

M.A. Space and Telecommunications Law

NALSAR University of Law

Hyderabad India.

Telecommunication Laws in India
Contemporary Issues and Challenges
Dr. Mohanavelu

ONLINE LECTURE PROGRAM

Date: 24-08-2023

Time: 9:00-11:00 Hrs

NALSAR University of Law Hyderabad India.

Lecture Topic: Telecom Industry in India Contemporary Issues and Challenges (Telecommunication Laws in India)

**Date: 24-08-2023
Time: 9:00-11:00 Hrs**

Speaker: K S Mohanavelu

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I also want to clarify that short falls in this paper, if any are entirely due to me.

K S MOHANAVELU

Contemporary Issues and Challenges

(Telecommunication Laws in India)

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**Various Telecom Issues Addressed in the Draft Indian
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**Contemporary Issues and Challenges may arise due to
factor such as Customer Protection, Service Requirements,
Policy, Regulations, Operations, Technology and Security.**

Contemporary Issues and Challenges

(Telecommunication Laws in India)

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The following points are given for studies / analysis:

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ARPU and Tariff for Mobile Services

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Telecom Industry -Contemporary Issues and Challenges

Introduction

- **Telecom Industry is a vast field; Indian Telecom Industry serves more than 1 Billion People; Important for National Socio-Economic Development;**
- **Need to be people or Citizen oriented**
- **Presently mobile phones: 1.2 billion; broadband users: >800 million**
- **Wide range of infrastructure like Wireless Networks, Optic Fibre Networks, Satellite Services, etc.**
- **Many New Emerging Services and Technologies like 5G, LEO Satellite Technology, IOT,**
- **M2M, Cloud, etc.**
- **Infrastructure is capital intensive – Needs Optimum and Efficient Use**
- **Industry faces challenging situations in Spectrum Allocation and Management**
- **Need of the Hour: Free and Open Market Conditions for using Satellite and Mobile**
- **Technologies ensuring Competition and avoiding Monopoly**
- **Policy, Regulations and licensing Regime must be enabling Factors - But Requires Constant Reviews and Reforms**
- **Policy to set immediate, medium term and long term goals and objectives**
- **TSP - Quality of Service to be ensured**
- **Industry to trigger Business and Job Opportunities**
- **Telecom Industry to influence and prepare the country and its citizens for the future**

Telecommunications Industry

Local Manufacturing and Value Addition Challenge

Local Manufacturing and Value Addition

National Digital Communications Policy 2018

<https://dot.gov.in/sites/default/files/EnglishPolicy-NDCP.pdf>

- Promoting research & development in Digital Communication Technologies
- Establishing Centres of Excellence including in Spectrum Management, Telecom Security and Next Generation Access Technologies
- Establishing India as a global hub for cloud computing, content hosting and delivery, and data communication systems and services
- Leveraging Artificial Intelligence and Big Data
- Promoting Start-ups and SMEs
- Local Manufacturing and Value Addition - Maximising India's contribution to global value chains, by focussing on domestic production, increasing exports and reducing the import

Telecommunications Industry
Local Manufacturing and Value Addition
Local Manufacturing and Value Addition
National Digital Communications Policy 2018
<https://dot.gov.in/sites/default/files/EnglishPolicy-NDCP.pdf>

Indian Telecom Network is the second largest in the world. But Indian industry role may not be significant in adding in the value chain.

Multi National Corporates like Intel, IBM, CISCO, etc operate in India and contribute in the fields of Telecommunications.

Foreign Vendors Dominate in the Indian Telecom Industry in the areas of Mobile, Phone Manufacturing Wireless Infrastructure/Equipment Manufacturing IT Products and Services.

Government wants Indian public and private sectors to add value and contribute. There is a need to conduct in-depth studies to explore the way forwards. Some initial information is given for undertaking such studies.

Telecommunications Industry Local Manufacturing and Value Addition

Telecommunications Engineering Centre (TEC):

TEC is the Technical Wing of DOT.

TEC Mission is to:

Develop new specifications and update the existing ones in order to keep pace with the global development. Establish state-of-art telecom laboratories.

Actively participate in professional bodies such as International Telecommunication Union (ITU), Internet Engineering Task Force (IETF), Asia Pacific Telecommunity (APT) etc. to protect country's interest.

Technology approval for Centre for Development of Telematics (C-DOT) in order to develop telecom technology aimed specifically for local manufacturer.

Telecommunications Industry

Local Manufacturing and Value Addition

Telecommunications Consultants India Limited

TCIL

TCIL was set-up on 10.03.1978 with the main objective of providing world class technology in all fields of telecommunications and information technology to excel in its operations in overseas and in the domestic markets by developing proper marketing strategies, to acquire state of the art technology on a continuing basis and maintain leadership.

TCIL has diversified into Cyber Parks, Intelligent Buildings, Cyber & Smart Cities and upgrading legacy networks by focusing on Broadband Multimedia Convergent Service Networks,

TCIL entering new areas of IT as systems integrator in Telecom billing customer care value added services; e-governance networks and Telecom fields by utilizing TCIL's expert technical manpower, developing Telecom and IT training infrastructure in countries abroad and aggressively participating in SWAN and IT-education projects in various States

Telecommunications Industry

Local Manufacturing and Value Addition

Centre for Development of Telematics

C-DOT of DOT

C-DOT is an autonomous telecom research & development body funded by the DoT.

C-DOT was established under the Society Registration Act XXI in 1984 to design and develop indigenous switching technology.

C-DOT is presently engaged in developing state-of-the-art telecommunication technology to meet the needs of the Indian telecommunication network.

C-DOT is involved in research and development (R&D) activities as well as in field implementation of technologies developed by C-DOT.

Telecommunications Industry

Local Manufacturing and Value Addition

Indian Space Research Organization - ISRO

<https://www.isro.gov.in/SatelliteCommunication.html>

Satellite Communication utilisation has become wide spread and ubiquitous throughout the country for such diverse applications like Television, DTH Broadcasting, DSNG and VSAT to exploit the unique capabilities in terms of coverage and outreach. The technology has matured substantially over past three decades and is being used on commercial basis for a large number of applications. Most of us are touched by satellite communication in more ways than we realise.

The potential of the technology for societal applications continue to fascinate ISRO and efforts are on to leverage the benefits of technology to the betterment of mankind. Important initiatives pursued by ISRO towards societal development include Tele-education, Tele-medicine, Village Resource Centre (VRC) and Disaster Management System (DMS) Programmes. The potential of the space technology for applications of national development is enormous.

Telecommunications Industry

Local Manufacturing and Value Addition

Tech Mahindra

<https://www.techmahindra.com/en-in/communication/>

Tech Mahindra has built pioneering systems, processes, and solutions, for enterprise clients across the globe. Sitting at the intersection of change, it's time to deliver the future of industries.

Building Integrated Customer Experiences in the Telco Space

With an array of service offerings for Communication Service Providers (CSPs), Telecom Equipment Manufacturers (TEMs) and Independent Software Vendors (ISVs), Tech Mahindra is a chosen transformation partner for several leading wireline, wireless and broadband operators in Europe, Asia-Pacific and North America.

Tech Mahindra offerings are based on 3 Mega Trends:

5G Revolution Customer of Tomorrow Telco Media Convergence

Telecommunications Industry

Local Manufacturing and Value Addition

Infosys



<https://www.infosys.com/industries/communication-services/overview.html>

Telecommunications Industry Local Manufacturing and Value Addition

Tata Consultancy Services

<https://www.tcs.com/what-we-do/services/cognitive-business-operations/solution/communication-services>

TCS SOLUTION

"TCS Communication Business Operations spans the value chain of communication service providers, consumers, and enterprises based on managed services and outcome-based operating and commercial models.“

TCS addresses the areas of Service Fulfilment, Service Management, Network Management, and Billing and Revenue Assurance.

