in various sectors, including broadcasting, finance, and governance, contributing to economic growth. In India, the satellite-enabled broadcasting industry alone serves 900+ channels to 21 crore households, providing employment to 1.83 million people. Additionally, satellite technology facilitates over 5 billion ATM transactions annually, supports rural connectivity, and automates critical services like e-governance and gas station operations.

The Government of India has initiated substantial reforms in the space sector to drive innovation and attract investment, aiming to propel the space economy forward rapidly. Currently valued at $8.4 billion, the Indian Space Economy is poised for significant expansion, with projections indicating a potential growth to $44 billion by 2033 through the implementation of the Indian Space Policy 2023.[30] These reforms encompass various measures such as permitting New Space Entities (NGEs) to undertake end-to-end activities, establishing IN-SPACe to oversee private participation, introducing supportive schemes, issuing new geospatial guidelines and policies, and amending the Telecommunications Act 2023 for administrative

[29]https://plumconsulting.co.uk/expanding-digital-connectivity-through-satellite-broadband-in-the-28-ghz-band/
[30]https://www.investindia.gov.in/team-india-blogs/next-frontier-analyzing-indias-focus-space-technology#:~:text=India's%20space%20economy%2C%20valued%20at,critical%20role%20in%20realising%20this.

spectrum assignment for space-based services and Foreign Direct Investment (FDI) Policy on Space Sector. The objective is to foster a vibrant space ecosystem, ensure regulatory clarity, and attract both domestic and foreign investment across satellite manufacturing, operations, and associated sectors.

Given reforms and the impact and current trends in the space sector as quoted by Dr Jitendra Singh, the Union Minister of State (Independent Charge) Science & Technology; MoS PMO, Personnel, Public Grievances, Pensions, Atomic Energy and Space in Dec 2023 and March 2024 are summarized as under:

· Private companies are exploring satellite-based communication solutions. Private players are increasingly participating in space-based applications and services.

· Satellite integration and testing facilities are coming up in the private sector.

· The local manufacturing of the satellite subsystems and Ground systems is being taken up by the private sector.

· Indian private space companies are increasingly entering into collaborations and partnerships with international space organizations and companies.

The proactive approach of the government in policy implementation reflects a commitment to leveraging space technology for national development, fostering innovation, and bridging the gap between governmental vision and private sector capabilities.

However, unlocking the full potential of satellite technology depends on effective policy implementation, supportive ecosystems for startups and established players, and seamless collaboration between government entities and private stakeholders. Similar to the evolution of mobile technology, satellite technology requires robust support and policy interventions to proliferate successfully and drive economic growth.

Satellite Spectrum Assignment India

In India, recent strides in the satcom sector are strongly influenced by evolving regulatory and policy frameworks. Secretary Abhay Karandikar of DST highlights the significance of the new Telecommunication Act, which opens avenues for spectrum allocation, thereby catalyzing a revolution in the satcom industry.
The ITU World Radiocommunication Conference 2023 (WRC-23), held in Dubai, marks a significant moment for the satellite industry globally with landmark decisions aimed at reshaping satellite services. Recognizing the dynamic nature of the satellite sector, WRC-23 embraced new satellite applications and emerging technologies with a stable regulatory environment globally, ensuring efficient access to the spectrum. This positive shift is set to have a profound impact on the satellite sector, fostering growth and prosperity across populations. This is particularly significant for India's satellite broadband future and aligns with the country's goals to enhance connectivity, support digital transformation, and bridge the digital divide across urban and rural areas.

It is also imperative to underscore the importance of safeguarding key SatcCom bands for satellite services.

The growing demand for spectrum from competitors, especially IMT elevates the risk of spectrum shortage and also the need for securing the limited spectrum bands for satellite systems. This could impede the growth of satcom services, which have already garnered substantial investments from the industry. Thus, band allocation strategies must prioritize the protection of services both in-band and adjacent bands, ensuring optimal performance through appropriate spacing.

