

# A Review of Reforms in the Indian Telecommunications Sector

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## Abstract

People call each other on the phone and look things up on Google all the time. These actions have become part and parcel of everyday life (Crabtree et al, 2003; Dutt, 2012). However, in this very country, earlier, one had to book calls in advance and wait by the phone for hours to hear it ring, and that was if they were affluent enough to afford one in the first place (Vohra, 2018). That time is now long past. Now, India is the 3<sup>rd</sup> cheapest country in the world for data (Das, 2023). As a result, it also has the fastest growing customer base for internet consumption and mobile handles. In 2012, commercial networks covered 83% of the country (Shrinivasan, 2012). The number has only increased after 5G and the introduction of single-window clearances at various state Department(s) of Telecommunications, even mulling it over at a national level. However, this change didn't happen overnight. It is the fruit of the labour(s) of many different politicians, industrialists, bureaucrats, engineers, and of course, the people of India over decades. Neither is everything all well; the country is plagued with scams, misappropriations of funds, political favouritism, inefficiency in government, and a growing monopoly. This article traces the reforms introduced in the telecommunications sector, their impact, their consequences, and gauge what the future may hold for the industry.

**Keywords:** Indian telecommunications, telecom sector, policy reforms

## Introduction

Omar Bradley, the last officer in the United States Armed Forces who was appointed to the rank of a 5-star general, who served as the first Chairman of the Joint Chiefs of Staff and was in charge of American troops in the Battle of Normandy, once commented, 'Amateurs talk strategy, professionals talk logistics' (Mikolashek et al, 2013; Rose, 2016). Most of the Second World War was won because of a superior logistics chain than any tactics they employed. In fact, Rider (1970) shows that it was so effective in World War II that the war actually led to the rebirth of logistics in modern warfare. The 'shock-and-awe' approach to military engagements, which served as the policy of the United States in the 2003 invasion of Iraq, basically advocated to overwhelm an enemy completely and deprive them of any hope they may have of winning the war using 'spectacles' of highly destructive armaments delivered through a superior logistics chain (Sepp, 2007). Doing this to ensure a quick, humbling (for the enemy) and decisive victory when all other things like international & domestic support, necessity of war, definite political & military goals, etc had been considered came to be known as the Weinberger-Powell doctrine (LaFEBER, 2009).

Like with many such technologies like the GPS, duct tape, jeeps, superglue and even the internet (which started out as the humble ARPANET), telecommunications owes its beginnings to the military (Nato, n.d.). Fundamentally, a method of communications was required to establish facts and discuss next steps between people engaged with the same enemy in different theatres of war with ease. This method used to be human messengers who had to deliver letters across open battlefields in order to ensure entire battalions didn't march to certain death. This was prone to both human error and human death. Necessity is the mother of invention, and, at the time, nothing seemed more necessary than winning the war, giving birth to telecommunications.

Eventually, as it usually does, the technology spilled over into the civilian section of society, as people found the idea of speaking with their close ones comfortably in their own homes without having to travel for days through perilous routes quite neat and convenient. However, it wasn't cheap in the beginning. It was a luxury reserved mostly for the elite. As with all things at the time, the government sought to maintain a monopoly on this as well.

Up until the early 1990s, the Department of Telecommunications managed all operations (Sivasankari et al, 2009). Reforms were introduced in the 1980s, setting the stage for liberalization in the 1990s, which marked a turning point for the industry. Prominent policies include the National Telecom Policy of 1994, the Telecom Regulatory Authority of India Act, 1997 & the New Telecom Policy of 1999.

Despite these reforms and substantial growth, the sector has faced challenges. The 2G spectrum allocation scam in 2008 became a symbol of corruption, involving misallocation of licenses at undervalued prices, leading to significant revenue losses for the government (Bhatia, 2019). The 3G spectrum allocation scam in 2010 raised further concerns, involving allegations of irregularities in the allocation of spectrum meant for faster data services. Other scandals, such as those involving caller ID spoofing and Anil Dhirubhai Ambani Group's Reliance Communications, have added to the industry's credibility issues. More recent reforms have focused on technological advancements and financial restructuring. The introduction of the National Digital Communications Policy 2018 aimed to create a robust digital infrastructure, enable inclusive growth, and position India as a global hub for telecom innovation. The NDCP strove to address challenges like the Digital Divide, spectrum pricing, and regulatory complexities. The Telecom Commercial Communications Customer Preference Regulations, 2018 and Spectrum Trading Guidelines, 2015 also played key roles in reducing spam and enabling more efficient use of the spectrum. However, all is far from good. There's sufficient competition, but it's basically between two companies, who together hold 61% of the market (Rathee, 2024). Competition from the government, in the form of PSUs like the BSNL and the MTNL, still haven't introduced 4G for customers when private players are almost are thinking about 6G (Desk, 2024). India has one of the cheapest data packs in the world at 17 cents for 1 GB, but accessibility (amongst other issues like safety concerns vis-a-vis radiation) is a huge problem (Panchal, 2024). As with all things and so with this, rural areas haven't seen the same kind of development as urban areas. Scams and mobile frauds are a dime a dozen. Nearly 23,000 cases every day (Srivastava, 2024). It would follow then that additional reforms are necessary. But why, then, have they not been instituted?

The present telecommunications industry, despite its defects, is a working model between industry, government, and the public. Neither is all too happy; the industry wants higher profits and margins, the government wants higher taxes and oversight, and the public just wants cheap, good, and accessible data. But they are content. This state of contentment is not something any party of the model would like to breach. But how did it come to be this way?

## Literature Review

The Indian telecom industry has undergone significant transformations, evolving from a government-controlled monopoly to one of the world's largest and most dynamic markets. This literature review examines the historical evolution, current structure, and future growth trajectory of India's telecom sector through the lens of three pivotal studies. These studies provide comprehensive insights into how regulatory changes, technological advancements, and market dynamics shape the competitive landscape and underscore the strategic importance of the telecom industry in India's digital economy.

Ms. Pritish and Dr. Taruna Saxena's (2015) paper, "An Analysis of the Indian Telecom Industry," offers a detailed historical overview of the sector's origins, beginning with telegraph services and postal communications in the mid-19th century. Their work highlights the modernization of the sector with telephone exchanges and radio telegraphy, which laid the foundation for future communication networks. Post-independence nationalization under the Department of Telecommunications (DoT) centralized policy formulation and service delivery. A significant turning point came with the liberalization reforms of the 1990s, which opened the industry to private investment and competition, transforming it into a competitive market. This era saw the emergence of private players such as Bharti Airtel, Vodafone, and Reliance Communications, while public operators BSNL and MTNL maintained dominance in wireline services. This competitive environment spurred rapid technological advancements and innovations in service delivery.

The advent of broadband services in 2004 marked a pivotal development, catalyzing socioeconomic development and providing new opportunities across various sectors, including education, healthcare, e-governance, and commerce. Government initiatives like the National Optical Fibre Network (BharatNet) aimed to extend broadband access to rural and underserved regions, effectively bridging the digital divide. Pritish and Saxena (2015) emphasize that regulatory changes and increased Foreign Direct Investment (FDI) caps to 100% played crucial roles in attracting global investments and fostering technological innovation. The shift from voice-centric to data-centric services compelled telecom operators to upgrade infrastructure to support next-generation technologies like 4G and 5G.

Arun Kumar Dogra's (2021) study, "Indian Telecom Overview and Government Policies Impact," further explores the sector's evolution and the critical role of government policies. The introduction of mobile phones in 1995 marked the beginning of modern telecommunications in India. Significant policy reforms in the early 2000s facilitated rapid expansion, making India the second-largest telecom market globally. Dogra highlights the challenges of regulating market practices, such as bulk marketing and spam SMS, and the impact of stringent policies on value-added services (VAS). Despite these challenges, the sector remains optimistic, driven by advancements in technology and further regulatory reforms. The widespread availability and affordability of telecom services have reached even the most remote areas of India, emphasizing the industry's role in bridging the digital divide and positioning Indian telecom firms to compete internationally.

Manek Yamini H.'s study, "Indian Telecom Industry: Evolution, Present Scenario & Future Challenges," provides an in-depth analysis of the industry's transformative journey and future prospects. The sector's growth has been driven by deregulation, new technology adoption, and competitive pricing. However, recent years have seen a revenue decline due to intense competition, particularly from Jio's disruptive pricing strategy, high licensing fees, and spectrum scarcity. Yamini H. discusses the significant growth potential in rural markets, suggesting that infrastructure sharing among operators and promoting digital literacy are key strategies for future expansion. The industry's valuation reaching

\$217 billion by 2020 underscores its robust growth, driven by a growing subscriber base, rapid infrastructure development, and government support. Prominent players such as Jio, Airtel, and Vodafone Idea have been instrumental in shaping the industry, vying for market dominance.

Despite its achievements, the telecom industry faces significant challenges. High licensing fees, currently at 8% of Adjusted Gross Revenue (AGR), exert additional financial pressure on telecom operators. Spectrum availability remains limited, restricting operators' ability to offer competitive pricing while maintaining service quality. Regulatory challenges and delays also hinder the timely deployment of new technologies like 5G. Despite these challenges, the sector holds significant growth potential, especially in rural markets. With over 44.6% of wireless subscribers residing in rural areas, improving rural penetration through affordable smartphones and lower tariffs presents a promising avenue. Infrastructure sharing among operators can optimize capital investments while maintaining service quality. Furthermore, promoting digital literacy and expanding broadband services will facilitate rural markets in harnessing the benefits of telecommunications.

The present literature on the topic collectively underscores the Indian telecom industry's remarkable transformation and its pivotal role in the country's socioeconomic development. Addressing financial, infrastructural, and regulatory challenges will be crucial for continued expansion. Strategic measures such as infrastructure sharing, affordable pricing, and rural market penetration are essential for maximizing growth potential. These initiatives will solidify the telecom sector's role as a cornerstone of India's digital economy, helping it adapt to the evolving landscape and embrace new technological advancements like 5G. The sector's strategic pivot towards data-centric services, the expansion of broadband connectivity, and readiness to embrace emerging technologies are poised to play a crucial role in India's digital transformation. Consequently, the authors foresee the telecom industry driving significant economic growth, creating millions of jobs, and enhancing India's global stature as a digitally empowered nation.