TCS leverages Digital—Social, Mobility, Analytics, Cloud, and Automation—across the telecom value chain.

TCS designs, enables, and executes business operations services for telecom service providers and equipment vendor enterprises.

Various Telecom Issues Addressed in the Draft Indian Telecommunication Bill

Key themes for developing a new legal framework for Telecommunications

Consultations with various stakeholders and industry associations, the Government had identified the following key themes for developing a new legal framework for Telecommunication Services:

- Recognition and acknowledgement of the need for a **new legal framework that is future-ready**;
- The need for updating the nomenclature and definitions of relevant terms in the telecommunication legal framework;
- The role that a strong legal framework can play in ensuring steady rollout of new telecommunication technologies;
- Need for legal certainty regarding spectrum management including issues relating to the use, allocation, and assignment, based on the underlying principle that spectrum is a natural resource that needs to be assigned in a manner that best subserves the common good;

Telecom Issues Addressed in the Draft Indian Telecommunication Bill

Key themes for developing a new legal framework for Telecommunications (contd.)

- **Alignment of telecommunication standards with international standards and best practices;**
- Importance of cybersecurity, national security and public safety concerns, while ensuring constitutional and procedural safeguards;
- Need for a distinctive insolvency framework that allows continuity of provision of telecommunication services, so long as the licensee pays all dues; and
- Need for rationalization of penalty framework, providing for specific penalties that are clearly linked with the nature of breach and gravity of the offence.

New Regulatory Framework for Telecommunications Industry in India Issues Addressed in the Draft Indian Telecommunication Bill

The Draft Indian Telecommunication Bill recognises that telecommunication is a **key driver of socio-economic development**.

The Draft Indian Telecommunication Bill It specifies that telecommunication infrastructure and telecommunication network are important parts of **public infrastructure**.

The Bill emphasizes the need to ensure availability of **affordable, reliable, secure and universal telecommunication services**.

The Bill further recognises that spectrum is a valuable and inexhaustible natural resource, which has an element of **public good**. Therefore, it is **vital to ensure efficient use and management of spectrum**.

New Regulatory Framework for Telecommunications Industry in India

Issues Addressed in the Draft Indian Telecommunication Bill

The Bill replaces the outdated concepts under the existing framework such as “telegraph”, “telegraph officer”. The new definitions are comprehensive and relevant to present day realities.

The term “**telecommunication**” has been defined to mean transmission, emission, or reception of any messages, whether by wire, radio, optical or other electro-magnetic systems.

The term “**telecommunication services**” has been defined to include broadcasting services, electronic mail, voice mail, voice, video and data communication services, audiotex services, videotex services, fixed and mobile services, internet and broadband services, satellite based communication services, internet based communication services, in-flight and maritime connectivity services, interpersonal communications services, machine to machine communication services, over-the-top (OTT) communication services which is made available to users by telecommunication.

(OTT – As per media reports OTT has been removed in the recently approved document)

New Regulatory Framework for Telecommunications Industry in India

Issues Addressed in the Draft Indian Telecommunication Bill

Regulatory Structure - Licensing, Registration, Authorization and Assignment

The Bill recognizes the globally established principle of **exclusive privilege of the Central Government** in relation to telecommunication services, telecommunication network, telecommunication infrastructure and spectrum.

The Bill further provides the structure for the Government to exercise this privilege through the grant of:

- (a) licenses for telecommunication services or telecommunication networks;
- (b) registrations for establishing telecommunication infrastructure;
- (c) authorization for the possession of wireless equipment; and
- (d) assignment of spectrum.

The Bill also provides that the terms and conditions of a license, registration, authorisation, or assignment, as the case may be, **will not be modified with retrospective effect to the detriment of the relevant entity**. This will remove any uncertainty in the minds of existing stakeholders.

New Regulatory Framework for Telecommunications Industry in India

Issues Addressed in the Draft Indian Telecommunication Bill

Spectrum Management – Spectrum Assignment

Spectrum is a scarce natural resource. It is not merely an economic good but also a public good and its efficient use is in public interest.

At present, spectrum assignment in India is done through a combination of government policies and judicial decisions.

The Bill lays down explicit statutory framework and regulatory clarity for the Central Government to undertake spectrum assignment. The underlying philosophy of the Bill is that spectrum assignment should serve the common good and ensure widespread access to telecommunication services.

The Bill provides for assignment of spectrum primarily through auction.

For certain specified functions relating to government and public interest like defence, transportation, research, etc. the Bill provides an enabling framework for assignment of spectrum through administrative process.

New Regulatory Framework for Telecommunications Industry in India

Issues Addressed in the Draft Indian Telecommunication Bill

Spectrum Management – Spectrum Assignment

The Bill provides for an enabling framework for optimal utilization of spectrum. These include the following provisions:

- (a) **Technology agnostic use:** To enable the utilization of the spectrum in a liberalized and **technologically neutral** manner, a spectrum assignee may deploy new technologies within its spectrum.
- (b) **Re-farming and re-purposing:** To enable repurposing of any frequency range for a different use, re-arrangement of the frequency range is often required. Therefore, the Bill provides for re-farming and harmonization of frequency range.
- (c) **Sharing, trading, leasing, and surrender:** To enable effective utilization of spectrum, the bill enables sharing, trading, leasing and surrender of spectrum assigned, subject to prescribed terms and conditions.
- (d) **Returning unused spectrum:** To ensure efficient utilization of spectrum, the Bill provide a process of return of unutilized spectrum.

New Regulatory Framework for Telecommunications Industry in India

Issues Addressed in the Draft Indian Telecommunication Bill

Regulatory Provisions to deal with Breach of Terms and Conditions

Voluntary undertaking

The Bill lays down a framework for “voluntary undertakings”. It is a mechanism through which a licensee, registered entity, or assignee may submit an undertaking to address any breach of terms and conditions. This innovative approach towards remedying breaches will bring in significant relief for the entire telecom ecosystem.

Dispute resolution

The Bill provides for the right of appeal before the appellate authority. It also creates an enabling provision for the Central Government to set up an alternate dispute resolution mechanism such as arbitration, mediation or other process of dispute resolution.

New Regulatory Framework for Telecommunications Industry in India

Issues Addressed in the Draft Indian Telecommunication Bill

Regulatory Provisions relating to Right of Way, Insolvency, National Security

Right of Way for Telecommunication Infrastructure

Right of Way is a pre-requisite for establishing telecommunication networks and improvement of telecommunication services. The existing regulatory framework, based on Right of Way Rules, 2016, has had a limited impact in addressing bottlenecks in rapid expansion of telecommunication infrastructure.

Insolvency

Special framework to address defaults in payment by licensee, registered entity, or assignee

Standards, Public Safety and National Security

New Regulatory Framework for Telecommunications Industry in India

Issues Addressed in the Draft Indian Telecommunication Bill

Telecommunications Development Fund

The Universal Service Obligation Fund (“USOF”) was established under the Telegraph Act, to meet the “universal service obligation” which was to provide telegraph access to people in rural and remote areas at affordable and reasonable prices.

Under the Bill, the USOF is sought to be expanded into the “Telecommunication Development Fund” (“TDF”), by adding further objectives of underserved urban areas, R&D, skill development, etc.

Example: USOF Support to 4G/LTE Technologies for providing Internet and Broadband Connectivity.

Innovation and Technology Development

Contemporary Issues and Challenges (Contd.)

(Telecommunication Laws in India)

Contemporary Issues and Challenges may arise due to factor such as Customer Protection , Service Requirements, Policy, Regulations, Operations, Technology and Security. The following points are given for studies / analysis from the Contemporary Issues and Challenges points of view. (Contd.)