While the National Digital Communications Policy (NDCP) 2018 provides a forward-looking blueprint for satellite communication, the government's efforts to refine space policy and authorisations and satellite spectrum assignment regulations are pivotal in this regard.

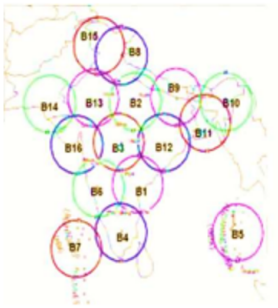
Total Satellite Bandwidth Capacity over India

In addition to regulatory enhancements, it's crucial to recognize that there's an abundance of available bandwidth in India's satellite spectrum. Leveraging this resource requires fostering an environment conducive to collaboration between domestic and international satcom operators. Facilitating an ease of doing business ecosystem would encourage partnerships and the sharing of resources. By embracing collaboration, India can maximize the utilization of its satellite spectrum, fueling innovation and driving economic growth in the satcom sector. This approach not only benefits the nation's technological advancement but also enhances connectivity for its citizens, businesses, and institutions, both within the country and globally.

SIAINDIA Satcom Industry Association

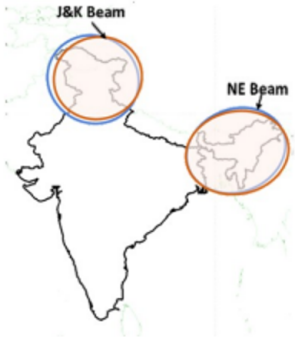
Bandwidth Capacities powered by ISRO satellites

GSAT-11



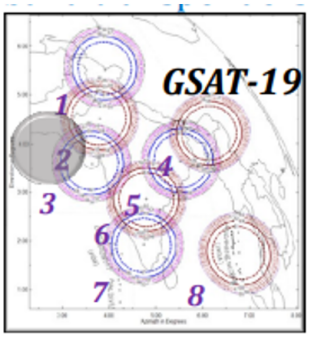
- 16 Gbps throughput
- 32 user beams
- 4 Gateways
- Ku User beams
- Located at 74° East