### **An analysis of reforms instituted**

1. National Telecom Policy, 1994: This policy marked the first significant step toward liberalizing India's telecom sector. It enabled private companies to provide telecom services, thereby breaking the government's monopoly and inviting competition (Chowdary, n.d.). The policy led to the establishment of two private players in each telecom circle alongside a government-run operator (Kokil et al, n.d.) and laid the groundwork for the sector's eventual explosive growth, facilitating the flourishing of the private sector. Other aims of the policy included aligning India's telecom sector with global standards, supporting economic growth through improved accessibility and quality of telecommunication services, ensuring universal access to basic telecom services, enhancing service quality to international standards, fostering domestic manufacturing of telecom equipment, and safeguarding national security interests. The policy emphasized that private sector participation was essential to bridge the resource gaps that were hindering pursuing these goals. As part of the policy, pilot projects were encouraged to facilitate technology adoption, while emphasis was placed on facilitating technology inflow and indigenous R&D to bolster India's technological competitiveness. Implementation strategies also focused on consumer protection, fair competition, and the promotion of national interests.
2. Indian telecom spectrum auctions (started in 1994, most recently held in 2022): Following the entry of private players into the market, the government found itself in the position of needing to regulate

bandwidth access with the consideration of these new stakeholders. Initially, licenses and spectrum were linked, allowing telecom companies to operate in one of the 22 telecom circles upon purchasing a Unified Access Services (UAS) license. The UAS license, valid for 20 years and extendable by 10 years, required renewal through bidding. However, spectrum was delinked from licenses starting in 2011. The early auctions, such as those in 1994, 1997, 2000, and 2001, involved primarily the 900 MHz band, with the 1800 MHz band auctioned for the first time in 2001 (Damani, 2016). However, the government switched to an administrative allocation model post-2001, resulting in significantly lower spectrum prices and subsequent controversies, including the high-profile 2G spectrum case in 2008, where the Supreme Court cancelled 122 licenses issued due to corruption. In 2010, a highly competitive auction for 3G and 4G spectrum generated substantial revenue for the government, with major telecom players like Airtel, Vodafone, and Reliance participating. This auction set a precedent for future spectrum sales, emphasizing competitive bidding. However, subsequent auctions, such as those in 2012 and 2013, faced challenges, including low bidder turnout and unmet revenue targets. For instance, the 2012 auction failed to attract bids for crucial circles like Delhi and Mumbai, leading to unsold spectrum and the need for further auctions. The 2014 auction marked another significant event, with the government earning INR 612 billion from the sale of 2G spectrum in the 900 MHz and 1800 MHz bands. The 2015 auction expanded to include the 800 MHz, 900 MHz, 1800 MHz, and 2100 MHz bands, concluding with a total revenue of INR 109,874 crore despite 11% of the spectrum remaining unsold. The 2016 auction was notable for introducing the 700 MHz band, though high reserve prices led to only 40% of the spectrum being sold (Sh, 2016). The subsequent years saw plans for 5G spectrum auctions, and significant consultations and price adjustments were taken and made to make the 700 MHz band more attractive to bidders. The most recent auctions reflected a growing focus on 5G technology, with major telecom operators like Jio, Airtel, and Vi actively participating. The 2021 auction saw bids for 37% of the available spectrum, raising INR 77,814.80 crore, while the 2022 auction, which included 5G bands, received bids worth INR 1.50 trillion, covering 71% of the spectrum on offer (Ians, 2022).

3. Telecom Regulatory Authority of India Act, 1997: The establishment of TRAI as an independent regulator was a crucial step in ensuring fair play in the industry. Some of the TRAI's responsibilities include setting tariffs, promoting fair competition, ensuring a transparent policy environment, making recommendations on matters like new service providers and technological improvements and ensuring compliance with license terms and service quality standards. TRAI comprises of a chairperson, two whole-time members, and two part-time members appointed by the Government of India. TRAI's recommendations are non-binding but can be referred back for reconsideration by the Central Government. TRAI holds powers to order information furnishing, appoint inquiries, inspect documents, and issue directions to service providers.
4. Satellite Communication Policy, 1997: Managed by the Department of Space (DoS) through the Indian Space Research Organisation (ISRO), the Satcom Policy regulates satellite capacity utilization, primarily focusing on leasing INSAT satellite capacity to Indian and foreign entities (Sanyal et al, 2022). While the policy allows some use of foreign satellites for services in India, it favors domestic satellite capacity. Although beneficial for sectors like telecommunications, broadcasting, and disaster management, the existing policy falls short in meeting the evolving needs of the satellite communications sector. It lacks provisions for non-geostationary satellites (NGSOs) like medium earth orbit (MEO) and low earth orbit (LEO) satellites, hindering the adoption of new



technologies such as satellite broadband. Furthermore, the bureaucratic process, involving multiple regulatory bodies like ISRO, the Antrix Corporation, and additional telecom regulators, creates administrative hurdles, deterring global companies from operating in India's satellite market. Additionally, entities intending to offer services using satellite capacity must obtain separate service licenses, adding to regulatory complexity.

5. Internet Service Providers (ISP) Licensing, 1998: On January 15, 1998, the Department of Telecommunications (DoT) announced guidelines for Internet Service Provider (ISP) licenses, with the sale of application forms commencing on February 18, 1998. These guidelines proposed a fixed annual license fee and prohibited ISPs from establishing international gateways or last-mile connectivity. They allowed ISPs to offer specific services such as email and Archies, but real-time services were not permitted. TRAI received representations regarding these guidelines in January 1998, leading to their stay in February 1998. In May 1998, the then newly elected PM Vajpayee formed an IT task force, which gazetted 108 recommendations, including issuing ISP licenses at Rs 1 per annum. A new definition of Internet services was adopted in November 1998 and ISP licenses were subsequently granted to private operators with a view to encourage growth of the Internet and increase Internet penetration. A supportive policy regime with light regulatory approach was adopted with no license fee, no entry fee, very liberal roll out obligations and no cap on number of Internet service providers in a license area. It was hoped that soft regulatory approach would encourage private participation, bring in competition and fuel the growth of Internet. The policy encouraged private participation and more than 700 licenses were issued within first 3 years of opening the sector to private participation. However, the expected growth was not achieved and, in 2007, only 20 out of existing 398 ISP licensees catered to 98% of total internet subscribers ("Recommendations on Review of Internet Services", 2007).
6. New Telecom Policy, 1999: It recognized the crucial role of telecommunication services in national development. Therefore, it aimed to address the shortcomings of the previous policy and adapt to the rapid growth in information and communication technology. As such, its objectives included ensuring affordable and effective telecommunication access for all citizens (especially in remote areas) and fostering India's development into an IT superpower through convergence of IT, media, telecom, and consumer electronics ("New Telecom Policy, 1999 — the Centre for Internet and Society", n.d.). It also introduced the Universal Service Obligation (USO) policy to extend telecom services to rural areas, implemented tariff structures to make services more affordable, and encouraged private sector participation. However, subsequent analyses have given mixed results. In the post-NTP 99 environment, overall teledensity in India increased to 12.8 by March 2006: a growth of four and half times in six years. The average urban teledensity was over 34, while it was not even two in rural India as on December 31, 2005. As for the interstate differences in rural teledensities, the central, eastern and northern regions with respective rural teledensity figures of 0.71, 0.86, and 1.41 fell behind the all-India average at the time (1.81). On the other side, the southern and western regions had rural teledensities of 3.87 and 2.34, respectively. Across states, Kerala (10.76), Himachal Pradesh (7.07), and Punjab (5.16) had the highest rural teledensities in the country. On the lower side were Chhattisgarh (0.52), Uttar Pradesh (0.55), Jharkhand (0.56), and Bihar (0.64) (Rao, 2007). As the numbers show, mobile telephone services predominantly remained urban-centric, contributing to the low rural teledensity. Limited infrastructure, sparse population distribution, and perceived low profitability deterred private operators from investing in rural areas.

Addressing these challenges required a critical examination of past government policies and proactive measures to bridge the digital divide and ensure equitable access to telecommunication services across all regions.

7. The Telecommunications Dispute Settlement and Appellate Tribunal, 2000: The TRAI was established in 1997 to regulate the telecommunications sector and resolve disputes. Initially, TRAI's adjudicatory powers were challenged, leading to a lack of a separate dispute settlement mechanism. To address this, the Telecom Disputes Settlement and Appellate Tribunal (TDSAT) was formed in 2000 through amendments to the TRAI Act. TDSAT's jurisdiction extends to telecom, broadcasting, IT, and airport tariff matters. It consists of a chairperson and two Members appointed by the Central Government, with powers similar to a civil court. TDSAT's orders are executable as a decree of a civil court. Appeals against its decisions can be made to the Supreme Court on substantial questions of law. Additionally, TDSAT has appellate jurisdiction over cyber matters, which can be appealed before the High Court ("Telecom Disputes Settlement and Appellate Tribunal: A Brief Introduction", n.d.).
8. Indian Telegraph Amendment Act, 2003: The Indian Telegraph (Amendment) Act of 2003 introduced Part IIA into the Telegraph Act, 1885, focusing on establishing the Universal Service Obligation Fund (USOF) to address universal service obligations ("Indian Telegraph Act, 1885 — The Centre for Internet and Society", n.d.). The USOF, originally established under the New Telecom Policy of 1999 (NTP'99), aims to provide basic telecom services to all at affordable prices. Funding for the Universal Service Obligation (USO) is sourced from a 5% levy on the Adjusted Gross Revenue of telecom operators, excluding pure value-added service providers. The Indian Telegraph (Amendment) Act, 2003, gave statutory status to the USOF, ensuring funds were used exclusively for USO objectives and did not lapse at the end of the financial year. The scope of the USOF included providing public access telephones and individual rural household telephones in rural and remote areas, as well as implementing universal public access broadband services through High Speed Public Tele-Information Centers (HPTICs) in villages with populations over 2000 (Rao, 2007). The policy also supported the provision of Village Public Telephones (VPTs) in all 607,000 revenue villages and additional Rural Community Phones (RCPs) in 46,000 villages with populations over 2000 and replaced 184,000 non-functional VPTs. Support from the USOF covered the net cost of providing services, including capital recovery and annual operating expenses, minus annual revenue. Funds were disbursed through a multi-layered reverse bidding process, with the lowest quoted subsidy winning. Basic Service Operators (BSOs), Cellular Mobile Service Operators (CMSPs), and Universal Services Access Licensees (UASLs) were eligible to participate. An independent agency set benchmarks based on fully allocated current costs, with data collection, analysis, and projections for 5-7 years determining reserve prices for bids. An officer of Secretary rank oversaw USOF administration, attached to the Department of Telecommunications (DoT), Ministry of Communications & IT. Implementation status highlights included financial support for 520,000 VPTs in 1991 census revenue villages, over 50% of 184,000 MARR VPTs replaced with CAPEX (capital expenditure) and OPEX (operational expenditure) support, and support for 8.6 million rural household DELs (dedicated exchange lines) installed before April 1, 2002. Agreements with two operators covered 46,253 RCPs in villages with populations over 2000, with further bidding for 66,822 VPTs in uncovered villages. Approximately \$100 million was disbursed in 2002-03 and 2003-04, with an expected \$600 million in 2004-05, and over \$2 billion during the 10th Five