3G vs. 4G/LTE Technologies

Customer Concern for Quality of the Service Provided by the TS

Customer Concern Regarding Unsolicited Commercial Communications

Regulations for providing Services Using Telecom Infrastructure

Telecom Infrastructure is Capital Intensive

Restrictions on Telecom Service Providers (TSP)

**MERGERS AND ACQUISITIONS (M&A) IN THE INDIAN TELECOM
SECTOR**

Telecom Service Security Aspects

Way Forwards identified in National Digital Communications Policy 2018

Trends in TV and Telecommunications

ARPU and Tariff for Mobile

Relevance of Satellite Technologies for Telecom

Role of Telecom Policy Framework

Advantages of Standardization in Telecom Sector

Present Government of India Policies For Telecommunication Sector

Action Plan For Future Policy Guidelines

Trends in TV/Video

Satellite DTH Subscribers:

Pay DTH has attained total active subscriber base of around 66.62 million.

The total active subscriber base has increased from 65.58 million in September 2022 to 66.62 million in December 2022.

No Significant increase in the demand for satellite DTH. May be Declining.

Free Dish (DD) Subscribers: About 40 million

Cable TV Subscribers: About 50 million? **Declining market**

Trends in TV/Video

OTT Market Share in India 2023: OTT Growth Rate at about 40 %?

OTT is an internet-based service

The consultancy firm estimates that India has more than 424 million OTT users.

With the emergence of smartphones and fast 4G networks, more and more people are switching to OTT.

It is reported that nearly 80% OTT users in India from tier II, tier III cities, rural India.

Therefore, as a motivation to switch over to OTT, the fibre penetration must be also increasing.

Trends in TV/Video

Smart Devices are favoured for availing TV/Telecom Services.

People prefer Internet enabled TV Sets and Mobile Phones.

Therefore the ongoing and future efforts in TV and Telecom Products, Applications, Solutions and Services need to be more and more Smart Internet enabled Mobile Phone and TV Set Oriented.

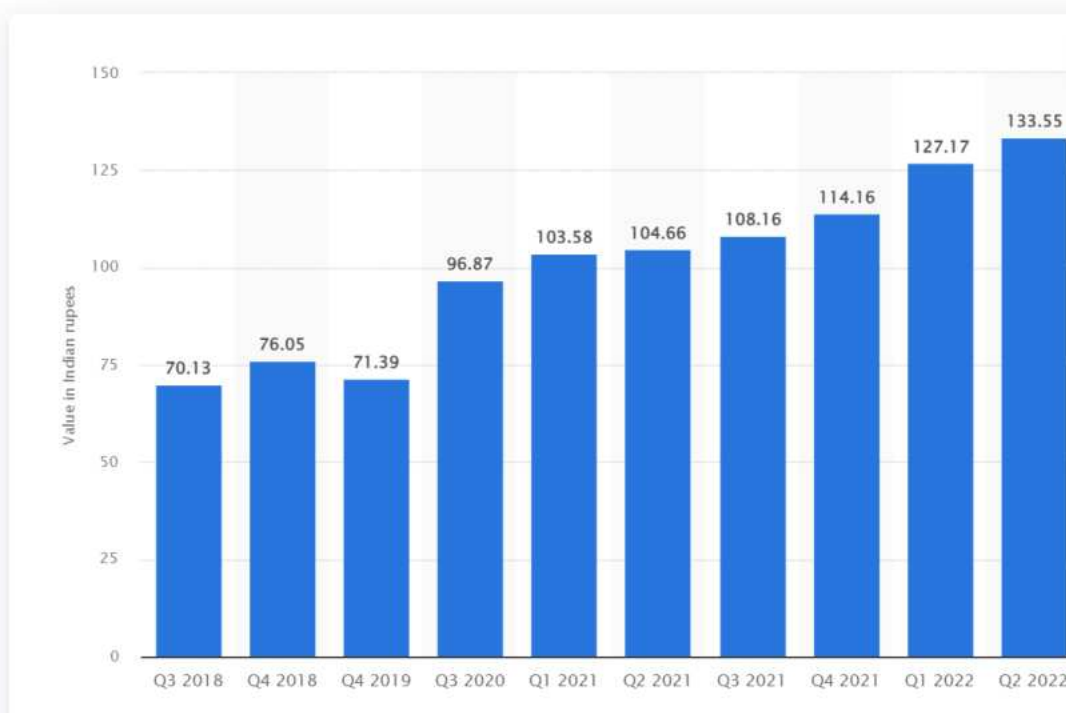
TV and Telecom Industries need to adapt to upcoming changes and paradigm shifts.

ARPU and Tariff for Mobile Services

- It is reported that Telecom Tariffs in India are one of the lowest in the world. Average revenue per user (ARPU) per month has been languishing. One of the primary reasons for this is the cut-throat competition in the sector.
- Even after a 20% increase in tariffs in November 2021 the cheapest tariff plan for Jio stood at just Rs 75 a month whereas for Airtel and Vodafone it was Rs 99 each.
- This seriously affects TSPs (Telecom Service Providers).

ARPU and Tariff for Mobile Services (contd.)

Monthly average revenue per user for wireless services across India from 3rd quarter 2018 to 2nd quarter 2022
(in Indian rupees)



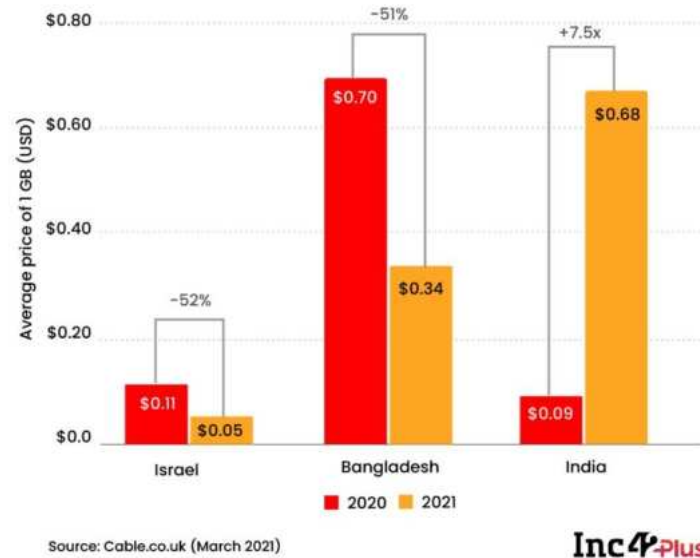
Average revenue per mobile user (ARPU) per sim card 2015-2022, by selected country Published by [Petroc Taylor](#), Jun 12, 2023

Canadian wireless telecommunications companies generated an average revenue per user (ARPU) of 38 U.S. dollars as of the final quarter of 2022, more than any other surveyed country. Australian providers achieved an ARPU of 24 U.S. dollars, while those in New Zealand generated an ARPU of 20 U.S. dollars. <https://www.statista.com/statistics/668966/mobile-average-revenue-per-user-by-country/>

ARPU and Tariff for Mobile Services (contd.)

India No Longer Has The Cheapest Mobile Data In The World

India fell to the 28th place as telcos looked to boost revenue in 2020; Israel now has the cheapest per GB mobile data in the world



Still \$0.68, the average cost of per gigabyte (GB) of data in India is well below the global average of \$4.21, overall.

<https://inc42.com/buzz/as-telcos-push-for-higher-arpu-india-no-longer-has-the-worlds-cheapest-mobile-data-plans/>

ARPU and Tariff for Mobile Services (contd.)

- One of the most vital growth drivers of the Indian internet economy has been the ultra-affordable cellular data or mobile internet plans, what many call [the Reliance Jio effect](#).
- Besides the need to increase their ARPU to increase profit margins, the two trailing telcos — Vodafone-Idea and Airtel — also had to contend with higher tax payments, after the Indian government's ruling on the adjusted gross revenue (AGR) dues. Overall, telecom companies owe over INR 1 Tn to the department of telecommunication in back taxes.
- Given the huge tax bill, telcos have urged the government to fix a floor tariff or price to restore the long-term viability of the telecom sector and bring investors back to the table, which is a severe need of the hour given. It remains to be seen whether the continued push for higher revenues in light of the need for increased spending towards 5G will take India further down the list of the world's most affordable mobile internet plans.