GSAT-29

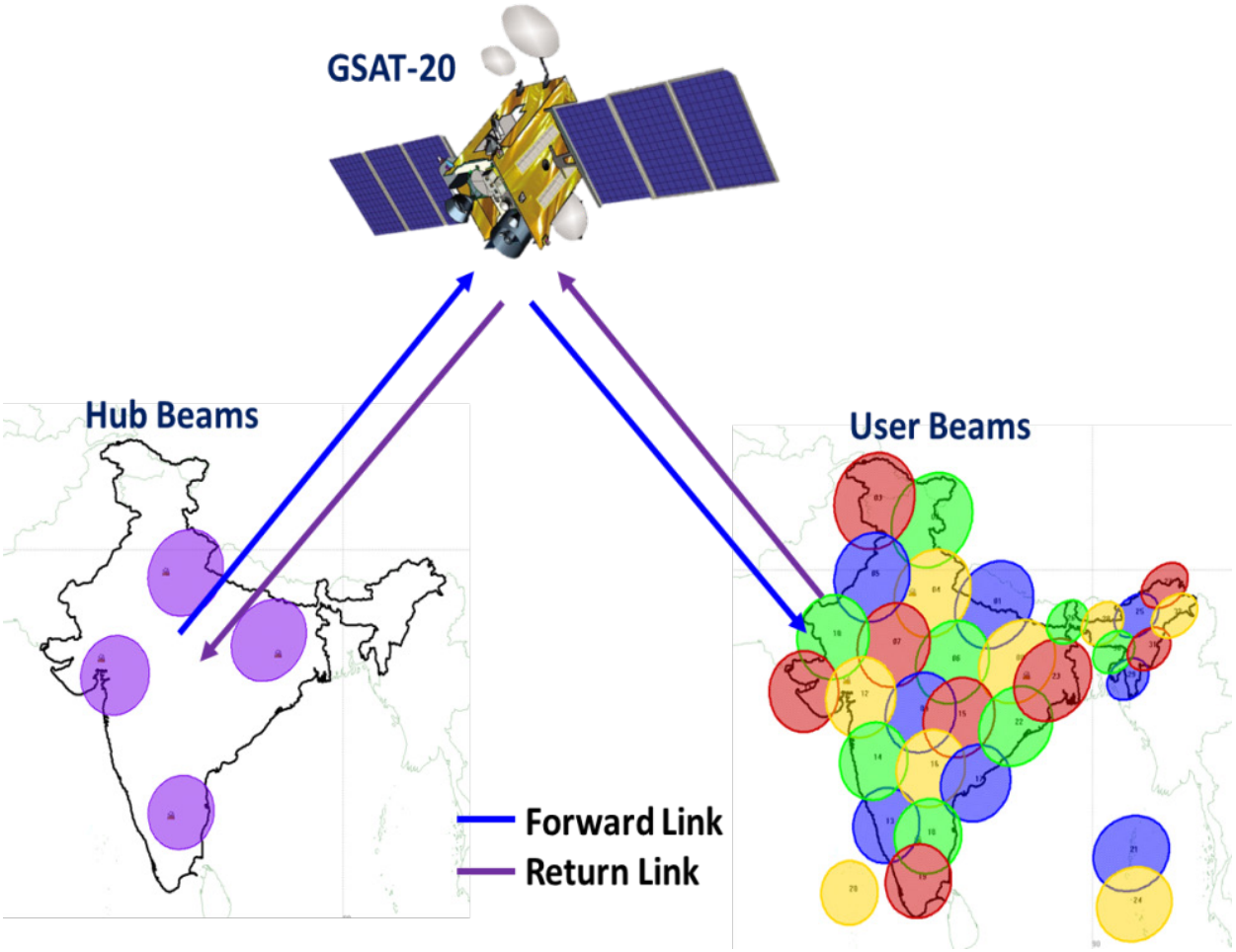


- 5.5 Gbps throughput
- 10 user beams
- 4 Gateways
- Ku+Ka User beams
- Located at 55° East

GSAT-19



- 2 Gbps throughput
- 8 user beams
- 2 Gateways
- Ku+Ka User beams
- Located at 48° East



The total satellite bandwidth capacity over India encompasses a comprehensive array of satellite resources, each contributing to the nation's communication infrastructure. Integral to this network are several key satellites, including GSAT-11, GSAT-29, GSAT-19, and GSAT-20, each offering unique capabilities tailored to different regions and requirements. GSAT-11, positioned at 74^0 East, boasts a substantial throughput of 16 Gbps across 32 user beams, while GSAT-29, located at 55^0 East, provides 5.5 Gbps throughput through 10 user beams. Similarly, GSAT-19, positioned at 48^0 East, contributes an additional 2 Gbps throughput across 8 user beams. The groundbreaking GSAT-20, India's first Ka-Band High Throughput Satellite, significantly bolsters the network with a whopping 48 Gbps throughput, facilitated by a combination of 32 user spot beams, including 24 wide and 8 narrow spot beams, along with 4 hub stations on the Indian Mainland.[31]

Moreover, GSAT-20 is designated to allocate special high-capacity and high-power resources specifically to address the critical connectivity needs of the North-East region. ISRO has revised the original configuration of GSAT-20 to better meet these requirements, tailoring the satellite's capabilities to provide enhanced and reliable service in this geographically challenging area. Complementing these indigenous satellites are foreign satellites such as Intelsat 33e and SES-12, adding a combined total of 2273 MHz in capacity. Collectively, these satellites maximize capacity and coverage over India, playing a crucial role in facilitating communication, connectivity, and technological advancement across the nation.