- Year Plan (2002-03 to 2006-07) ("THE UNIVERSAL SERVICE OBLIGATION FUND (USOF) IN INDIA – AN OVERVIEW", n.d.).
9. Unified Access Service License (UASL) regime, 2003: The introduction and implementation of the UASL in India in 2003 marked a significant milestone in the country's telecommunications sector. UASL was designed to simplify the licensing regime by allowing telecom operators to offer both wireless and fixed-line services under a single license, thus eliminating the need for separate licenses for different types of services (DETAILED GUIDELINES FOR UNIFIED ACCESS (BASIC & CELLULAR) SERVICES LICENCE, n.d.). This reform facilitated the convergence of telecom services, enabling operators to provide a seamless and comprehensive range of services to consumers. The move not only reduced compliance costs and regulatory burdens for operators but also encouraged the growth of multi-service providers, fostering a more competitive and innovative market. By streamlining the licensing process, the UASL paved the way for greater investment in telecom infrastructure, enhanced service delivery, and rapid expansion of telecom networks across India, contributing significantly to the sector's overall growth and modernization.
  10. Telecom Enforcement Resource and Monitoring (erstwhile Vigilance Telecom Monitoring, 2004): TERM cells serve as the vigilance and monitoring arm of the Indian Department of Telecommunications (DoT). It comprises of 34 Cells across India's 22 telecom circles and 10 large telecom districts, each led by a Deputy Director General (DDG) of Senior Administrative Grade (SAG). The primary functions of TERM Cells include vigilance, monitoring, and network security, along with operating the Central Monitoring System (CMS) for electronic surveillance. Initially established as Vigilance Telecom Monitoring Cells (VTM) in 2004, they were created to curb illegal telecom operations. Over time, VTM Cells expanded across various states and were eventually renamed TERM Cells in 2008 to better encompass their multifaceted functions. These functions include analyzing and addressing complaints, ensuring compliance with EMF radiation norms, assessing mobile spectrum utilization, investigating telecom and internet service complaints, and facilitating the registration of Other Service Providers (OSPs) and telemarketers. TERM cells also conduct service testing of licensed Telecom Service Providers (TSPs) to ensure compliance with roll-out obligations and quality standards, issuing Service Test Result Certificates (STRCs) and collecting fees for testing services. Additionally, TERM Cells compile data on roll-out obligations to impose Liquidated Damage (LD) charges on non-compliant TSPs.
  11. Do Not Disturb (DND) Registry, 2007: The National Customer Preference Register (NCPR) in India, established by the Telecom Regulatory Authority of India (TRAI), empowers users to opt-out of unwanted marketing calls and messages. It covers seven categories but excludes essential sectors like market research and charitable causes. Users can register by sending an SMS to 1909, with registration lasting indefinitely until voluntarily revoked. Complaints can be filed against violators, who face penalties and service disconnection. Organizations must obtain explicit consent for marketing messages, renewable every 60 days. The NDNC ensures privacy and control over received messages, promoting informed consent in managing marketing communications effectively (Dash et al, n.d.).
  12. National Knowledge Network (NKN), 2010: It is a transformative project in India designed to connect over 1500 institutions across diverse sectors. With an investment of Rs 5990 Crore over 10 years, NKN aimed to provide high-speed connectivity, enabling collaborative research, advanced distance education, and seamless integration with global networks (Pti, 2010). It was a visionary



initiative fostering inclusive growth and next-generation applications to propel India into a knowledge-driven economy. Some of the connected institutions include IIT Guwahati, IIT Dharwad IIM Ahmedabad & IIM Bangalore.

13. Spectrum Auctions 2010 onward: After the 2001 spectrum auction, the government of India shifted to an administrative allocation program vis-a-vis spectrum allocation instead of the auction model. This led to the infamous 2G spectrum scam, which is estimated to have cost the exchequer a whopping 176,000 crores (ET Online, 2024). After this, the government was forced to shift back to the auction model, which led to greater transparency and much higher revenue for the government. The 2010 spectrum auction in India was primarily organized to allocate airwaves for 3G and Broadband Wireless Access (BWA) services, aiming to revolutionize the telecom industry by enabling high-speed internet and advanced mobile services. The auction was also a response to the burgeoning demand for data services and the need to decongest the existing 2G networks, providing operators with the necessary spectrum to enhance their service offerings and cater to a rapidly growing subscriber base. The Department of Telecommunications (DoT) adopted a simultaneous multiple-round ascending (SMRA) format, ensuring transparency and maximizing revenue. Pre-qualification criteria were established, and operators interested in participating had to meet stringent financial and technical prerequisites. The auction featured multiple rounds of bidding, allowing participants to place bids on spectrum blocks across different telecom circles, with the process continuing until no further bids were received. The SMRA format allowed for competitive bidding, ensuring that the spectrum was allocated to those who valued it the most. The auction concluded with a resounding success, garnering a record-breaking revenue of approximately 67,718 crores for the Indian government (Pahwa, 2010). Major telecom operators like Bharti Airtel, Vodafone, and Reliance Communications emerged as significant winners, securing 3G spectrum in several key circles.
14. National Telecommunications Institute for Policy Research, Innovation, and Training (NTIPRIT), 2010: Initially, after recruitment through the Combined Engineering Services Examination conducted by the Union Public Service Commission (UPSC), induction training for Indian Telecommunication Service (ITS) Group-A probationers commenced at Bharatratna Bhimrao Ambedkar Institute of Telecom Training (BRBRAITT), Jabalpur. From 1978 onwards, the focal point for managing this training shifted to the Advanced Level Telecommunication Centre (ALTTC) in Ghaziabad. Until 1980, ITS officers were also trained at the Lal Bahadur Shastri National Academy of Administration (LBSNAA). In the year 2000, the services and operations wing of the Department of Telecommunication (DoT) was corporatized, leading to the establishment of a new corporate entity called Bharat Sanchar Nigam Limited (BSNL). Both training institutes, ALTTC and BRBRAITT, became part of BSNL to cater to the training needs of absorbed technical officers of BSNL. In 2010, the Ministry of Communications and Information Technology (MoC&IT) approved the establishment of the National Telecom Academy to operate under the supervision and control of the Senior Deputy Director General (Sr DDG) of Telecommunication Engineering Centre (TEC). It was decided that this academy would operate from ALTTC Ghaziabad. The Academy commenced its training activities in January 2011. In March 2011, the MoC&IT accorded approval to enhance the scope of activities of the academy and renamed it as the National Telecommunications Institute for Policy Research, Innovation & Training (NTI). Since then, besides meeting the training needs of

- DoT officers, NTI also conducts training programs for law enforcement agencies in India and functions as a think-tank for policy issues and advises the Ministry from time to time.
15. Telecom Commercial Communications Customer Preference Regulations (TCCCPR), 2010: The Telecom Commercial Communication Customer Preference Regulations, 2010 (TCCCPR) were enacted by the Telecom Regulatory Authority of India in 2010 and implemented from September 27, 2011. Spearheaded by Telecom Minister Kapil Sibal, the regulation aimed to provide relief to Indian consumers from unsolicited marketing calls and SMS. India's telecom industry, with nearly 900 million subscribers, ranked the second-largest wireless market globally. The prevalence of low tariffs and direct consumer reach made SMS and direct calling popular for selling services and products. However, telemarketing became a significant nuisance for customers over the years. Under the TCCCPR, subscribers have the option to opt for either a 'fully blocked' category to block all commercial calls/SMS or a 'partially blocked' category to receive selected promotional SMS. The regulation imposes hefty penalties of up to INR 2.5 lakh on telemarketing companies for violations, along with blacklisting habitual offenders. A limit of 200 SMS per day per SIM card was introduced to curb mass broadcasting of SMS. Certain exceptions, like festival days and specific entities such as telecom dealers and e-ticketing agencies, are exempt from this limit. Initially set at 100 SMS per day per SIM, the limit faced criticism, particularly from text-heavy users such as college students (Pti, 2011). As a result, TRAI later raised the limit to 200 SMS per day per SIM. In July 2012, the Delhi High Court lifted the ban on the SMS limit, citing it as a restriction on freedom of speech and expression.
  16. Mobile Number Portability, 2011: Mobile Number Portability (MNP) was introduced in India in January 2011, following years of debate and delay. It allows users to retain their existing mobile numbers while switching to a different service provider. Initially pioneered in Singapore in 1997, MNP has been implemented in various countries worldwide (Kaushik, 2011). In India, with nearly 900 million subscribers, the rapid growth of the mobile market necessitated the implementation of MNP to address concerns about network quality and service offerings. The introduction of MNP empowered subscribers to switch operators without changing their numbers, addressing issues such as poor network coverage and tariff concerns. As of February 5, 2011, approximately 17.11 lakh subscribers had submitted porting requests. MNP is viewed as a critical step towards promoting fair competition in the telecom market, benefiting consumers and encouraging operators to enhance their quality of service (QoS) and offer attractive packages to retain customers (Singh, 2013). Quality of service (QoS) and average revenue per user (ARPU) are crucial metrics in the telecom industry. MNP was expected to drive operators to improve their QoS to attract and retain customers, especially in the corporate segment, where heavy voice and data usage contribute substantially to ARPU. However, offering competitive tariffs to match the competition was expected to further pressure operators' margins, particularly as they already grapple with falling ARPU. Despite these challenges, the growing subscriber base in India and the entry of new operators drove up the demand for MNP, and the telecom industry had to significantly improve service quality. It provided customers with a wider choice and intensified competition amongst operators.
  17. BharatNet Project, 2011: BharatNet, also known as Bharat Broadband Network Limited (BBNL), is a central public sector undertaking established by the Department of Telecommunications under the Ministry of Communications. It aims to provide a minimum of 100 Mbps broadband connectivity to all 250,000 gram panchayats, covering nearly 625,000 villages, as part of the Digital India initiative.

BharatNet Phase-I, completed in December 2017, connected 100,000 village councils covering 300,000 villages (Ians, 2017). BharatNet Phase-II, which was targeted for completion by March 31, 2023, aimed to connect the remaining 150,000 village councils covering 325,000 villages in 16 states. The project also planned to create 700,000 Wi-Fi hotspots across all 625,000 villages, supported by a union government grant of INR 36 billion to sustain commercially non-viable hotspots. BharatNet is the world's largest rural broadband connectivity program, built under the Make in India initiative without foreign involvement. It supports other key government schemes like Digital India, Make in India, the National e-Governance Plan, and various infrastructure development programs. The project began in 2011 as the National Optical Fibre Network (NOFN) and was later renamed BharatNet. Initially slow to take off, the project gained momentum under the BJP government from 2014, with significant funding, streamlined implementation through public sector units like BSNL, RailTel, and PowerGrid, and the use of existing government infrastructure to bypass right-of-way issues. Implementation partners include BSNL, RailTel, and PowerGrid, with BSNL handling 18 states and UTs, RailTel 8 states and UTs, and PowerGrid 5 states. BharatNet aims to provide employment opportunities, improve service delivery (e-governance, e-health, e-education, etc.), and boost initiatives like Make in India, Digital India, and Startup India. Increased internet usage due to BharatNet is projected to significantly boost India's GDP, with a 10% increase in internet usage potentially adding an INR 4.5 trillion to the economy (FEOnline, 2017). Funding for BharatNet includes an INR 450 billion union government share from the Universal Services Obligation Fund, with additional contributions from state governments. The project emphasizes Make in India, using domestically produced optical fiber and equipment. BharatNet also collaborates with entities like C-DOT, Telecommunications Consultants India Limited, and the National Informatics Centre. BharatNet is designed as a middle layer for broadband connectivity across all Community Development Blocks, gram panchayats, and villages. Phase-I, completed in December 2017, connected 100,000 gram panchayats, while Phase-II aimed to connect the remaining 145,000 gram panchayats by March 2023. The project includes significant investments in Northeast India (Ians, 2018). Bharat Broadband Network Limited (BBNL) was merged with Bharat Sanchar Nigam Limited (BSNL) in July 2022.