ARPU and Tariff for Mobile Services (contd.)

Fixing Floor Price for Mobile Phone Prices

Issue: No Minimum Tariff

- Mobile data rates in India continue to be one of the lowest in the world.
- TRAI is not considering fixing a floor for mobile phone tariffs
- Regulatory officials say that the mobile phone tariff must be under the self control rather than regulator fixing the minimum tariff.
- Government of India / DOT should intervene and address this issue and come out with suitable solutions.
- One possibility is to help TSPs with incentive type support in cash or kind. Suitable criteria needs to be developed for providing such support to restore long term business viability.

Relevance of Satellite Technologies for Telecom

- While the Tariff/ARPU situation for 5G will be known as deployment of 5G networks begins, satellite based systems cannot compete with terrestrial systems on tariff.
- Satellite based systems may be considered for **interim solutions**. In some occasions Satellite can **complement terrestrial systems**.
- Paradigm shift: All along Stand Alone Satellite Networks are being developed. There is a need to integrate satellite networks with 5G type terrestrial systems. These aspects need to be studied.
- In the meantime entirely new technologies like HAP may develop also. Already Ballons are being used for military surveillance applications.

Stand Alone Satellite Systems vs. Integrated System

Internet Connectivity Services

Optical Fibre based internet connectivity services are highly competitive in India.

India's Fastest Broadband Internet service providers 2021 are:

Airtel; Reliance Jio Fiber; Excitel Broadband; BSNL; Hathway's Broadband; ACT Fibernet Broadband; You Broadband

(<https://freekaamaal.com/miscellaneous/best-internet-service-provider-in-india>)

Satellite based internet services are expensive

GSO and NON GSO Satellite Based Internet Access Services

Provider	Best For	Price	Download speed	Details
	Fastest satellite internet speeds	\$30.00– \$150.00/mo.*	12–100 Mbps	12–300 GB
	Budget-friendly low-end plans	\$59.99– \$149.99/mo.**	25 Mbps	10–50 GB

Non GSO Satellite Based Internet Access Services may bring down the price and the availability:

SpaceX / Starlink satellite internet price

Plan	Price	Downlink Speed	Data Cap
	\$99/mo.	50–150 Mbps	Unlimited

Other Non GSO Systems like m03b, OneWeb, etc are likely to offer similar highly competitive satellite based internet service services and prices.

Key role of LEO Satellite operators

LEO Satellite Constellation Operators Getting Ready to provide Broadband Connectivity

Countdown Begins

SpaceX, Bharti Global's OneWeb and Amazon's Project Kuiper are eyeing India's **satellite broadband space**

SpaceX has been accepting pre-orders for beta version of its service in India for a fully refundable deposit of **\$99**

Co's satellite broadband services are being targeted in **India** in 2022 subject to regulatory approvals



Major Advances in Satellite Technologies

Innovative use of new technologies reduces Cost per Mbps



Reduce Infrastructure Costs:	Increased Payload Flexibility:
More efficient payloads Advanced Electric Propulsion Lower dry mass – Lattice like structure	Advanced Digital Beam Forming Processors Advanced Phase Array KA MPA – Lower Cost of Capacity
Launch Vehicles – Higher Performance/Cost:	Resilient end to end ground network:
Reduce launch mass Use lower class vehicles to inject Larger Payloads	Higher Performance Greater Capacity Secure Network
High Throughput Satellite (HTS) 50 – 200 Gbps to 1 Tbps	Innovation in All Satellite Bands
NGSO Satellite Constellations	Open Architecture - IP and 5G Standards
Higher Speeds 50/5 Mbps	Highly Cost Effective – Terrestrial comparability
Enhanced Utility for Rural/Remote	Land/Sea/Air Connectivity
Innovative use of new technologies reduces Cost per Mbps	
Reference: Presentation by Dr Bashir Patel to SIA Working Group on Satellite – 5G Integrated Systems	

1

Mobile Network and Communication Satellites

Two Independent Paths

- All along Satellite Systems have been generally Designed, Built. Launched and operated as 'Stand Alone' Systems for applications like DTH, VSAT, TV Distribution and Satellite News Gathering Services (SNG).
- These Satellite Systems are operated as individual Networks. As these networks were based on proprietary specifications these individual satellite networks could not be operated as integrated or connected systems.
- Whereas in the case of terrestrial mobile communication systems, right from nineties international forum like 3GPP focussed on developing international inter operability for mobile phones (IMT standards) and as a result worldwide mobile network expansion is phenomenal.
- Now there are more than **5 billion** unique mobile phone users in the world according to the available data.

Paradigm Shifts in Communication Satellite Technologies

3GPP Decision on Integration of Satellite Networks with 5G Mobile Networks

- For very long time the international forum 3GPP did not consider satellite systems as a part of mobile communication architecture and hence satellite industry could not take advantage of such large scale advances and growth of mobile communications networks since nineties.
- But in the recent years, there has been an increasing interest from the satellite communication industry in participating in the 3GPP standardization effort for 5G.
- Recognising the advantages of integrated satellite-terrestrial network, 3GPP Forum initiated in March 2017, as part of Release 14, a study item to analyse the feasibility of satellite integration into 5G network.
- Such an integrated approach is being pursued by 3GPP and the Industries.

Paradigm Shifts in Communication Satellite Technologies

Integration of Future Satellite Networks with 5G

Satellite Networks to Emerge as Integrated Systems in the future

- 3GPP forum is now in the process of defining in detail the interfaces between 5G Mobile networks and satellite based networks facilitating the development of integrated systems.
The 3GPP 5G Base Station Standards compliant interfaces are being developed for Satellite Gateway Station as well as Satellite On-board Regeneration Payload to facilitate integration with terrestrial 5G Networks in a phased manner.
- This will enable satellite networks to function as the integrated systems availing the advantages of 5G Service features.

Example Action for Integration of MEO Satellite Network with 5G

International Satellite Operator SES is playing leading role in satellite integration of its MEO Satellite Constellation **O3b mPower** with Terrestrial 5G Networks. SATis5 offers Technology for Integration.

SES is playing leading role in satellite integration into 5G

Leadership role in critical industry standards and technology initiatives



   	▲ Active contributor to relevant standards for promoting satellite integration into 5G	 	▲ Co-founder and Vice-Chair of the 5G Infrastructure Association ▲ Providing policy, regulatory, standards, spectrum and technology narrative
	▲ Only CE 2.0 certified services (sub 150 ms latency) in industry ▲ Designing orchestration solutions aligned to MEF 55 LSO spec	 	▲ Member of ESA "Satellite for 5G" Task Force
 	▲ Founding member of Linux Foundation Networking Fund ▲ Designing network automation solutions aligned to ONAP		▲ Active participation in publicly-funded collaborative innovation projects for ecosystem and technology development
 TELECOM INFRA PROJECT	▲ Contributing to critical initiatives to lower cost of reaching underserved populations	 	▲ Developing and demonstrating the technologies and capabilities needed for satellite integration into 5G

SES Proprietary and Confidential | 16th BroadSky Workshop, 16 October 2018

Formation of Indian National Space Promotion and Authorization Center (IN-SPACe)

Basis for Frequency Assignments for Satellite Networks

Space Infrastructure / Satellite Based Telecommunications

Indian National Space Promotion and Authorization Center (IN-SPACe)

Recently Government of India has established IN-SPACe.

IN-SPACe is an independent nodal agency under Department of Space for allowing space activities and usage of DOS owned facilities by NGPEs as well as to prioritise the launch manifest.

The Policies and Guidelines formulated and adopted by IN-SPACe will be applicable for establishing and operating space infrastructures for providing Satellite Based Telecommunication Services in the Country.