[31]https://www.thehindu.com/sci-tech/science/isros-commercial-arm-to-launch-gsat-20-satellite-on-spacexs-falcon-9-in-2024/article67700823.ece

Government Initiatives to Promote Satcom in India

High Capacities Summary over India
(Now->1 year : till end-23)

	Satellite Type |Name]	Name	Operated By	Available timeline India	India Capacity	NE Capacity
N	GEO	GAT-29(Ku)	ISRO	Now	2Gbps	1Gbps
O	GEO	GSAT-11(KuÀ	ISRO	Now	16Gbps	3Gbps
W	GEO	GAT-19(Ku)	ISRO	Now	2Gbps	0.5 Gbps
	GEO	GAT-2(Ka)	ISRO	Now	3.5 Gbps	2Gbps
	GEO	Intelsat 33e	(Ku) Intelsat	Now	2 Gbps	0.5 Gbps
	GEO	IPStar (Ku)	Thaicom	Now/End-life 6Gbps	6 Gbps	1.5 Gbps
	GEO	K1- Ka	Kacific	Now	2Gbps	640Mhz
	GEO	AM 7-Ku	Intersputnik	Now	216 Mhz	0
2	LEO	OneWeb (Ku)	OneWeb	Q3-23	15 Gbps	3 Gbps
0	GEO	GSAT-20(Ka)	ISRO	Q4-23	48 Gbps	16 Gbps
2	GEO	SES-12(Ku)	SES	Q2-23	3 Gbps	0.5 Gbps
3	LEO	Starlink(Ku)	SpaceX	Q3-23	25 Gbps	5Gbps
	MEO	SES mPower(Ka)	SES	Q4-23	6 Gbps	1.5 Gbps
	Available In India	**126.7 Gbps**		**Total Unused capacity**		**30 Gbps**

- As per industry information
- There is more capacity available on Satellites like ABS, AMOS etc if the BSS bands are opened for use and this will bring the satellite capacity costs further down as more the capacity available the lower the price will be .

The India Space Policy 2023, Telecommunications Act 2023, Standardization of Space Industry, and FDI Liberalization Policy 2024, represent significant milestones for India's space sector. These frameworks provide a solid foundation for space activities, fostering an environment conducive to investment, research, and technological advancement.

India Space Policy 2023: Facilitates entry for domestic and foreign entities by establishing well-defined rules for licensing, safety standards, liability, and intellectual property rights.

IN-SPACe Norms Procedures Guidelines (NGP) for authorizing space activities, including space-based communications and orbital resource utilization. It states that only Indian entities can apply for IN-SPACe authorization; non-Indian entities must apply through an Indian entity, such as a subsidiary or joint venture. Authorized representatives of non-Indian entities can seek authorization for specific categories like non-Indian GSO/NGSO satellites for communication services or space-based earth observation data dissemination.

FDI Liberalization: Permits 100% FDI in manufacturing essential satellite components and significant allowances for satellite manufacturing and launch vehicle operations. Welcomes foreign companies to invest in and collaborate within India's space sector, positioning India as a pivotal hub for global space activities.

This expansion into international markets can benefit Indian startups by granting access to a broader customer base and international partnerships.

Foreign OEMs can partner with or invest in Indian companies, facilitating technology transfer to enhance the capabilities of Indian space companies.

Market Segments with Greatest Potential for Growth:

- Rural Connectivity: Initiatives to bridge the digital divide by providing internet access in remote areas.
- Backhaul Services: Satcoms complement cellular network extensions, especially in regions lacking terrestrial infrastructure.
- Broadcasting: Leveraging satellite technology to distribute content widely.
- Broadband Services: Extending high-speed internet to underserved locations.
- Other Growing Sectors: Defence, airlines, maritime operations, enterprise connectivity, and satellite-based Internet of Things (IoT) are gradually integrating satcom capabilities to enhance operational efficiency and connectivity.

Additionally, enhanced satellite capabilities are revolutionizing disaster management efforts, minimizing human and economic losses through precise forecasting and efficient emergency response. In regions where traditional connectivity fails, such as war zones or during natural disasters, satellite technology proves indispensable, often being the sole reliable technology for communication and strategic operations.