18. National Telecom Policy, 2012: This policy outlined several key objectives and strategies for the development and regulation of the telecom sector in India. It aimed to establish a unified licensing regime across services and areas, striving for full Mobile Number Portability (MNP) and eventually free roaming. Legal and regulatory frameworks were harmonized to enable converged services, networks, and devices, while a move towards a Unified License regime was initiated to exploit benefits of convergence and spectrum liberalization. Merger and acquisition processes were simplified, ensuring competition was maintained. Resale at both wholesale and retail levels under the proposed licensing regime was encouraged. Spectrum management ensured adequate availability through transparent allocation processes, with liberalization allowing service provision in any band, technology, and sharing. Spectrum utilization was periodically audited to introduce new technologies. Efforts were made to increase rural teledensity and recognize broadband connectivity as a basic necessity. Affordable and reliable broadband with minimum speeds was provided, with access extended to all villages. Indigenous R&D, innovation, and manufacturing were promoted to meet domestic demand, with a telecommunications standard development organization (TSDO) established to drive consensus. Preference was given to domestically manufactured telecom products

in procurement. Telecom was recognized as infrastructure, promoting green telecommunications, while regulation was strengthened to ensure compliance with quality of service standards and consumer protection. An institutional framework for safe device induction and network security was established. Efforts were made to assess manpower requirements and partner with industry for skill development. The significance of cloud computing and IPv6 in service delivery and innovation was recognized. Taxes and duties were rationalized to stimulate investments and affordability. Regulatory acts were reviewed to address inadequacies and impediments, with comprehensive review of telecom legislation undertaken to align with policy objectives. Migration to the new regime was facilitated with detailed guidelines. Overall, the policy aimed to promote innovation, indigenous manufacturing, and skill development while ensuring regulatory compliance, security, and affordability in the telecom sector (Deora, 2013).

19. Unified License Regime, 2013: The Unified License (UL) introduced in India significantly revamped the regulatory framework for telecom services, particularly impacting managed data services. Prior to the UL, telecom companies needed both international long distance (ILD) and national long distance (NLD) licenses to provide global services within India. The UL consolidated various service authorizations under a single license, updating technical standards, security measures, and financial terms, and relaxed foreign direct investment limits (Aulakh, 2013). Financially, the entry fee for ILD and NLD services remained INR 25 million, but the processing fee for NLD license applications increased to INR 50,000. Licensees were required to provide performance bank guarantees of INR 25 million and financial bank guarantees reduced to INR 5 million. The UL restricted foreign carriers from directly acquiring Indian customers or billing them, targeting the 'one-stop-shop' model where foreign companies resold Indian telecom services without paying license fees to the Department of Telecom (DoT). It also facilitated infrastructure sharing amongst licensees and allowed ILD licensees to establish international gateways and cable landing stations with government approval. New security conditions mandated connectivity to the Centralized Monitoring System (CMS) and required extensive call monitoring capabilities. The UL reiterated restrictions on transferring user and accounting information outside India, complicating global operations management for telecom companies. It defined International Private Leased Circuit (IPLC) and imposed conditions for leasing international bandwidth, requiring the domestic leg of IPLC to be managed by NLD service providers ("The unified license has revamped the regulatory framework governing the provision of telecom services in India. But will it provide the clarity it so desperately requires?", 2013). Additionally, while access service providers could now interconnect internet telephony networks with PSTN/PLMN/GMPCS (Public Switched Telephone Network/Public Land Mobile Network/Global Mobile Personal Communications by Satellite) networks, internet service providers were prohibited from such interconnections. Overall, the UL modernized the regulatory environment but imposed stringent conditions, significantly impacting telecom operations in India.
20. Central Monitoring System, in effect from 2013: The Central Monitoring System (CMS), developed by the Centre for Development of Telematics (C-DOT) and operated by Telecom Enforcement Resource and Monitoring (TERM) Cells, centralized telephone interception in India. Telecom operators were mandated to grant access to their networks to law enforcement agencies. The CMS aimed to automate government-approved Lawful Interception & Monitoring of telecommunications, receiving funding of INR 400 Crores from the Cabinet Committee on Security. Despite delays, the



project was initiated to strengthen national security following the 2008 Mumbai attacks. The system faced multiple deadlines, ultimately rolling out state by state from April 2013. Authorization for interception was governed by the Indian Telegraph Act and required approval from designated government officials. The Supreme Court upheld the constitutional validity of interceptions under the Act. Authorized agencies included central bodies like R&AW and state agencies like state police departments (Smith, 2013). Call data records could be accessed following statutory provisions outlined in the Code of Criminal Procedure and the Indian Telegraph Act. Concerns were raised by human rights and civil liberties groups regarding the Central Monitoring System (CMS), labelling it as prone to abuse and an infringement of privacy and civil liberties. Critics expressed worries over extensive surveillance capabilities facilitated by digital communications, suggesting that governments were overstepping boundaries and intruding into private lives. There were concerns about the lack of balance in addressing cyber threats and the potential misuse of the system bypassing judicial oversight (Nandakumar, 2013). Additionally, there were apprehensions about the growing power imbalance between citizens and the state, with inadequate checks and balances in place. Recommendations to bypass such monitoring included shifting to free/open-source software, encrypting sensitive Internet traffic, and establishing privacy laws for better government accountability. Some even viewed the CMS as a threat to democracy, potentially challenging governmental authority.

21. National Cyber Security Policy, 2013: It was a landmark initiative aimed at addressing the growing challenges of cyber threats and vulnerabilities in India. It provided a comprehensive framework for monitoring, safeguarding, and strengthening defences against cyberattacks, with the ultimate goal of ensuring a safe and reliable cyberspace for all stakeholders. One of the key objectives of the policy was to protect the information infrastructure in cyberspace and reduce vulnerabilities that could be exploited by malicious actors. To achieve this, the policy emphasized the development of capabilities to prevent and respond to cyber threats effectively. This included the establishment of institutional structures, processes, and technological measures to mitigate the risks posed by cyber incidents. The policy also focused on promoting collaboration and cooperation amongst various stakeholders, including government agencies, private sector organizations, academia, and international partners. It recognized the need for a collective effort to address cyber threats effectively and called for the establishment of partnerships at both the national and international levels. Another important aspect of the policy was its emphasis on capacity building in the field of cybersecurity. It aimed to develop a skilled workforce of cybersecurity professionals to meet the growing demand for expertise in this area. This included initiatives to train and educate individuals in cybersecurity best practices, as well as efforts to promote research and development in cybersecurity technologies. Furthermore, the policy outlined specific measures to enhance the security of critical information infrastructure, such as financial systems, energy networks, and government services. It called for the implementation of security measures based on global best practices and standards, as well as the adoption of technologies and solutions tailored to the unique requirements of India's cyberspace (GFG, 2022).
22. Telecommunications Standards Development Society India (TSDSI), 2014: The TSDSI was established in 2014 as part of the government's commitment outlined in the National Telecom Policy, 2012. It serves as an autonomous organization focused on developing standards for telecom and ICT products and services in India. TSDSI collaborates with global standards bodies to integrate

Indian requirements into international standards, promoting the generation of Indian intellectual property rights (IPRs) and fostering indigenous research, product development, and manufacturing. Supported by the Department of Telecommunications and the Ministry of Electronics and Information Technology, TSDSI aims to standardize India-specific telecom/ICT requirements, facilitate the adoption of Indian standards globally, enhance domestic manufacturing capabilities, and provide leadership to developing nations. With a membership structure encompassing various stakeholders from the telecom ecosystem, including government departments and industry associations, TSDSI operates under the principles of openness, transparency, fairness, consensus, and technology neutrality, advocating for its members' interests to government bodies on policy, regulatory, and standardization matters in the telecom sector ("Overview of TSDSI - India's Telecom SDO", 2024).

23. USOF-sponsored Left-Wing Extremism (LWE) Mobile Tower Project (Phases I and II): Phase I was approved in August 2014. The project aimed to provide mobile services (2G-based) in 2199 locations affected by left-wing extremism (LWE). Bharat Sanchar Nigam Limited (BSNL) was awarded the project on a nomination basis. The agreement saw the Universal Service Obligation (USO) Fund covering the capital expenditure for 1836 sites and operational costs for all 2199 sites over a five-year period. This encompassed the installation of 1836 new towers and the operation of 363 existing towers already installed by BSNL in these areas. Additionally, in June 2016, the Ministry of Communications (MOC) and IT approved the extension of mobile services to an additional 156 sites under the same agreement. Phase I of the project has been completed, with a total of 2355 sites approved, out of which 2343 are operational and radiating mobile services. Approved in May 2018, the second phase of the project entailed the installation of 4072 mobile towers equipped with 2G and 4G technology in areas affected by left-wing extremism (LWE), as identified by the Ministry of Home Affairs (MHA). This initiative, supported by a subsidy of Rs 7330 crore (excluding taxes) from the Universal Service Obligation (USO) Fund, aimed to improve connectivity in these regions. The rollout period spanned 18 months from the date of signing the contract with implementing agencies. Agreements were signed with Reliance Jio and Bharti Airtel. Surveys were completed for 2338 sites, with an additional 218 locations incorporated into the scheme based on MHA recommendations to replace deleted sites. As of May 27, 2024, implementation efforts have resulted in the installation of 939 mobile towers and associated infrastructure across Andhra Pradesh, Telangana, Jharkhand, Maharashtra, Chhattisgarh, Madhya Pradesh, and Odisha, covering a total of 988 sites.
24. Aadhaar-Linked SIM Verification, 2015: The provision for Aadhaar-linked SIM verification, approved by the Prime Minister's Office, entailed a partial rollout of a scheme proposed jointly by the Department of Telecom (DoT) and the Unique Identification Authority of India (UIDAI). This initiative, scheduled to commence on March 4, 2015, in major cities such as Delhi, Kolkata, Lucknow, and Bangalore, was slated to run for six weeks. As per the scheme, individuals purchasing SIM cards were required to furnish their Aadhaar number and provide fingerprint impressions during the transaction. This decision followed concerns raised by the Intelligence Bureau regarding security implications, including discrepancies within Aadhaar data (Kumar, 2015). The Union Home Ministry's agreement to the linkage was contingent upon service providers furnishing the identity and address proof of SIM cardholders upon request. While some security officials viewed Aadhaar-