<https://www.isro.gov.in/indian-national-space-promotion-and-authorization-center-space>

Space Infrastructure / Satellite Based Telecommunications

Indian National Space Promotion and Authorization Center (IN-SPACe)

IN-SPACe has already started taking actions on the usage of DOS owned facilities by NGPEs and the Launch Manifest.

Recently IN-SPAC has made formal announcements on SATCOM Policy and other space matters.

https://www.inspace.gov.in/inspace?id=inspace_search&spa=1&q=POLICY

<https://www.isro.gov.in/indian-national-space-promotion-and-authorization-center-space>

Space Infrastructure / Satellite Based Telecommunications

Indian Space Policy – 2023

Indian Space Policy – 2023 has thus been formulated as an overarching, composite and dynamic framework to implement the reform vision approved by Cabinet.

Vision

To augment space capabilities; enable, encourage and develop a flourishing **commercial presence in space**;

Strategy

Government seeks to pursue a holistic approach by **encouraging and promoting greater private sector participation in the entire value chain of the Space Economy**,

Space Infrastructure / Satellite Based Telecommunications

Indian Space Policy – 2023 (contd.)

Non-Governmental Entities. NGEs shall be allowed to undertake end-to-end activities in space sector through establishment and operation of space objects, ground-based assets and related services, such as communication, remote sensing, navigation, etc.

Encourages NGEs/TSPs to **self-own or procure or lease GSO/NGSO communication satellites for providing telecom services to customers.**

Indian Space Research Organization ISRO, as the National Space Agency, will focus primarily on **research and development** of new space technologies and applications,

NewSpace India Limited NSIL, as the Public Sector Undertaking under DOS, shall be responsible for all types of commercial activities including commercialising space technologies and platforms created through public expenditure.

Basis for Frequency Assignments for Satellite Networks

Industry bats for administrative allocation of Satcom spectrum

Issue: Auction for Satellite Spectrum ?

- **Industry body Broadband India Forum (BIF) has made a pitch for administrative allocation of Satellite Spectrum in tune with global norms**
- **Terrestrial Concept of exclusivity does not apply to Satellite Spectrum**
- **Satellite Operators Coordinate Spectrum internationally and share for Multiple Satellites and Uses**
- **Satellite Spectrum is subject to international obligations as per ITU Radio Regulations**
- **Forum argues for Liberal Licensing Policy and Regulatory Framework for Satellite Services**
- **Free and Open Market Eco System for the use of satellite Technologies**

Frequency Assignments for Satellite Networks

Industry bats for administrative allocation of Satcom Spectrum

No Auction for Satellite Spectrum

- **World over Satellite Spectrum is authorized for 'right-to-use' principle**
- **Satellite Spectrum Allocation only by administrative process just to cover the cost of administration**
- **Satellite bandwidth is from internationally coordinated satellites over Indian Skies**
- **BIF says such Satellite bandwidths must be also put into use through the process of direct negotiations**
- **Proposes utilizing the available foreign satellite capacity and promoting local equipment and components in gateways**

Frequency Assignments for Satellite Networks

Industry bats for administrative allocation of Satcom Spectrum

No Auction for Satellite Spectrum

Need of the Hour:

Free and Open Market Conditions for using Satellite and Mobile Technologies

- **Liberal Regulatory Framework for Satellite Services will trigger flow of foreign investments.**
- **BIF also proposes also lowering the levies in the Telecom Sector**
- **Such measures will drive Satellite Operators providing rural broadband coverage and services**
- **Public Data Offices use satellite powered VSATs and mobile networks for many societal applications**
- **These applications demand high volumes of capacity at affordable prices**
- **This calls for Changes to current regulations**

28 GHz Band Allocation for Space or Terrestrial Services

Issue: 28 GHz Spectrum Allocation

5G vs Satellites

- **Satellite Companies oppose auctioning satellite spectrum 28 GHz band (27.5-29.5 GHz) for 5G mobile services**
- **The frequency band 27.5-29.5 GHz is considered highly efficient band for 5G Mobile Services**
- **Telcos argue that 5G deployment costs would surge in the absence of 28 GHz band**
- **Telcos have been allocated spectrum in the 700 MHz, 3.3-3.6 GHz, and 24.25-28.5 GHz bands for 5G trials in India in various locations**
- **Satellite Companies and Telcos need to discuss frequency sharing and other possibilities to find solutions**

New Spectrum for 5G Backhaul Requirements

71-76/81-86 GHz Band

The Department of Telecommunications (DoT) will allot E-band (**71-76/81-86 GHz**) airwaves via the administrative route only to mobile phone operators for their backhaul needs in circles where they will hold 5G spectrum.

Considering increased capacity backhaul requirements of TSPs-especially due to 5G, an interim arrangement of assignment of up to two carriers (each carrier of 250 MHz paired bandwidth) in E-band spectrum for backhaul purposes.

LSA wise, to each TSP with access service authorization, to be made with pricing of 0.15% of AGR, for each carrier on similar lines as the provisional allotment of carriers for MWA/MWB purposes (Microwave Access (MWA) Carrier AND Microwave Backbone (MWB) Carriers), pending final decision on spectrum assignment methodology and pricing of E band spectrum.

Role of Telecom Policy Framework

- Policy, Regulations, Licensing and Spectrum allocation Procedures are the enabling factors for orderly and efficient operation of Telecom Services.
- The Policy guidelines are to ensure that the advantages of new technologies are accessible to all equitably and affordably.
- The policy sets goals like
Universal Broadband Connectivity at 50 Mbps speed,
Fixed Internet Connectivity at Homes and Public places,
High speed Internet Broadband connectivity for Gram Panchayat / Developmental Institutions / Educational Institutions / Remote Areas
- The overall Objective of the National Policy on digital communications is to prepare the country and its citizens for the future

Policy Directive For Proactive Actions

In the immediate future there is a need to take actions on the following aspects:

- **Inclusive Growth Criterion:** Improve the penetration of Telecom Services in rural areas/villages.
- **Harnessing New Technologies:** Government is taking proactive actions for starting of 5G services in India.
- **Taking Advantage of Satellite Technologies:** Adopting GSO and Non GSO Satellite based solutions for providing internet and broadband connectivity to villages/remote areas.

Advantages of Standardization in Telecom Sector

Telecom Equipment vendors play a major role in the Industry.

Telecom Standardization work is done at international levels.

International Standardization Organisations - Examples:

[3GPP](#) – 3rd Generation Partnership Project; [3GPP2](#) – 3rd Generation Partnership Project 2;

[IEEE](#) – Institute of Electrical and Electronics Engineers; [IETF](#) – Internet Engineering Task Force;

[ITU](#) – The International Telecommunication Union; [W3C](#) – World Wide Web Consortium;

[TIA](#) – Telecommunications Industry Association;

[ETSI](#) – European Telecommunications Standards Institute;

[India](#) – BIS – [Bureau of Indian Standards](#);

(https://en.wikipedia.org/wiki/List_of_technical_standard_organizations)

A lot of advances in technology happen for Mobile / Access Services.

Advantage of International Standardization

- **Technology is taken for granted.**
- **Because of the worldwide standardization efforts, it is easy for the Telecom Industry to absorb the latest technologies as and when it happens.**

Need to Enhance National Telecom Industry

- **However Home grown R&D work needs to be encouraged and enhanced.**
- **Such efforts are required not only in technical areas but also in areas like management, finance, legal, etc.**

EXISTING POLICIES FOR TELECOMMUNICATIONS SECTOR

NATIONAL DIGITAL COMMUNICATIONS POLICY- 2018

NDCP 2018 sets goals, initiatives, strategies and intended policy outcomes.

https://dot.gov.in/sites/default/files/2018_10_29%20NDCP%202018_0.pdf

National Broadband Mission - December 2019

National Broadband Mission sets the vision to provide affordable and universal access of Broadband connectivity to all.

https://dot.gov.in/sites/default/files/National%20Broadband%20Mission%20-%20Booklet_0.pdf?download=1

ACTION PLAN FOR FUTURE POLICY GUIDELINES

THERE IS A NEED TO CONTINUOUSLY STUDY AND EVALUATE THE PROGRESS BEING MADE UNDER THE AEGIS OF THE NDCP-2018:

NATIONAL DIGITAL COMMUNICATIONS POLICY

THERE IS A NEED TO TAKE INTO ACCOUNT THE ADVANCES IN TECHNOLOGIES AS WELL AS THE EMERGING NEW TELECOM REQUIREMENTS AND DEVELOP ACTION PLANS FOR THE FUTURE POLICY GUIDELINES EXPECTED IN 2024 TIME FRAME.