G20 Space Economy Leaders Meeting: Organized under India's G20 presidency by the Department of Space to discuss the space economy. Recognizing the increasing number and diversity of players in space, leaders stressed the importance of bilateral and multilateral partnerships involving the space agencies, industries and academia and also encouraged all space-faring nations to promote international cooperation and capacity building in support of the space-aspiring nations.

Development of GSAT 20: GSAT-20, set for launch in the second quarter of 2024, represents a pioneering advancement in India's satellite technology. Designed to operate in the Ka-band spectrum, this satellite aims to significantly enhance broadband connectivity across the country. It will play a crucial role in supporting various sectors including In-Flight and Maritime Connectivity (IFMC), as well as providing robust cellular backhaul services.

Digital India and National Broadband Missions: Integration of satellite solutions to complement existing initiatives aimed at digital inclusion and broader connectivity.
Public-Private Partnership (PPP) Models.

National Emergency Telecommunication Plans (NETPs): ITU has released new guidelines for National Emergency Telecommunication Plans (NETPs) and related contingency strategies, highlighting the pivotal role of satellite communication in disaster management and emergency telecommunications. Advanced satellite-enabled connectivity is expected to catalyze a digital revolution, potentially saving lives and reducing emergency-related GDP expenditures significantly.

Sustainable Development Goals (SDGs): Satellite connectivity plays a crucial role in advancing the UN SDGs by supporting education, healthcare, and socio-economic development.

development. Space technologies are instrumental in monitoring climate change and natural resources, thereby contributing to sustainable growth. India is steadfastly integrating these technologies to align with SDGs, ensuring progress towards global development targets.

Case studies highlighting the impact of satellite broadband on GDP in other countries

Country	Satellite Project	Impact on GDP
Indonesia	SATRIA	Expected to provide broadband internet service to over 149,400 unserved public service points, including schools, village offices, and health facilities, contributing to economic growth through improved connectivity.
Japan	UDcast collaboration with JSAT Corp.	Bringing satellite IP-based communication to small islands and rural areas, enhancing connectivity and fostering economic growth in regions where optical fiber is not available.
Australia	Sky Muster satellites	Providing NBN services to locations outside the reach of other technologies, contributing to economic development and connectivity.
Burkina Faso	Hybrid communication network with satellite and OFC	Creating a significantly faster, broader, and more reliable communications network, supporting economic growth in this landlocked nation.
Greenland	Satellite-enabled network	Replacing unreliable relay radio towers with fast and reliable satellite connectivity, improving access to communication services in remote communities and contributing to economic development.
Switzerland	Ka-band satellite	Providing reliable, high-throughput broadband to rural households, enhancing connectivity and supporting economic development in rural areas.
Malaysia	Satellite broadband	Bridging the digital divide and enabling remote broadband connectivity with 300,000 broadband connections nationwide, contributing to economic growth and transforming the lives of unserved communities.
Other		Across Philippines, Vanuatu, Papua New Guinea, Solomon Islands, Indonesia etc Satellite solutions are deployed to target immediate connectivity to hundreds of high priority locations such as schools, colleges, hospitals etc. without waiting for the delay associated with fiber roll-out.

SIA-India's Role and Way Forward

SIA-India is a non-profit organization representing the interests of the space industry in India. Our membership includes satellite operators, manufacturers, suppliers, startups, academic institutions, and law firms. The association is committed to serving as a voice for the industry and representing the industry's interests at policy making and regulatory bodies. SIA-India also offers a platform to forge international collaborations and provides an interface with the government.

Strategies for collaboration between SIA-India and government agencies to accelerate broadband deployment are crucial for leveraging the expertise and resources of both sectors. SIA-India's extensive network within the satellite industry, including operators, manufacturers, academia, and global associations, positions it as a valuable partner in advancing India's broadband mission and facilitating the implementation of 5G/6G technologies.