- SIM linkage favourably for authentication purposes, apprehensions persisted regarding data security and online tampering.
25. Digital India Initiative, 2015: The Digital India initiative, launched by Prime Minister Narendra Modi on July 1, 2015, aims to empower the citizens of India digitally and bridge the digital divide in the country. It emphasizes e-governance and seeks to transform India into a digitally empowered society. With an estimated budget of Rs 1,13,000 crore, the initiative focuses on providing high-speed internet services to all gram panchayats, ensuring easy access to government services online, and promoting digital literacy amongst citizens, including those in rural areas. The initiative encompasses various projects such as manufacturing of electronics, providing public access to the internet, laying broadband services on highways, improving mobile connectivity, enhancing e-governance, and providing IT training for jobs. Additionally, the initiative includes e-Kranti, which aims to deliver electronic services related to health, education, agriculture, justice, security, and financial inclusion. The response to the Digital India initiative from global investors like Sundar Pichai, Satya Nadella, and Elon Musk has been positive, with commitments to support the program and invest in initiatives such as setting up low-cost broadband technology services in rural areas (Nidhi, 2018).
26. Smart Cities Mission, 2015: The Indian Smart Cities Mission, launched by the Government of India in June 2015, aims to develop 100 cities across the country into smart cities that provide core infrastructure, a clean and sustainable environment, and a high quality of life to their citizens through the application of smart solutions (Pti, 2018). The mission focuses on promoting sustainable and inclusive cities that provide a good quality of life to their citizens, a clean and sustainable environment, and the application of 'Smart' Solutions. Key components of the Smart Cities Mission include the development of robust infrastructure, efficient public transportation systems, improved water and electricity supply, and effective waste management systems. It also emphasizes the use of technology to enhance the efficiency of urban management and service delivery. There were also several sub-initiatives to better develop telecommunications in urban centres to facilitate the mission. This includes the implementation of integrated command and control centres, smart meters, and sensors for utilities, and the deployment of ICT solutions to improve governance and citizen participation. The mission adopts a 'city-centric' approach, where each city prepares its own proposal through extensive citizen engagement to reflect the unique vision and aspirations of its residents. The proposals outline specific plans for area-based development (retrofitting, redevelopment, and greenfield development) and pan-city initiatives that leverage technology to improve the quality of urban life. Funding for the mission comes from a mix of government grants, private investment, and public-private partnerships (PPPs). The central government provides financial support, while states and urban local bodies are encouraged to generate additional funds through various means, including leveraging land and property values.
27. Launch of Unified Payments Interface (UPI) (2016): In April 2009, the National Payment Corporation of India (NPCI) was established to integrate and standardize all retail payment mechanisms in India. By 2011, the Reserve Bank of India (RBI) identified significant gaps in the country's financial inclusion: only six non-cash transactions per person were conducted annually, and 145 million families lacked access to any form of banking (Datta, 2020). In response, RBI released a vision statement in 2012 aimed at creating a secure, efficient, and inclusive payment system, reducing paper usage as part of a Green Initiative. Under RBI's guidance, NPCI developed

the Unified Payments Interface (UPI), officially launching it in 2016 (Mehta, 2023). UPI was designed to be simple, secure, and interoperable, working on a four-pillar push-pull model involving remitter and beneficiary payment service providers and banks. This innovation allowed seamless monetary transactions between users (Patnaik, 2021). By 2019, UPI's success prompted Google to suggest to the US Federal Reserve Board that they consider UPI as a model for its FedNow real-time payment system. In 2020, UPI facilitated 25.5 billion transactions, making India the world's largest real-time payment market, ahead of China, South Korea, and the UK. In 2019, India's Ministry of Finance removed the merchant discount rate (MDR) for UPI transactions, leading to a surge in low-value transactions. UPI's transaction limits were increased to INR 200,000 in March 2020 and further to INR 500,000 for specific applications in December 2021. In 2022, RBI proposed cardless cash withdrawals via UPI QR codes and introduced UPI Lite for offline transactions. UPI's global footprint expanded with collaborations through NPCI International Payments Limited (NIPL). Agreements were signed with several countries to develop UPI-like systems, including Namibia, Kenya, Mozambique, Indonesia and members of the Commonwealth (Anand et al, 2024). UPI 2.0 was launched in 2018, introducing features like linking overdraft accounts and pre-authorizing transactions. In 2022, RBI allowed linking RuPay credit cards with UPI, and in 2023, proposed extending credit on UPI through pre-approved bank lines. UPI 123PAY, launched in 2022, enabled feature phone users to make payments using voice commands, further promoting financial inclusion. NPCI also introduced e-RUPI in August 2021, a voucher-based system for welfare services and corporate social responsibility initiatives, acting as a precursor to a future Central Bank Digital Currency (CBDC). UPI Lite, launched in 2022, facilitates offline transactions for small-value payments, enhancing its usability in low-connectivity areas. This entire UPI system significantly expanded both the scope and reach of telecommunications, as a medium is obviously required to process such transactions.

28. JAM Trinity (Jan Dhan-Aadhar-Mobile), cleared by the Supreme Court in 2018: The JAM trinity, short for Jan Dhan-Aadhaar-Mobile, is an initiative by the government of India aimed at linking Jan Dhan accounts, mobile numbers, and Aadhaar cards of Indian citizens to prevent leakages in government subsidies. Originating from the Economic Survey of 2014-15, the JAM trinity encompasses several key components. First, the Pradhan Mantri Jan-Dhan Yojana (PMJDY), launched on August 28, 2014, by Prime Minister Narendra Modi, is India's National Mission for Financial Inclusion. By June 1, 2016, over 220 million bank accounts were opened under this scheme. Second, the Unique Identification Authority of India (UIDAI) is tasked with collecting biometric and demographic data of residents, storing them in a centralized database, and issuing a 12-digit unique identity number called Aadhaar to each resident. Despite opposition from civil liberty groups citing privacy concerns, the Aadhaar (Targeted Delivery of Financial and other Subsidies, benefits, and services) Act, 2016, was passed in March 2016. The Supreme Court of India, while initially ruling that Aadhaar should not be mandatory for availing services (Venkatesan, 2016), later upheld the country's biometric identity system and mandated Aadhaar enrolment for recipients of government welfare benefits (Writer, 2018). Aadhaar-linked SIM verification, as explained in Reform 24, was also termed optional and not compulsory in this same hearing. According to Arun Jaitley, the JAM trinity aims to streamline government subsidies by ensuring efficient delivery to eligible beneficiaries, leveraging the reach of Jan Dhan accounts, the



- identification capabilities of Aadhaar, and the communication infrastructure provided by mobile numbers (Mishra, 2016).
29. Pradhan Mantri Gramin Digital Saksharta Abhiyan, 2017: The PMGDISHA was initiated by the Union Cabinet in February 2017 to promote digital literacy in rural India. The scheme aims to train 6 crore rural households to operate computers and digital devices, access the internet, and utilize government services for nation-building. To achieve this, various measures have been implemented, including awareness campaigns, establishment of WiFi-choupals for internet connectivity, engagement of rural schools for training, and distribution of certificates by local authorities. The scheme targets individuals aged 14-60 years, and to date, approximately 5.66 crore candidates have been enrolled, with 4.81 crore completing the training and 3.54 crore certified under the scheme (Chandrasekhar, 2022).
  30. Net Neutrality Rules, 2018: India's Department of Telecommunications endorsed net neutrality regulations prohibiting the blocking, throttling, and zero-rating of internet data, with certain exceptions in 2018. These regulations, formulated based on a recommendation from the Telecom Regulatory Authority of India (TRAI) the previous year, marked the culmination of a prolonged campaign advocating for net neutrality in India (Robertson, 2018). TRAI initiated the rule-making process in early 2015, soliciting public comments on potential internet regulations. Activists mobilized internet users in support of net neutrality rules, particularly after two companies announced zero-rating plans that critics feared would disadvantage local startups in favour of wealthy American companies. One such initiative was Facebook's Internet.org or Free Basics project, which provided free access to select internet services in developing nations. India banned Free Basics in 2016. Airtel's 'Airtel Zero' was also affected.
  31. National Centre for Communications Security, 2018: The establishment of the NCCS stemmed from the Indian Telegraph (Amendment) Rules of 2017, which mandated rigorous testing and certification for telecom equipment in India. Recognizing the critical need for ensuring the security and integrity of the nation's communication infrastructure, the Department of Telecommunications formulated the Procedure for Mandatory Testing and Certification of Telecommunication Equipment (MTCTE) in October 2018. To address the evolving security landscape and meet the challenges posed by emerging technologies, the Government of India took proactive steps to establish the NCCS. NCCS was tasked with the responsibility of implementing the Communication Security Certification Scheme (ComSec). Under this scheme, NCCS plays a pivotal role in developing country-specific security standards, establishing a robust testing ecosystem, and certifying telecom equipment against Indian Telecom Security Assurance Requirements (ITSAR).
  32. National Digital Communications Policy, 2018: The NDCP, 2018 aimed to transition India into a digitally empowered economy by establishing resilient and affordable digital communication infrastructure and services. The policy set strategic objectives to be achieved by 2022, including universal broadband access at 50 Mbps for all citizens, 1 Gbps connectivity to all Gram Panchayats by 2020 and 10 Gbps by 2022, and 100 Mbps broadband-on-demand for key development institutions ("Cabinet approves National Digital Communications Policy-2018", n.d.). It also aimed to attract \$100 billion in digital communication investments, create four million jobs in the digital sector, contribute 8% to India's GDP from the digital sector, enhance India's position in the ICT Development Index and global value chains, and ensure digital sovereignty and security. To achieve these goals, the policy outlined three core missions: Connect India, Propel India, and Secure India.

The Connect India mission focused on developing robust digital communication infrastructure, including promoting broadband for all, ensuring service quality, and environmental sustainability. This involved infrastructure sharing, creating a National Fibre Authority, and facilitating open access next-generation networks. The Propel India mission aimed to promote investments, innovation, and IPR generation in emerging technologies like 5G, AI, IoT, and cloud computing. It included reforming licensing, rationalizing taxes, and incentivizing local manufacturing. The Secure India mission emphasized data protection, security, and sovereignty, with strategies such as establishing a data protection regime, ensuring compliance with net neutrality, addressing security issues, and formulating policies on encryption and data retention. The implementation strategies included establishing a National Digital Grid, improving regulatory frameworks to attract investments and ensure fair competition, removing regulatory barriers, and reducing the regulatory burden. The policy also encouraged the use of renewable energy in the communication sector. The policy aimed to promote the growth of the telecom sector, which was crucial for GDP growth and job creation. It encouraged innovation and investment in new technologies and enhanced digital connectivity, thus boosting socioeconomic progress. The success of the policy depended on effective execution and collaboration amongst various stakeholders, including government bodies, telecom service providers, innovators, and the academic community.