Broadband Connectivity Issue

Broadband Connectivity Issue

Broadband Connectivity is A Key Factor for overall growth of national Economy.

For Example

10 % Increase in Internet Subscribers will lead to 3.2 % Increase in GDP.

10 % Increase in Mobile Internet Traffic will lead to 1.6 % Increase in GDP

Enabling Broadband Connectivity Across the Nation will Bridge the Digital Divide Gaps.

India ranks very low at 131 out of 140 nations on Global Index in Speed and Quality

Government of India / DOT has taken an important step by launching National Broadband Mission in 2019 with a Vision to provide Affordable Nationwide Broadband Services

Concerns

Fixed broadband penetration in India is among the lowest in the world at only 1.69 per hundred inhabitants.

>50% of rural India is still not digitally connected.

>70% of rural India lack Broadband penetration.

70% of students lacked access to online education in India during COVID due to poor internet signal..

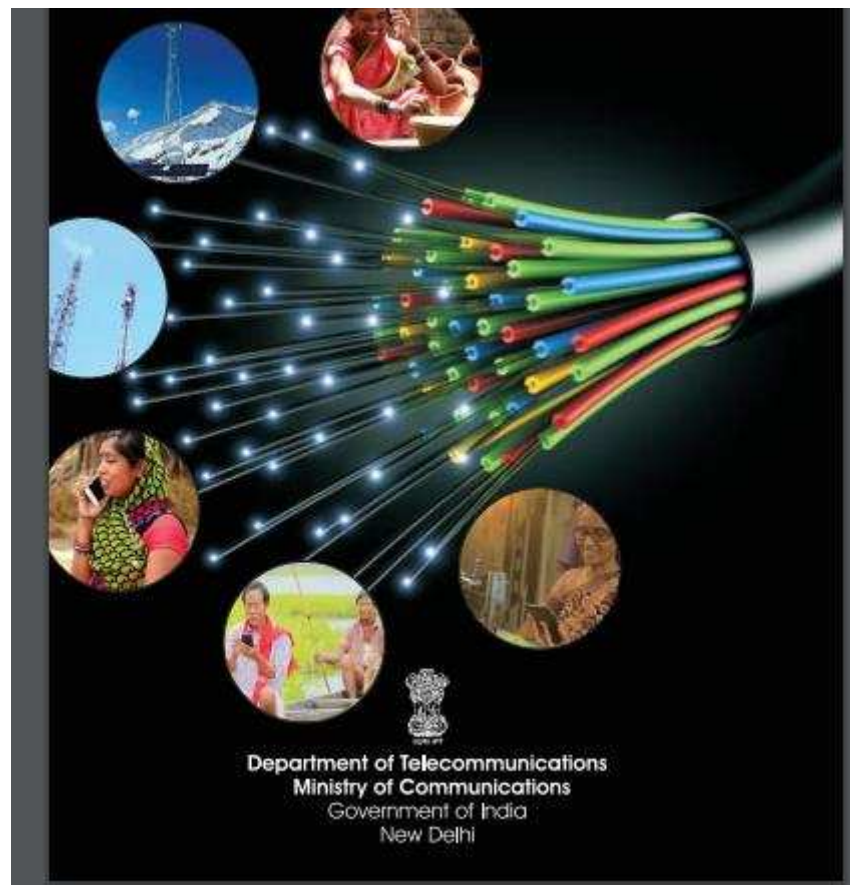
Fiber Optics Network

- **India's current per capita fiber coverage stands at 0.09 fibre km as compared to 0.87 fibre km for China and 1.3 fiber km for Japan and US.**

As data consumption continues to increase, deep fiberisation becomes essential for ubiquitous connectivity.

- **Mobile Backhaul is another issue that the Indian networks need to resolve. India has around 2.3 million mobile base stations but only 30-40% are fiberized.**
- **Also for 5G to succeed, India will need fiber backhaul for tower connectivity of about 80 % in the next 1 - 2 years.**
- **India needs FTTH (to Home) and FTTX (to Anywhere)**
- **India has an optical Fibre Network of around 2.8 million km. National Broadband Mission has set a target of 5 million km by 2024.**

Government of India recognises Fibre Optics Network Infrastructure is Crucial for Telecommunication Services



Importance of Fibre Optics Network Infrastructure

- **Core Network, International / Overseas Communications, Mobile Back Haul, Internet Connectivity for Customers / Enterprises, Lease Circuits and many others**
- **Applications are many. E-learning, E-health, E-governance, Access to information & broadband services, Communications during Natural disasters and Emergency situations**
- **Government of India recognises Fibre Optics Network Infrastructure is Crucial for Telecommunication Services**
- **National Fibre Authority (NFA) is planned to expand and speed up fibre deployments.**

Innovative Action Plan

- **As per surveys, it is found that fibre optics and other means are not possible for providing broadband connectivity for about 40000 villages and hence satellite baded networks can only be used for broadband connectivity for these villages.**
- **Beyond these locations also, satellite technologies can play an useful role in accelerating the rollout of an even larger number of locations against multi-year fiber rollout schedules.**
- **Taking Advantage of Technologies**
There is a need to accelerate the actions for enabling Nationwide Broadband Connectivity taking advantage of Fiber Optics, Satellite and Other Advanced Technologies.

Number of Internet Subscribers TRAI Data – December 2022 Subscribers per 100 Population

Rural: 38.93 Urban: 106.19 % Overall: 62.56 %

ISSUE: Rural Areas lag in Broadband Services

Internet/Broadband Subscribers	
Total Internet Subscribers	865.90 Million
% change over previous quarter	1.76%
Narrowband subscribers	33.70 Million
Broadband subscribers	832.20 Million
Wired Internet Subscribers	32.41 Million
Wireless Internet Subscribers	833.49 Million
Urban Internet Subscribers	516.37 Million
Rural Internet Subscribers	349.53 Million
Total Internet Subscribers per 100 population	62.56
Urban Internet Subscribers per 100 population	106.19
Rural Internet Subscribers per 100 population	38.93
No. of Public Wi-Fi Hotspots	1,76,662
Aggregate Data Consumed (GB)	1,40,24,519

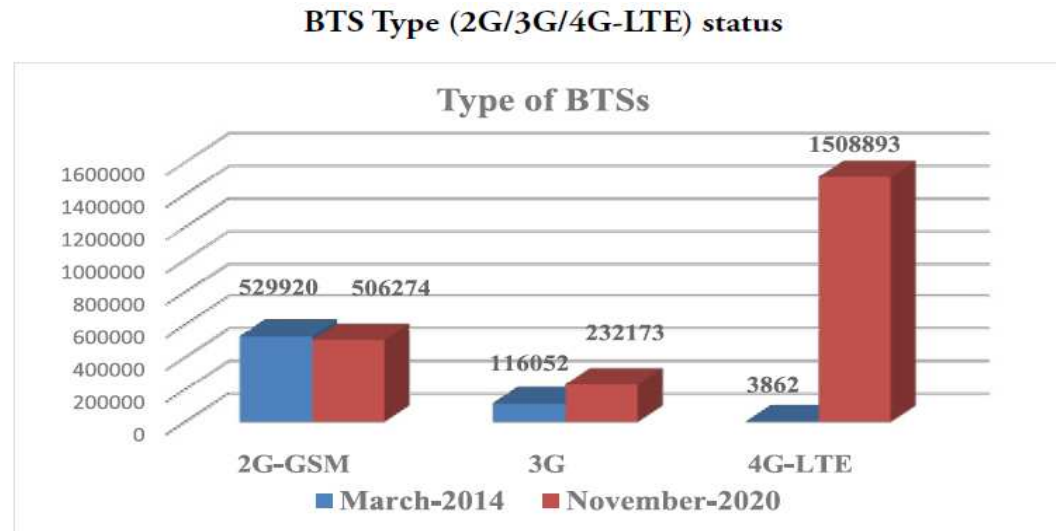
**DOT initiative for Fibre Penetration and
LEO Satellite Constellation Technology Based Solution
For Broadband Service in Rural Areas**