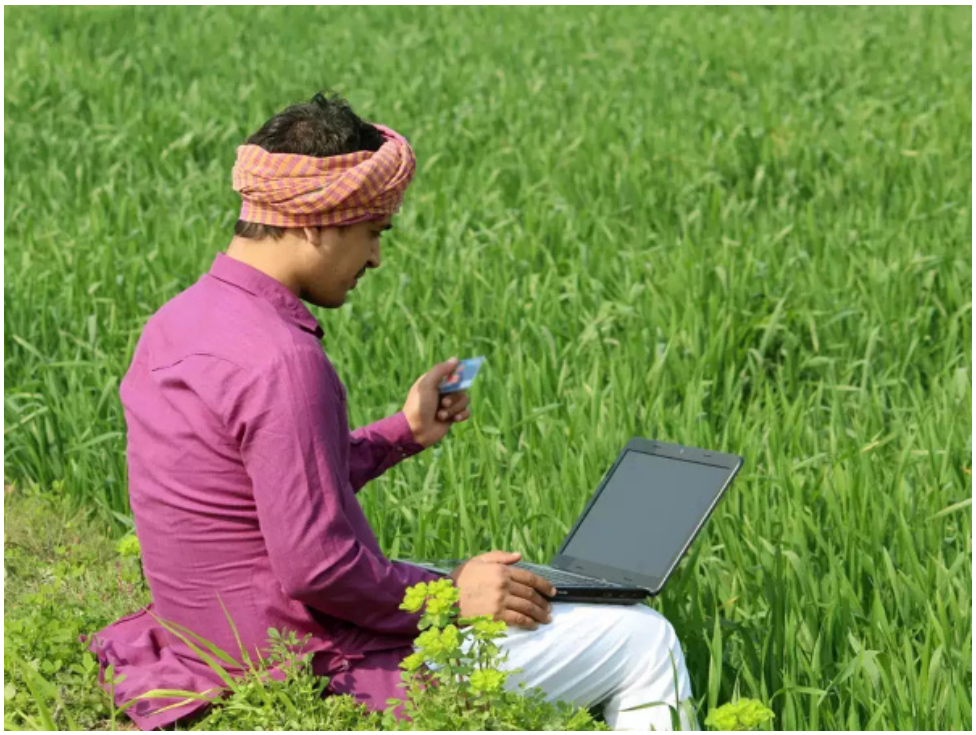
Recognized as a leading industry association, SIA-India serves as a platform for stakeholders to collaborate and enhance synergy within the satellite ecosystem. With strong affiliations with national and international bodies, including regulatory and policymaking institutions like the ITU and 3GPP, SIA-India plays a pivotal role in representing the interests of the satellite industry. Additionally, SIA-India has actively engaged with government agencies, DoT [Regional levels as well], TRAI, including the Prime Minister's Office, through various submissions, highlighting the importance of satellite infrastructure for achieving broadband connectivity goals. This collaborative approach fosters innovation, scalability, and sustainability in India's space sector, ultimately contributing to the nation's technological advancement and economic growth.