33. Flight and Maritime Connectivity Rules, 2018: The Flight and Maritime Connectivity Rules 2018 allowed individuals to utilize phone calls and internet access via their mobile devices during air travel and ship journeys within Indian territory. These regulations permitted both Indian and foreign airlines, as well as shipping companies operating in the country, to collaborate with valid Indian telecom license holders to provide in-flight and maritime voice and data services. These rules permitted connectivity via both ground-based telecom networks and satellites, subject to clearance from the Department of Space. When utilizing satellite systems for connectivity, messages had to pass through earth stations located within India and be interconnected with the national long-distance or access service licensee's network for delivery. To prevent interference with terrestrial mobile networks, in-flight connectivity services activated at a minimum altitude of 3,000 meters in Indian airspace.
34. Introduction of Voice-over LTE: Jio made headlines for revolutionizing telecom connectivity in India by introducing VoLTE services, along with unlimited "free calls." Subsequently, Airtel VoLTE services were launched in Mumbai (Pathak, 2017). Then, VoLTE services dissipated to other telecom providers and have now become commonplace in India.
35. Introduction of Wi-Fi calling in India: In December 2019, Airtel launched its voice over Wi-Fi service, aimed at significantly enhancing the indoor voice calling experience for smartphone users which allowed customers to switch seamlessly from LTE to Wi-Fi for voice calls when they were inside their homes or offices. This ensured excellent signal quality without any extra charge for calls. The service was launched in the Delhi-NCR region. The service was easily configured on compatible smartphones without the need for any additional app. Jio launched similar services soon after.
36. National Broadband Mission, 2019: The National Broadband Mission (NBM) of India was an ambitious initiative aimed at ensuring universal broadband access and bridging socio-economic gaps by connecting all villages and driving the deployment of 5G technology. Supporting the 'Make in India' initiative, the mission promoted domestic manufacturing and aligned with the Digital India programme's vision of transforming the country into a digitally empowered society. As of 2020,

India boasted around half a billion active internet users, with broadband penetration soaring from approximately 61 million subscribers in 2014 to about 625 million by September 2019. The nation also led globally in mobile data consumption, averaging nearly 10 GB per subscriber per month. Recognizing the continuous growth in the telecom sector, the government launched NBM to further enhance broadband infrastructure. The mission operationalized the "Broadband for All" objective of the National Digital Communications Policy 2018 (NDCP-18), aiming to bridge the digital divide, accelerate the growth of digital communications infrastructure, and promote digital empowerment and inclusion. NBM was built on three core principles: universality, ensuring ubiquitous broadband availability; affordability, providing cost-effective services to bridge the socio-economic divide; and quality, offering high-speed, reliable broadband access for all. Key objectives of NBM included enabling universal and equitable broadband access, particularly in rural and remote areas, expediting policy and regulatory changes to expand digital infrastructure, creating a comprehensive digital fibre map, and collaborating with various stakeholders and the Department of Space for satellite connectivity. The anticipated outcomes of the National Broadband Mission by 2022 were to provide broadband access to all villages, ensure high-speed connectivity nationwide, increase the length of Optical Fiber Cable (OFC) to 50 lakh km, enhance telecom tower density, and connect at least 70% of towers with fiber.

37. PM Wi-Fi Access Network Interface scheme, 2020: The PM Wi-Fi Access Network Interface (PM-WANI) scheme was established by the Indian government to deploy numerous public Wi-Fi hotspots across the country. With an existing shortage of Wi-Fi hotspots in India, this initiative played a crucial role in bridging the digital divide and advancing the vision for a Digital India. The scheme focused on enhancing broadband accessibility, particularly in rural areas, by enabling Public Data Office Aggregators (PDOAs) to establish Wi-Fi networks through Public Data Offices (PDOs). This setup allowed small entrepreneurs and local businesses to offer broadband services and generate additional income. Inspired by the successful Public Call Office (PCO) model, the PM-WANI scheme aimed to replicate its widespread impact on telecom connectivity. While challenges such as growing 4G coverage in urban areas persisted, the scheme's emphasis on complementing existing services and catering to underserved areas held promise for reducing the digital divide in India (Hetting, 2020).
38. Telecom equipment manufacturing after Production-Linked Incentives, 2021: The PLI scheme has had a significant impact on the telecom manufacturing sector in India. Firstly, it has led to increased domestic production of telecom equipment, with companies like Samsung, Nokia, and Ericsson expanding their manufacturing operations within the country. This expansion has not only boosted production but has also contributed to job creation across various stages of the value chain, from research and development to manufacturing, distribution, and sales. Additionally, there has been a noticeable uptick in Foreign Direct Investment (FDI) in the sector, as global manufacturers have either set up new facilities or expanded existing ones in India, taking advantage of the incentives provided by the PLI scheme. This influx of FDI has further fuelled the growth of the telecom manufacturing industry in India. Moreover, the PLI scheme's focus on next-generation technologies, particularly 5G, has driven Indian manufacturers to upgrade their technological capabilities to align with global standards. This emphasis on technological advancements has not only enhanced the competitiveness of Indian manufacturers in the domestic market but has also positioned them favourably for international markets. Lastly, the PLI scheme has contributed to the growth of

- telecom equipment exports from India. As Indian manufacturers improve their competitiveness and technological prowess, they have been able to capture a larger share of the global market, leading to a significant increase in the export of telecom equipment ("New success story after smartphone exports! Telecom equipment production crosses Rs 45,000 crore milestone", 2024).
39. Guidelines for establishing satellite based-communication network(s) 2022: These guidelines primarily consolidate existing frameworks and offer clarifications where necessary. They outline the steps for offering any satellite-based communication service to the public or establishing a satellite-based network, which include obtaining authorization from various bodies: DoT for service license, Department of Space (DoS)/New Space India Limited (NSIL) or authorized space segment provider for space segment assignment, Wireless Planning & Coordination (WPC) Wing of DoT for frequency assignment and wireless operating license, Network Operations & Control Centre (NOCC) for carrier plan approval and up-linking permission, and security clearance if required (Sanyal et al, 2022). While these procedures were also in place previously, the guidelines streamline and clarify the process, providing businesses in the sector with clear guidance.
  40. National Frequency Allocation Plan, latest allocation in 2022: NFAP plays a central role in defining the roadmap for future spectrum usage across various national authorities. NFAP serves as a regulatory framework, identifying available frequency bands for a range of services, including cellular mobile, Wi-Fi, broadcasting, radionavigation, defence and security communications, disaster relief, emergency communications, and satellite broadcasting. The recent update of NFAP in October 2022 addressed the allocation of satellite spectrum, a contentious issue in the then-draft telecom Bill, and identified new spectrum bands, such as the 26 GHz band recognized by the International Telecom Union (ITU) for 5G deployment. The updated NFAP was expected to facilitate the next round of 5G auction and deployment by identifying additional spectrum bands. The NFAP also aimed to align with global developments and provisions set by the International Telecommunication Union's Radio Regulations 2020, while promoting innovation and research in emerging fields such as radio astronomy and deep space communications (Chakraborty, 2023).
  41. Machine-to-Machine (M2M) Guidelines, 2022: In February 2022, the Department of Telecommunications (DoT) in India released guidelines for the registration of Machine to Machine (M2M) service providers, titled "Registration Process of M2M Service Providers (M2MSP) & WPAN/WLAN Connectivity Provider for M2M Services" (M2MSP Guidelines). This development marked a significant milestone in the regulatory framework for M2M communications, a process that began with the M2M roadmap issued by DoT in 2015. The guidelines mandated the registration of M2M Service Providers (M2MSPs) and WPAN/WLAN Connectivity Providers, aiming to regulate entities offering M2M services in India. While these guidelines were timely, given the impending introduction of 5G services and increased adoption of IoT devices, they also presented new challenges across sectors using M2M communications. Notably, certain issues, such as the use of international SIMs for permanent roaming, remained unaddressed (Co, 2022).
  42. Sanchar Saathi, 2023: The Sanchar Saathi portal, an initiative of the Department of Telecommunications, is a citizen-centric platform aimed at empowering mobile subscribers, enhancing their security, and promoting awareness about government initiatives. Through Sanchar Saathi, citizens gain the ability to manage their mobile connections effectively, including identifying connections issued in their name, disconnecting unauthorized or unnecessary connections, and blocking or tracing stolen or lost devices (Balaji, 2023). Additionally, the portal facilitates the



verification of device authenticity when purchasing new or used mobile phones and enables users to report suspected fraudulent communications. Sanchar Saathi encompasses various modules such as Chakshu, CEIR, TAF COP, KYM, RICWIN, KYI, amongst others, offering a comprehensive suite of services to empower and protect mobile subscribers.

43. Telecommunications Act, 2023: The Telecommunications Act of 2023, introduced by the Indian Parliament, aimed to modernize the nation's telecom legislation by replacing outdated laws such as the Indian Telegraph Act of 1885, the Wireless Telegraphy Act of 1933, and the Telegraph Wires (Unlawful Possession) Act of 1950. Following almost a year of consultations regarding its draft counterpart in 2022, the new Act was enacted on December 18, 2023. While it sought to update regulatory protocols concerning user authentication, spectrum allocation, and licensing procedures, it also extended the Union government's surveillance powers and authority to suspend internet services. This expansion raised significant concerns regarding privacy and civil liberties. Notably, the Act granted broad authority to intercept and disclose messages in an intelligible format, posing a threat to the principle of end-to-end encryption and potentially discouraging encrypted messaging services from operating in India, thereby impacting freedom of speech and privacy. Additionally, the Act increased the government's ability to order internet shutdowns, a measure already frequently employed, raising criticisms for its adverse effects on rights and economic activities. Clause 20(2)(b) of the Act solidified these powers without the procedural safeguards recommended by the Supreme Court in the Anuradha Bhasin case (Singh et al, 2024). Furthermore, the Act's potential mandate for Aadhaar linkage with mobile phones, despite previous Supreme Court rulings against it, exacerbated privacy concerns. The Act imposed severe penalties for non-compliance, disproportionately affecting users with low digital literacy. Ambiguous provisions regarding spectrum allocation raised concerns about illicit allocations and bypassing due process. Additionally, the Act aimed to subject online communication services to the same regulatory framework as traditional telecom services, potentially undermining user rights and democratic freedoms.
44. Right of Way (RoW) Rules after Telecommunications Act, 2023: Under Chapter III of the Telecommunications Act, detailed provisions concerning the installation and maintenance of telecom networks on public and private properties were outlined, termed as the "Right of Way for Telecommunication Network" (RoW). While the consolidated RoW provisions signified progress, there existed gaps necessitating attention through forthcoming rules under this section. Preceding the Act, the Indian Telegraph Right of Way Rules, 2016 governed the RoW regime. Despite subsequent amendments, these rules had proved inadequate in meeting the burgeoning demands for digital connectivity, prompting calls for enforceable RoW provisions. A World Bank study had underlined the economic significance of liberal RoW provisions in bolstering telecommunication access across India. The 2023 Act had addressed this imperative by instituting legally enforceable RoW provisions. The Act had stipulated that telecom networks were distinct from the properties they occupied, shielding them from related claims or encumbrances. Disputes regarding compensation had fallen under the purview of the District Judge, while other disputes had been adjudicated by the District Magistrate or a designated authority. Notwithstanding its merits, the Act had exhibited certain lacunae warranting attention. Social Impact: The Act had failed to adequately address the social ramifications of telecom infrastructure deployment, treating it predominantly as a private activity. Environmental Impact: Overlooking the environmental implications, especially in wildlife-rich areas, the Act had not integrated recommendations to mitigate adverse effects. Incorporating

Sustainable Practices: The Act had lacked provisions ensuring adherence to sustainable industry practices, neglecting recommendations like the "dig only once" policy for minimizing disruptions and optimizing resource utilization. Awaiting the rules under the Act's RoW provisions, it had been anticipated that these rules would address identified gaps. Liberalizing RoW provisions had been essential for 5G services' efficient rollout, yet successful implementation had hinged on reconciling aspirations with practical realities. Addressing social and environmental concerns had been paramount to determining the Act's efficacy. In essence, while the Telecommunications Act of 2023 had signified progress, rectifying its lacunae had been essential to ensure sustained effectiveness and environmental responsibility in India's dynamic telecommunications landscape (Garg et al, 2024).