3G vs. 4G/LTE Technologies

Technology Issue affecting Telecom Industry Players

ISSUE: 3G Spectrum Costs

<https://dot.gov.in/sites/default/files/Annual%20Report%202020-21%20English%20Version.pdf>



(Source TARANG Sanchar Portal & CoAI)

Comparison 3G and 4G-LTE Technologies

This Figure shows that 4G-LTE system is more successful and versatile as compared to 3G.

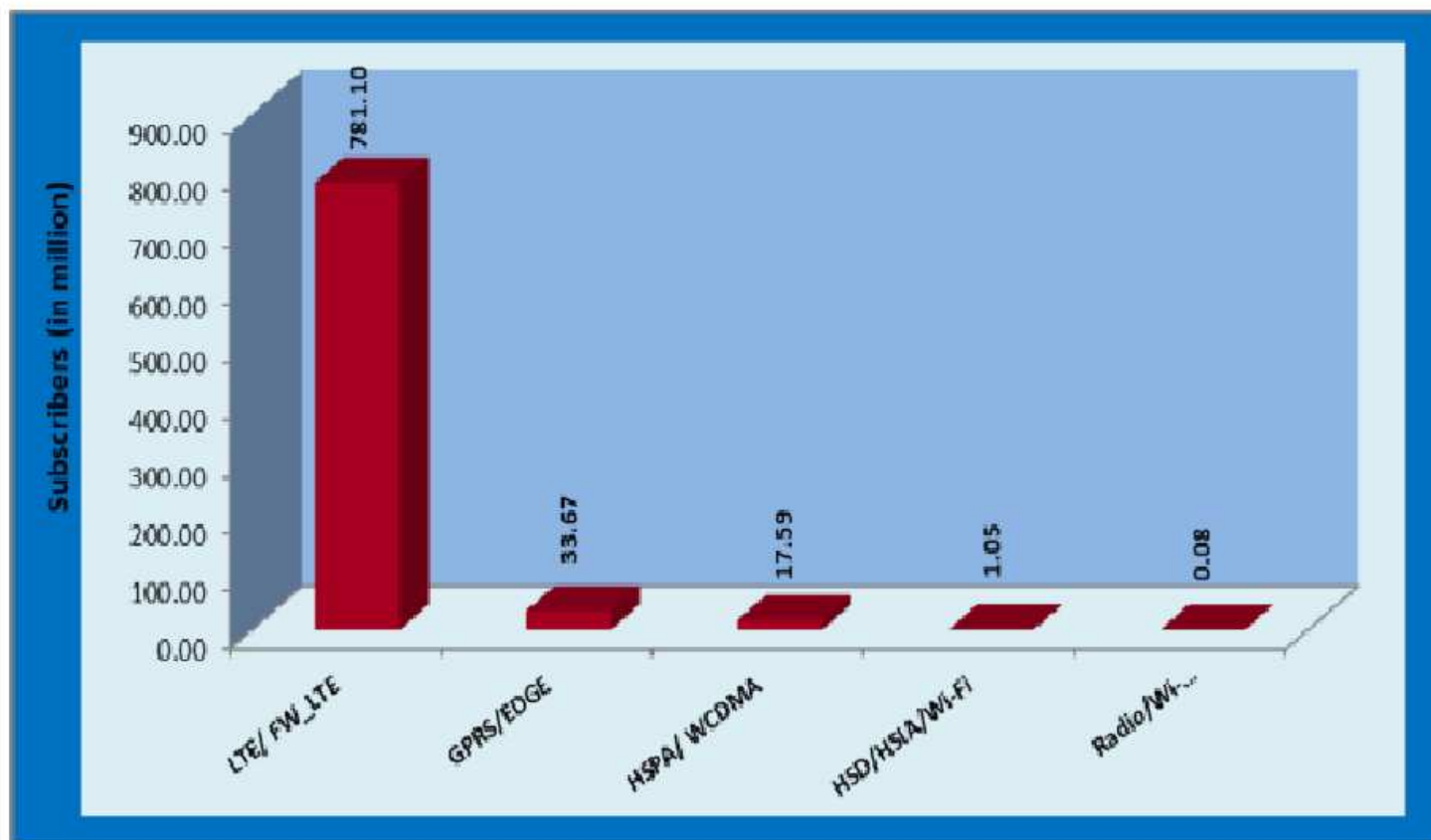
TSPs (like AirTel, Vodafone) who operate 3G and also went through the highly competitive auction process for 3G Services way back in 2010 are affected.

AirTel and Vodafone operate 3G Mobile Networks in India

<https://www.nepalitelecom.com/2017/02/frequency-bands-2g-3g-4g-mobile-india.html>

S.N	Mobile Technology in India	Frequency bands in India	Major Operators
1	GSM (2G)	900 MHz, 1800 MHz	Airtel , Idea Vodafone, Aircel , BSNL
2	CDMA	850 MHz	Reliance, BSNL, Tata
3	WCDMA (3G)	2100 MHz, 900 MHz	Airtel , Idea Vodafone
4	WiMAX	2300 MHz	BSNL
5	4G LTE (4G)	1800MHz	Airtel , Idea Vodafone, Jio
		850 MHz	Jio
		2300 MHz	Airtel , Idea Vodafone, Jio
		2500 MHz	BSNL, Idea Vodafone
5G: 700 MHz, 3.3-3.6 GHz, and 24.25-28.5 GHz; 4G spectrum for trials in the 900 MHz, 1800 MHz, and 2300 MHz bands.			

Chart 1.20 : Technology trend for Wireless Internet Access



TRAI The Indian Telecom Services Performance Indicators Oct – Dec, 2022

Importance of 4G Technology for Mobile and Data in Villages and Rural Areas

USOF Support for 4G Technology

DOT Approved the proposal for providing Comprehensive 4G mobile coverage in remaining Uncovered Villages in the country on nomination basis to BSNL through USOF (Universal Service Obligation Fund) as under:

Submitting the case for approval of the Cabinet for Provisioning of 4G mobile services to 24,680 uncovered villages across the country by installing 16,464 4G mobile towers at an estimated cost of Rs 17,664 Cr. (CAPEX + OPEX for 5 years) (excluding taxes and levies) to be funded by Universal Service Obligation Fund on cost plus with 10% as administrative charges.

The work shall be awarded on nomination basis to BSNL. The ownership of Asset created under this project will be with BSNL and the timeline/rollout for the implementation for the project will be 24 months.

Reference: DOT Annual Report 2022-23

Importance of 4G Technology for Defence Mobile and Data Networks

GOI Support for 4G Technology

DOT Approved the proposal regarding provision of 4G mobile coverage at Border Out Posts (BOPs) of various Border Guard Forces (BGFs) and Border Intelligence Posts (BIPs) of Intelligence Bureau (IB) as under with timeline for implementation of the project shall be 18 months:

Submitting the case for approval of Cabinet for provision of 4G based mobile services at 1117 locations of Border Out Posts (BOPs) of various Border Guard Forces (BGFs) and Border Intelligence Posts (BIPs) of Intelligence Bureau (IB) on nomination basis to BSNL. The ownership of the assets created under the project will be with BSNLReference:

Ref: DOT Annual Report 2022-23

**Customer Concern for
Quality of the Service Provided by the TSP**

**Customer Concern Regarding
Unsolicited Commercial Communications**

**Regulations for providing Services Using Telecom
Infrastructure**

Issue: Customer Concern for Quality of the Service Provided by the TSP

Mobile Number Portability Regulations

MNP allows mobile subscribers to retain their existing telephone numbers when they switch from one telecom operator to another irrespective of mobile technology.