Key Recommendations

Recommendation Description

Technology Neutrality	India's Broadband Policy must focus on an optimal mix of technologies. Satellites are the only connectivity option for many rural and remote communities in India. The BharatNet program should increase satellite addressable sites from the estimated 7,000 to approximately 37,000 to ensure quick coverage.
Satcom to be complimentary to Terrestrial	Satellite communication services will play a crucial role in complementing terrestrial mobile networks, esp within the 5G/6G ecosystem. This integration will utilize GEOs (Geostationary Equatorial Orbit), MEOs (Medium Earth Orbit), and LEOs (Low Earth Orbit) to form a mesh of integrated technology networks designed to work in conjunction with Wi-Fi and other terrestrial technologies to enhance connectivity and coverage globally.
Government and Industry Collaboration	Need collaboration between government and private sectors to expand satellite capacities in large scale, and promote initiatives like BharatKaSatcom with GSAT 20 like Fiber First initiative
Conducive Policy Support	It is urgent to promote the use of satellite communication technologies through policies and regulations that encourage their adoption, and by providing incentives for companies to invest in satellite infrastructure and services. To increase digital accessibility in rural areas, taxes, levies, GST, spectrum usage charges and any other government-collected fee should be done away with, especially for rural connectivity via satellite.
Spectrum Policy	The Spectrum policy should align with the ITU-designated frequency spectrum usage for the ITU region, promoting global harmonization of the spectrum for space activities. Protect existing satellite investments from harmful radio frequency interference.
Shared Spectrum Use	Administrative licensing of satellite spectrum is a global best practice and should be allowed in India. Since satellite spectrum is shared between multiple service providers, its use is naturally suited for administrative assigning, hence, should be assigned based on a transparent administrative process.
USOF Utilisation	Portion of the unutilized USOF fund could be allocated for satellite services to improve connectivity and bridge the digital divide in rural/remote areas of the country. Licensed VSAT operators need to be allowed to bid for USOF funding, similar to telecom service providers, in areas where other modes of connectivity are not available.
Optimum utilisation of Satcom Capacities	Optimum utilisation of available and planned satellite capacities in India can bring down the costs and speed up connectivity
IFMC Policy	Quickly advance the IFMC ecosystem by addressing issues such as high implementation, making policy recommendations, creating a favorable investment environment, and improving the flight and maritime connectivity experience for end-users

Conclusion



Source - https://brandequity.economictimes.indiatimes.com/tag/rural+india

Satellite communications adoption in India is steadily evolving, driven by various essential service sectors recognizing the unique advantages of satcoms in achieving extensive and reliable communication coverage. From Disaster Management agencies utilizing satcoms for real-time information exchange during emergencies to Rural Connectivity initiatives bridging the digital divide in remote areas, and from Backhaul services complementing cellular networks to Broadcasting sectors distributing content widely, the diverse applications of satcoms are reshaping India's communication landscape. While some sectors like Defence, Airlines, Maritime operations, Enterprise connectivity, and Satellite-based Internet of Things (IoT) are in the nascent stages of integrating satcom capabilities, their gradual adoption underscores the emerging role of SatCom in addressing both immediate needs and strategic long-term deployments.

The convergence of terrestrial and satellite technology, driven by significant growth and innovation in 2024, is poised to revolutionise global connectivity at an unprecedented level.