### Existing challenges

1. **Delayed Approvals:** Despite clarifications in the Telecommunications Act, 2023 (Chapter III), the acquisition of approvals for infrastructure development, such as tower installation or Right of Way (RoW) permissions, frequently encounters significant delays. This is primarily due to the disparate regulatory frameworks and the absence of standardized procedures across various states and municipalities. These inconsistencies create a cumbersome and protracted approval process, impeding timely infrastructure deployment.
2. **Multi-Layered Clearances:** The infrastructure development process is entangled in a labyrinth of bureaucratic approvals, each necessitating extensive documentation, fees, and stringent compliance checks. This intricate web of requirements not only decelerates the pace of infrastructure deployment but also substantially escalates the associated costs, burdening telecom operators. For example, the cost of setting up a tower in Delhi was hiked substantially in 2021, leading to higher operational costs for telecom operators in the nation's capital (Parbat, 2021).
3. **Urban-Rural Divide:** Despite advancements in broadband penetration, a pronounced disparity persists between urban and rural areas. Rural regions continue to suffer from inadequate connectivity due to insufficient infrastructure development. This digital divide exacerbates socio-economic inequalities, limiting opportunities for rural communities. In 2021, TRAI's findings revealed that accessibility to the internet in rural regions was limited, with only 27.57 out of every hundred people having access. In contrast, urban areas boasted a significantly higher accessibility rate, with 104.25 out of every hundred individuals being connected (Moinuddin, 2021).
4. **Fiber Optic Connectivity:** Initiatives such as BharatNet aim to extend fiber optic connectivity across the nation, yet progress is hindered by logistical challenges, exorbitant costs, and bureaucratic obstacles. The absence of robust high-speed backhaul networks significantly undermines the efficacy of wireless networks, curtailing the overall reach and reliability of broadband services. The BharatNet project, stemming from the National Optical Fibre Network (NOFN) initiative, faced significant hurdles due to sluggish implementation by central public-sector entities (CPSUs) and a lack of cohesive ownership and coordination among stakeholders, particularly between Bharat Broadband Network Ltd (BBNL) and the CPSUs. The revised BharatNet proposal, which aimed to enhance infrastructure and increase capital expenditure, relied on revenue generation from private service providers (PSPs) to offset costs. However, discussions regarding implementation models, such as Engineering, Procurement, and Construction (EPC) versus Build-Own-Operate-Transfer (BOOT), raised concerns about potential conflicts of interest and the project's long-term viability (Jain et al, 2015).

5. **Power Supply Issues:** In rural locales, inconsistent and unreliable power supply severely affects the uptime of telecom towers, leading to frequent outages. This inconsistency compromises the reliability of telecommunications services, hindering consistent connectivity. According to data from 2005, only 60% of rural households had an electricity supply, stable or unstable (Khandker et al, 2014).
6. **Spectrum Allocation:** The exorbitant cost of spectrum acquisition through auctions imposes substantial financial strain on telecom operators. Additionally, the fragmentation of spectrum bands, coupled with regulatory fees and inflexible licensing conditions, further complicates the financial outlook for these operators, making sustainable operations challenging. For example, telecom providers together spent nearly INR 1.5 trillion on acquiring spectrum rights in 2022 (Ians, 2022).
7. **Tariff and Interconnection Regulations:** While regulatory measures are designed to safeguard consumer interests, the frequent changes in tariffs and interconnection charges generate uncertainties for telecom operators. This regulatory volatility disrupts financial planning and operational stability. For example, under the Unified License Regime, 2013, the license fees for International Long Distance and National Long Distance stand at INR 25 million, plus additional variable costs ("The unified license has revamped the regulatory framework governing the provision of telecom services in India. But will it provide the clarity it so desperately requires?", 2013).
8. **Retrospective Taxation:** Some telecom operators have faced retrospective tax demands, introducing a layer of unpredictability that adversely affects business confidence. Such retroactive fiscal measures can destabilize financial planning and discourage investment.
9. **Financial Health of Operators:** Fierce competition within the telecom sector has led to aggressive pricing strategies, eroding profitability margins. This, combined with regulatory levies and the substantial debt incurred from spectrum purchases, has significantly impacted the financial health of major operators, restricting their capacity to invest in essential infrastructure upgrades. To take the example of the country's leading telecom operator, Bharti Airtel, from March 2019 to March 2023, Bharti Airtel Ltd.'s net profit experienced significant fluctuations, starting at approximately INR -1,723 crore, then plummeting to INR -43,177 crore, and subsequently dropping to INR -3,432 crore. However, by March 2023, the company was projected to achieve a net profit of around INR 16,561 crore (Jaiswal, 2023). This fluctuating, and often negative profit, is not entirely indicative of a consistent, healthy firm.
10. **Market Consolidation:** The consolidation within the telecom market has reduced the number of active players, potentially diminishing consumer choice and affecting long-term pricing strategies. This reduction in competition could lead to monopolistic behaviours, disadvantaging consumers. The country's leading telecom operators, Bharti Airtel and Reliance Jio, together control 61% of the market (Rathee, 2024).
11. **Fraud and Scams:** The proliferation of digital services has also precipitated a rise in telecom-based fraud and scams like the 2G scam. These fraudulent activities result in substantial financial losses and erode consumer trust, necessitating robust measures to safeguard consumers and maintain the integrity of telecom services.
12. **5G Rollout:** Despite a supportive policy framework, the exorbitant cost of 5G spectrum, along with the existing financial distress within the sector, has delayed the rollout of 5G networks. Telecom operators remain cautious about investing in this next-generation technology without a clear and immediate return on investment, slowing technological advancement. Despite improving legislation,

Quality-of-Service rules and Right-of-Way rules still pose a big problem for 5G rollout. The TRAI is mulling over even more stringent performance benchmarks for telecom operators to meet to ensure a smooth 5G rollout (Kumar, 2023).

13. Regulation of New Technologies: Despite legislation, emerging technologies, including the Internet of Things (IoT), machine-to-machine (M2M) communication, and Artificial Intelligence (AI), lack comprehensive regulatory frameworks. This regulatory lag hampers the adoption and innovation of these technologies, stifling potential growth and advancements.
14. Data Security: With the rapid increase in digital adoption, concerns regarding cybersecurity and data privacy have escalated. The evolving regulatory frameworks compel telecom operators to balance compliance requirements with cost-effective security solutions, posing significant operational challenges. Not just with respect to interference from foreign players but also domestic surveillance as well. India's Central Monitoring System and TERM cells have been subject to extensive scrutiny both from internal and external parties (Smith, 2013).

### Goals of further reforms

Bridging the digital divide through reforms aimed at expanding rural connectivity and promoting digital inclusion can have a transformative impact on socio-economic development in India's hinterlands. Access to reliable and affordable internet services can unlock opportunities in education, healthcare, financial inclusion, and e-governance, thereby empowering rural communities and fostering inclusive growth. Additionally, enabling digital entrepreneurship within a robust and innovation-friendly telecommunications ecosystem can nurture ventures particularly in e-commerce, fintech, agritech, and other technology-driven sectors. This can create employment opportunities, drive economic diversification, and contribute to India's transition towards a knowledge-based economy.

Enhancing productivity and efficiency through the adoption of advanced technologies like 5G, cloud computing, and the Internet of Things (IoT) can substantially improve various industries, from manufacturing to agriculture. Reforms that facilitate the seamless integration of these technologies can boost India's overall economic competitiveness and drive sustainable growth. Furthermore, empowering e-governance in a digitally connected India can pave the way for more efficient and transparent initiatives. This can improve the delivery of public services, enhance accountability, and foster greater citizen engagement, ultimately strengthening the foundations of India's democratic institutions.

Attracting foreign investment through a well-regulated and forward-looking telecommunications sector can serve as a powerful magnet for foreign direct investment (FDI). Telecom companies with good financial metrics can also be attractive picks for Foreign Portfolio Investors. By creating a conducive environment for innovation, intellectual property protection, and ease of doing business, India can position itself as an attractive destination for global technology companies and investors.

Fostering technological leadership by prioritizing research and development, promoting public-private partnerships, and incentivizing indigenous innovation can propel India towards leadership in emerging domains like 5G, IoT, and advanced telecommunications solutions. This not only reduces reliance on imported technologies but also creates opportunities for India to become a global exporter of telecom products and services. Enhancing global connectivity through a robust telecommunications infrastructure can facilitate seamless integration into global markets and value chains. This can boost exports, foster international collaborations, and enhance India's integration into the global digital economy.



Finally, by establishing itself as a global leader in digital technologies and telecommunications, India can leverage its technological prowess as a source of soft power and diplomatic influence. This can strengthen the country's position in international forums, negotiations, and partnerships, ultimately contributing to its overall global standing.

### **Proposed Broad Recommendations**

1. **Spectrum Pricing:** Streamline spectrum pricing mechanisms to ensure affordability for telecommunications operators and maximize efficient utilization of spectrum resources. This can lead to more equitable access to spectrum and foster competition within the industry. The delinking of spectrum from licensing was indeed a very good move vis-a-vis raising revenue for the government, but it has led to great additional costs for the government. Also, the costs vary from state-to-state, as does profitability. Therefore, for some parts of the country, telecom providers have simply deemed them too miniscule or unimportant to actually take the trouble for setting up towers and infrastructure there. The government must make these areas seem more appealing through reduced costs and subsidies. Spectrum pricing must be reduced, revised, and streamlined in a manner that allows for private players to connect historically underdeveloped parts of the nation.
2. **Tax Reforms:** Introduce a balanced and equitable tax structure that ensures adequate government revenue while promoting sustainable growth within the telecommunications sector. This reform should consider reducing the tax burden on operators to encourage investment and innovation. The USOF itself is operated by charging telecom operators a percentage of their adjusted gross revenue. This is after corporate taxes, mandated CSR, state taxes, overhead charges, and charges for upkeep of licenses. These have simply proven to be too great for some telecom providers to bear, which explains why two firms together control 61% of the market.
3. **Unified Regulatory Framework:** Consolidate regulatory functions under a single, cohesive authority to eliminate overlapping regulations and streamline the approval process. This will enhance regulatory efficiency and reduce bureaucratic delays. For example, the government mandates that TERM cells must have complete access to all calls through the Central Monitoring System. However, not all provisions of this have been officially cleared by the court under the provisions of the Indian Telegraph Act, 1885. Also, firms must possess a moral imperative to protect the privacy of its clients. There are also multiple regulatory bodies spanning across the Department of Space, Department of Telecommunications, municipal corporations, state regulatory bodies, and other bodies under the Ministry of Communications & IT that a telecom provider must obtain clearance from for even something as simple as establishing a mobile tower.
4. **Simplify Licensing:** Introduce a unified licensing system to minimize the administrative burden on telecom operators. Simplified licensing will facilitate easier market entry and operations, thereby encouraging new entrants and fostering competition. While everything had been greatly integrated on a national level, there is still not a simple single-window clearance that a telecom operator may avail of. There are multiple licenses for multiple categories of services offered. Municipal and state-to-state variance is another pain altogether.
5. **Research & Development:** Foster robust collaboration between government bodies, academic institutions, and telecommunications operators to advance research and development in emerging technologies. This partnership can drive innovation and ensure the industry remains at the forefront of technological advancements.