TRAI introduced the Telecommunications Mobile Number Portability Regulations, 2009 .

As per the regulations, the subscribers would be allowed to retain their mobile number while moving from one TSP to another.

This in turn is likely to compel the telecom service providers to maintain/improve the quality of their service to avoid losing subscribers.

This can be seen as mature element of the Indian telecom industry and a natural step for the industry to go forward as it helps customers.

Issue: Customer Concern Regarding Unsolicited Commercial Communications

SMS Regulations to help Customers to Choose Commercials

The SMS Regulations have mandated the creation of a National Customer Preference Register, a national database with a list of the telephone numbers of all subscribers who have registered their preferences regarding receipt of commercial communications.

Subscribers have been given the option of indicating their preference by registering either under the fully blocked category or the partially blocked category.

In the fully blocked category, a subscriber opts not to receive any type of commercial communication, while the partially blocked category enables subscribers to receive commercial communications only in the categories they have chosen.

Subscribers under the partially blocked scheme may choose from a selection of categories including: banking, insurance, financial products and credit cards; real estate; education; health; consumer goods and automobiles; communication, broadcasting and entertainment; IT; and tourism.

Issue: Regulations for providing Services Using Telecom Infrastructure

Other Service Provider (OSP) Registration with DOT

Other Service Providers (OSPs) do not require a specific license; however a registration process is required to be fulfilled subject to fulfilling certain criteria. The most important of which is the Other Service Providers registration.

Call centres (international and domestic), BPOs, Network Operation Centers, Vehicle Tracking Systems, services with respect to tele-banking, tele-medicine, tele-education are allowed to operate (with 100% FDI) upon registration as “Other Service Provider” or “OSP” with the DoT.

These OSPs operate the service using the telecom infrastructure provided by licensed telecom service providers.

These aspects will be addressed in the New Telecom Bill 2022.

Telecom Infrastructure is Capital Intensive

Preference to Indian Telecom Equipment Manufacturers

Restrictions on Telecom Service Providers (TSP)

**MERGERS AND ACQUISITIONS (M&A)
IN THE INDIAN TELECOM SECTOR**

Telecom Service Security Aspects

**Way Forwards identified in National Digital Communications
Policy (NDCP)2018**

Issue: Telecom Infrastructure is Capital Intensive

Telecom License Permits Sharing of Telecom Infrastructure

The telecom sector is a very capital intensive sector and requires large investments.

The telecom licenses permit the telecom operators to share passive infrastructure such as building, tower, dark fibre, etc.

Sharing of active infrastructure amongst licensees shall be governed by the license conditions/amendments issued by the DoT.

As a result of this policy, new entrants who are allotted spectrum by the WPC can easily launch their telecom services within a short period by taking the assistance of the existing active infrastructure of other telecom service providers and thereby will not have to incur huge infrastructural costs

Issue: Preference to Indian Telecom Equipment Manufacturers

Government Departments Grant Preferential Market Access to Indian Telecom Equipment Manufacturers

Government issued a notification granting preferential market access to domestic telecom manufacturers.

The notification, mandates that domestically manufactured telecom products must be given preference, when the same is being procured by Government departments and agencies .

The main objective is to give impetus to Indian Telecom Equipment Manufacturers.

Issue: Restrictions on Telecom Service Providers (TSP)

Balanced and Transparent License Provisions

The licenses themselves have a number of provisions which can be seen as quite restrictive.

These are mostly security driven restrictions and have not led to any dampening of foreign interest in this sector. Some of these restrictions are discussed as follows:

- i. Telecom licenses are only granted to companies which are registered in India;
- ii. The majority of directors of the board of the company have to be Indian citizens;
- iii. Certain positions which are instrumental to the operations of the company such as Chief Officer in charge of technical network operations, Chief Security Officer and Officials dealing with lawful interception of messages have to be occupied by resident Indian citizens;
- iv. Certain key positions (such as chairman, managing director, chief executive officer and/ or chief financial officer), if held by foreign nationals are required to be security vetted by the Ministry of Home Affairs.

MERGERS AND ACQUISITIONS (M&A) IN THE INDIAN TELECOM SECTOR

DoT Guidelines on M&A

With the liberalization of the Indian economy, the telecom sector has become very attractive for mergers and acquisitions.

Some of the big deals that have taken place in the Indian telecom include the following:

- SingTel increasing its stake in Bharti telecom from 30.8 % to 32.34 % in 2013;
- Reliance Industries Limited acquiring 95% of the equity shares of Infotel Broadband Services to gain access to the BWA spectrum won by Infotel Broadband Services.
- Aditya Birla Telecom acquiring Spice Telecom
- Providence's investment into Aditya Birla Telecom in 2009
- Vodafone taking over Hutchison-Essar in 2007
- Malaysia Telekom's 49% stake in Spice Telecom
- Temasek Holdings' 9.9% stake in Tata

DoT Guidelines on M&A

A. *Prior Approval of the DoT*

B. *Validity of the License*

C. *Lock In on Sale of Shares*

D. *Easing of Rules to Avoid Monopoly in the Market*

E. *Acquirer to Pay Difference Between the Market Price of Spectrum and the Entry Fee Paid by the Target*

Issue: Telecom Service Security Aspects

Security Related Requirements

Details of infrastructure/network diagram could be provided on a need basis only to telecom equipment suppliers/manufacturers and affiliate / parent of licensee company.

Clearance of DoT would be required if such information is to be provided to anybody else.

Licensee company should ensure that the information transacted through their network is secure and protected.

Incorporation of Provisions in the Telecom Network for Monitoring of identified Calls Originated and Terminated in India

Way Forwards identified in National Digital Communications Policy (NDCP)2018

- Promoting Next Generation Technologies
- Enabling Hi-speed internet, Internet of Things and M2M by rollout of 5G technologies:
- Establishing India as a global hub for cloud computing, content hosting and delivery, and data communication systems and services
- Leveraging Artificial Intelligence and Big Data in a synchronized and effective manner to enhance the overall quality of service, spectrum management, network security and reliability
- Strengthening Satellite Communication Technologies in India - Review the **regulatory regime for satellite communication** technologies - **Optimise Satellite communications** technologies in India - Developing **ecosystem for satellite communications** in India

Way Forwards identified in National Digital Communications Policy (NDCP)2018

- Widening the scope of Telecom Infrastructure Providers, Attracting Investments and Capacity Building, Ensuring a holistic and harmonised approach for harnessing Emerging Technologies
- Channelizing the Universal Service Obligation Fund (USOF) for various deserving Developmental Activities
- Ensuring Standards and Quality Assurances for Telecom Services
- Facilitating the establishment of a Pan-India network for Public Protection and Disaster Relief (PPDR)
- Research and Development and Local Manufacturing and Value Additions
- Creating Job Opportunities and Training Personnel in the Digital Communications Sector

Contemporary Issues and Challenges

(Telecommunication Laws in India)

We discussed Contemporary Issues and Challenges in the field of Indian Telecom Industry under the following three broad topics:

Telecommunications Industry

Local Manufacturing and Value Addition Challenge

Various Telecom Issues Addressed in the Draft Indian Telecommunication Bill

Contemporary Issues and Challenges may arise due to factor such as Customer Protection, Service Requirements, Policy, Regulations, Operations, Technology, Security and other related factors.

Thank You