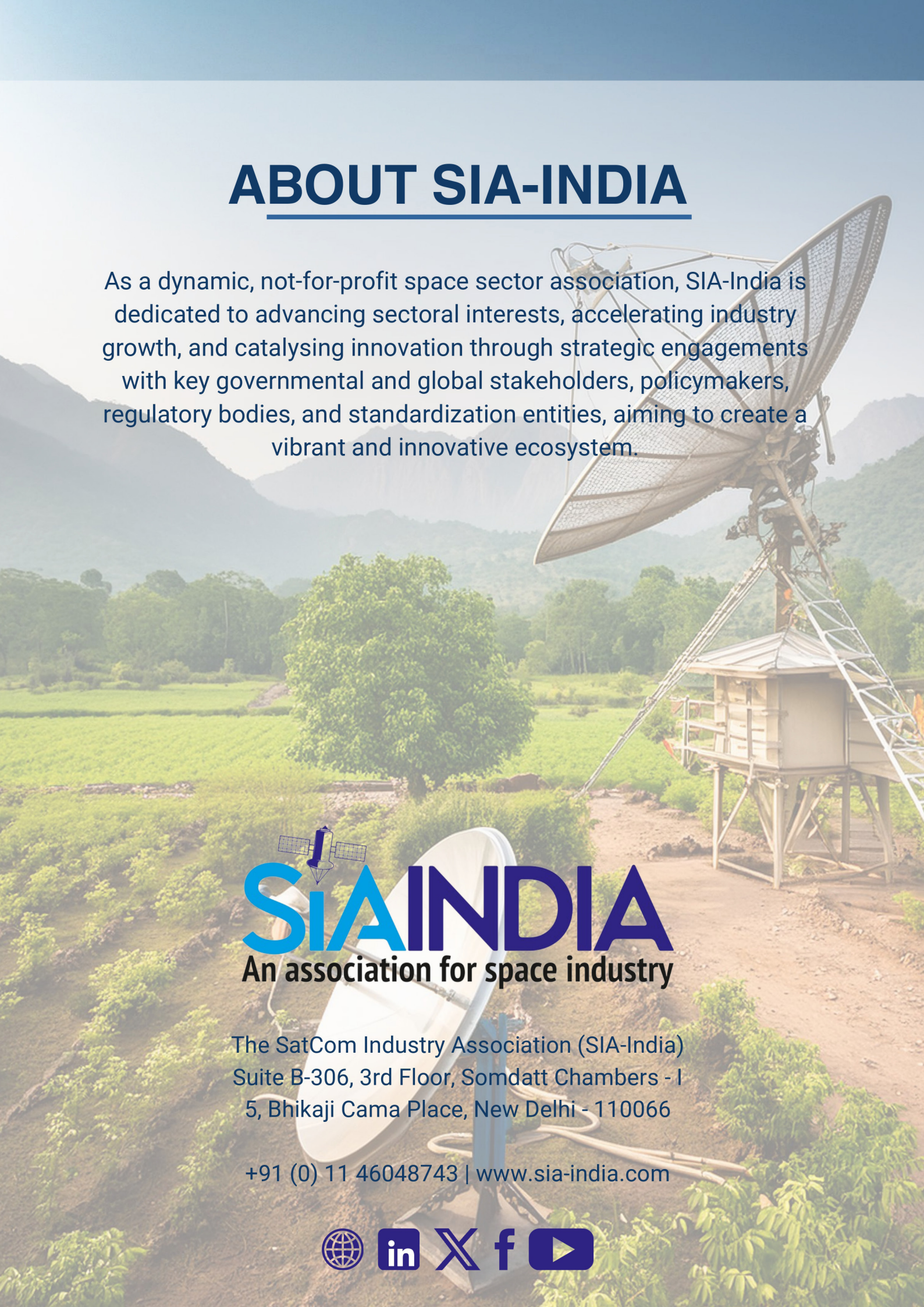
Satellite technology plays a critical role in bridging the digital divide in India, offering versatile solutions for delivering broadband services, especially in challenging geographies where traditional methods falter. Through trunking, backhauling, and communications on the move, satellites ensure reliable connectivity to underserved populations, potentially contributing significantly to India's GDP growth by fostering economic development and supporting vital sectors.

Policy interventions are crucial to promoting satellite technology adoption and encouraging private sector participation. While initiatives like the National Digital Communications Policy and reforms in the space sector are steps in the right direction, concerted efforts are needed to unlock the full potential of satellite technology. Collaboration between government agencies, industry stakeholders, and associations is essential to accelerate broadband deployment effectively and bridge the digital divide. By leveraging satellite infrastructure and embracing innovative solutions, India can realize its vision of universal broadband access and propel its journey towards a digitally inclusive society and a thriving knowledge economy.

In conclusion, the future of SatComs in India holds immense promise, offering significant advancements in the nation's socio-economic objectives through comprehensive connectivity. Satellite technology requires similar support and policy intervention as cellular mobile technology received 25 years ago to proliferate successfully in the country, ensuring its vital role in India's digital transformation.

ABOUT SIA-INDIA

As a dynamic, not-for-profit space sector association, SIA-India is dedicated to advancing sectoral interests, accelerating industry growth, and catalysing innovation through strategic engagements with key governmental and global stakeholders, policymakers, regulatory bodies, and standardization entities, aiming to create a vibrant and innovative ecosystem.



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