6. **Infrastructure Sharing:** Encourage and facilitate infrastructure sharing among telecommunications operators to reduce the costs associated with network deployment and maintenance. This approach can enhance coverage, particularly in underserved and rural areas, by maximizing the use of existing infrastructure. Currently, this is not a top priority for the government as the two firms that dominate the market are constantly innovating to perform better against the other and consolidate a better market share. Therefore, customers, currently at-least, are satisfied with the pace of adoption of technology and infrastructure.
7. **5G Adoption:** Implement comprehensive policies to accelerate the adoption of 5G technology. This includes providing funding for research and development, fostering partnerships between telecom operators and technology companies, and creating a favourable regulatory environment for 5G deployment. Also, there's a lot of apprehension amongst the public regarding the effects of radiation (ET, 2022). Research must be conducted to allay these fears.
8. **Digital Literacy Campaigns:** Launch nationwide campaigns aimed at enhancing digital literacy, especially in rural and underserved areas. Ensuring greater digital inclusion will empower more citizens to participate in the digital economy and access essential services. While there are several programmes like the Pradhan Mantri Gramin Digital Saksharta Abhiyan, 2017 (Chandrasekhar, 2022) and the Digital India initiative, however, these have had limited effect and have not really addressed the core problems.
9. **Data Privacy Laws:** Enact comprehensive and robust data privacy laws to safeguard user data, build consumer trust, and ensure compliance with international standards. Protecting user data is crucial in maintaining public confidence in digital services. However, despite international concerns and great resistance from internal pressure groups, the government itself is still monitoring us and stealing our data (Nandakumar, 2013; Kumar, 2013). Telecom companies have really lax regulation vis-a-vis our data and initiatives like the National Do Not Call Registry are underfunded and not efficiently enacted.
10. **Quality of Service:** Enforce stringent standards for service quality and hold operators accountable to ensure consistent and reliable consumer experiences. Regulatory bodies should monitor performance and implement measures to address deficiencies in service delivery. The Indian Telecommunications Act, 2023, has better enforcement to ensure Quality of Service, these have served only to stifle rollout of additional services rather than ensure customer satisfaction.

### **Challenges & trade-offs in pursuing recommended reforms**

Government entities and regulatory bodies aim to strengthen regulatory frameworks and expand telecommunications infrastructure, ensuring equitable access across all demographics while generating revenue through spectrum auctions. They face the challenge of balancing affordable pricing for operators with meeting fiscal revenue targets, all while supporting rapid technological advancements like the deployment of 5G networks.

Telecommunications operators, in turn, advocate for reduced spectrum fees and streamlined regulatory processes to alleviate financial burdens. Although committed to investing in emerging technologies, they remain cautious about heightened competition and the financial challenges posed by the substantial investments required for 5G infrastructure deployment. This leads to the broader industry concern of balancing the need for rapid technological advancement with maintaining financial health.

Consumers, the end-users of telecommunications services, seek high-quality, cost-effective services but are increasingly concerned about data privacy and security. They urge the government to implement stringent measures to safeguard personal data, emphasizing the need to balance technological innovation with effective regulatory oversight to protect consumer rights. This consumer demand ties directly into the broader discussion on data sovereignty, where both operators and consumers advocate for data localization to ensure national data security. However, this objective may conflict with the interests of global partners who favour seamless data flows for interoperability and operational efficiency.

Investors and international partners, crucial stakeholders in the telecommunications sector, seek a stable and predictable regulatory environment to justify their investments. They are often concerned about policy unpredictability, particularly when regulations have direct implications on profitability and return on investment. This need for a stable environment goes hand-in-hand with the ongoing debate over investment in domestic telecommunications research and development. While some stakeholders prefer purchasing established solutions to minimize costs, others advocate for building local innovation capabilities to ensure long-term technological independence.

The telecommunications needs of rural and urban areas differ significantly. Rural regions prioritize basic accessibility and digital inclusion, whereas urban areas demand the rapid adoption of advanced technologies such as 5G. This dichotomy creates a conflict over the allocation of resources and prioritization of technological initiatives. The challenge is to balance the push for modern technologies with the necessity of ensuring that rural areas are not left behind.

A key trade-off exists between fostering market competition and encouraging industry consolidation. While new technologies are intended to benefit the entire population, the rapid deployment of 5G may exacerbate the connectivity divide between urban and rural areas. Policymakers face the challenge of supporting legacy networks while encouraging investment in emerging technologies. Operators need to maintain compatibility with older devices and services while developing cutting-edge technological solutions.

Telecommunications firms argue that high tax burdens impede profitability and restrict investment potential. Conversely, the government views taxation as essential for generating revenue necessary to fund infrastructure development and other public goods. This financial tug-of-war highlights the broader issue of balancing fiscal needs with the industry's ability to innovate and grow.

Environmental concerns are another critical aspect, as the expansion of telecommunications networks raises issues about increased energy consumption and electronic waste. There is a pressing need to balance the rapid pace of digitization with sustainable environmental practices to mitigate negative ecological impacts. While telecommunications operators seek to implement automation to enhance efficiency and reduce operational costs, there is a risk of significant job displacement. This potential reduction in the workforce presents a socio-economic challenge that needs to be carefully managed.

Telecom companies also push for stricter regulations on over-the-top (OTT) services to create a more level playing field. However, consumers often oppose measures that might limit access to these increasingly popular services, highlighting a tension between industry interests and consumer preferences. Intense price competition within the telecommunications market benefits consumers by lowering costs but threatens the long-term financial sustainability of operators. Companies struggle to balance competitive pricing strategies with the need to maintain profitability.

Encouraging foreign direct investment is vital for the growth and development of the telecommunications sector. Nonetheless, this objective may sometimes conflict with national security

concerns, particularly regarding strategic and sensitive technologies. Telecommunications operators face significant financial challenges due to high debt burdens from previous obligations. These debts hinder their ability to invest in future infrastructure projects, posing risks to the continued expansion and modernization of telecommunications networks. This ongoing struggle between managing legacy debt and planning for future investments underscores the complex financial landscape of the telecommunications industry.

### **Emerging Opportunities**

Accelerating the deployment of 5G networks is paramount for unlocking the full potential of ultra-high-speed connectivity. This can be achieved through strategic policy interventions, such as rationalizing spectrum pricing, providing incentives for infrastructure sharing, and developing a comprehensive and transparent roadmap for spectrum allocation. Similarly, harnessing the potential of IoT applications holds significant promise, particularly in sectors like agriculture, manufacturing, and smart cities. To drive IoT adoption, it is essential to establish streamlined regulatory frameworks for machine-to-machine (M2M) communication, well-defined spectrum policies, and robust cybersecurity measures. Promoting advanced cloud and edge computing services is another critical area. Enhancing data processing and storage capabilities for various industries can be achieved by facilitating the seamless flow of data across borders and easing regulatory norms related to data management. Encouraging collaboration between established telecom operators and tech startups through accelerators and innovation hubs can further catalyze the development of cutting-edge services such as mobile payments, digital healthcare solutions, and smart mobility initiatives, significantly accelerating technological advancements.

Incentivizing investments in research and development (R&D) through substantial tax benefits and grants can stimulate the indigenous creation of advanced telecom technologies. This approach will reduce dependence on imports and enhance India's global competitiveness in the telecom sector. Aligning telecom initiatives with Sustainable Development Goals (SDGs) by accelerating the expansion of rural networks can greatly improve access to education, healthcare, and economic opportunities. Collaborations with local organizations are pivotal in facilitating effective last-mile connectivity.

Promoting sustainable and energy-efficient practices is also crucial. The adoption of energy-efficient network equipment and renewable energy sources for telecom infrastructure, such as towers, can significantly reduce carbon footprints. These measures are essential for helping telecom companies achieve their sustainability targets and reduce operational costs. Enhancing digital literacy and promoting inclusion through comprehensive skills training programs and affordable device initiatives will empower marginalized communities to actively participate in the digital economy, bridging the digital divide.

Expanding the "Make in India" initiative to include telecom equipment manufacturing can boost local production and exports. Providing targeted incentives and strengthening supply chain resilience are critical to minimizing disruptions and ensuring steady growth in the sector. Harmonizing Indian telecom standards with international norms will facilitate better integration into global value chains. This alignment is essential for enabling cross-border partnerships, ensuring compliance, and obtaining necessary certifications, thereby enhancing the sector's global competitiveness.

Finally, developing export-friendly policies and building strategic trade partnerships can position India as a leading global supplier of telecom products and services. From innovative software solutions to



comprehensive technical support, these measures can significantly enhance India's presence in the global telecom market.

### Conclusions

India has made great leaps in telecommunications, all the way from a government monopoly with even basic landlines being a luxury afforded only to the elite and affluent to the competitive landscape today. It all started with the economic reforms initiated due to the Balance-of-Payments crisis in 1991. That then led to the first economic reform in 1994, the New Telecom policy, which established up to two private players per telecom circle alongside a government operator. Subsequent reforms like the TRAI and the Telecom Disputes Settlement and Appellate Tribunal have given much-needed regulatory supervision and initiatives like the National Do Not Call Registry and the National Customer Preference Register have significantly improved customer welfare & privacy. However, challenges vis-a-vis privacy persist with government monitoring through TERM Cells and the Central Monitoring System. Telecom companies are also very lax in securing the data of their consumers. In this digital era, the government must understand that connectivity must be reinterpreted to be a basic right and not a purchased service. Despite initiatives like the BharatNet Project and the Universal Service Obligation Fund, rural India still faces challenges with connectivity and data, and the simple truth is that while metropolitan areas like Bangalore's Central Business District and New Delhi's Chanakyapuri are good to show progress off to foreign diplomats, the greater part of the country still lives in the countryside. India has extremely cheap data, but it may not always be so. Currently, two companies control 61% of the market. Right now, they have to compete against each other to acquire a greater market share. But if together they control even more, let's say, 75%, they may conspire within themselves to no longer compete against each other but against the customer. Thus, left now with only two options, and given that customers in India now are rich enough to pay a premium for not having to deal with government bureaucracy were they to subscribe to government services like the BSNL or the MTNL, Indian consumers would find themselves paying much higher rates for the same amount of data they were consuming earlier. The government's pilot project to combat left-wing extremism in affected areas primarily in Chhattisgarh and Odisha do not seem to have yielded any results. Insurgency does not seem like it's going to wane anytime soon. There are also great leakages in government expenditure as different initiatives are under different ministries and administrators but have similar goals. There is very little consolidation, which could easily be done with a simple caveat that all development projects are under the purview of the USOF. Also, the Competition Commission of India, much like the Anti-Trust Division in the U.S., needs to be more proactive in ensuring that customers don't get the short end of the stick. Further reforms are needed, most necessarily for bridging the rural-urban divide and to curb government overreach. However, if a country can go from having to book trunk calls to call someone in the next town over to having one of the largest subscriber bases in the world and the fastest-growing telecom sector on the planet, one should keep faith in the country to overcome these problems. In time.

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