Telecom Regulatory Authority of India

TRAI
20 Glorious Years
1997-2017

A Twenty Year Odyssey

1997-2017

एम. वेंकैया नायडु
M. VENKAIAH NAIDU

शहरी विकास,
आवास और शहरी गरीबी उपशमन एवं
सूचना एवं प्रसारण मंत्री
भारत सरकार
MINISTER OF URBAN DEVELOPMENT,
HOUSING & URBAN POVERTY ALLEVIATION
AND INFORMATION & BROADCASTING
GOVERNMENT OF INDIA

25 APR 2017

Message

I compliment the Telecom Regulatory Authority of India (TRAI) on completion of two decades of its service to the nation. As a regulator, its role has been marked by high degree of professional competence in legal, technological and commercial matters. The authority of TRAI was initially confined to telecommunication sector but later extended to include broadcasting as well. Both the telecommunication and broadcasting sector witnessed a revolution in the last two decades that have impacted our lifestyle, dissemination of content, transmission of ideas, delivery of services and creation of job opportunities.

The reforms in the field of telecommunication have increased tele-density phenomenally. The total telecom subscriber base in India has risen to 1060 million, 97 percent of which is mobile/wireless. The market share of private operators is almost 90 percent. The TRAI stands that the centre of this universe as the market regulator ensuing level playing field.

The digital convergence is emerging where content is created in different formats and shared across multiple platforms. India has emerged large Media and Entertainment market. The TRAI has played great role in ensuring fair play in the last 20 years. I am sure, its more eventful days are actually ahead.

(M. Venkaiah Naidu)

मनोज सिन्हा

MANOJ SINHA

संचार राज्य मंत्री (स्वतंत्र प्रभार)
एवं रेल राज्य मंत्री, भारत सरकार
**Minister of State (Independent Charge)
for Communications
and
Minister of State for Railways
Government of India**

MESSAGE

The Telecom Regulatory Authority of India Act 1997 was enacted 20 years ago that led to the creation of Telecom Regulatory Authority of India (TRAI). The Act is an important milestone in the telecommunication history of the country as an independent statutory body to regulate telecommunication services in the country was set-up with the task of protecting the interests of telecom service providers and consumers and promoting the orderly growth of the sector. The mandate of TRAI was subsequently widened to include broadcasting services also in 2004.

Today, India has a strong telecom network of one billion plus telephone connections with an overall teledensity touching 90%. This narrative of exponential growth of telecom services in the country in the past 20 years also mirrors the role played by TRAI in catalyzing the sector through its recommendatory as well as regulatory roles.

Today a mobile phone is not a mere means of communications but is a symbol of empowerment for the citizens of this country. The backbone for the 'Digital India' initiative of the Government is availability of seamless and ubiquitous data connectivity. Telecommunication sector has extremely important role of providing this connectivity and I am sure TRAI will continue to play its role in ensuring the healthy growth of the sector with focus on consumer.

As time and tide wait for none, so is the case with technology. Technological advancements leading to convergence of services is prompting calls for a comprehensive regulatory framework that supports seamless delivery of converged services in a technology and service-neutral environment. We expect TRAI to be at the forefront addressing these regulatory challenges confronting the sector.

This publication that traces the 20 years & eventful journey of TRAI is an excellent attempt to record the work done, pause and reflect on what needs to be done and then strategize for the future. I wish TRAI success in all its initiatives and efforts.

(signature)

(MANOJ SINHA)

कर्नल राज्यवर्धन राठौड़ (रिटा.) एवीएसएम
Col Rajyavardhan Rathore (Retd.), AVSM

सूचना और प्रसारण राज्य मंत्री
भारत सरकार
**MINISTER OF STATE FOR
INFORMATION & BROADCASTING
GOVERNMENT OF INDIA**

MESSAGE

I am pleased to know that, the Telecom Regulatory Authority of India (TRAI) has successfully completed twenty years of its regulatory services to the nation.

Over the last two decades, TRAI has emerged as a pioneer regulatory body in the country. The phenomenal growth of telecommunication & broadcasting sectors in the country is primarily attributed to the regulatory role played by TRAI. Its regulatory frameworks has not only provided a conducive environment for the services providers but also enabled the consumers to access telecommunications & broadcasting services at affordable prices in a competitive environment.

It is noteworthy that TRAI has always accorded top priority to promote orderly growth of the sector while ensuring protection of the interests of service providers and consumers. It has been proactive in anticipating emerging technology and business trends in the broadcasting sector. TRAI has an important role to play in the coming years as broadcasting sector is expected to see a paradigm shift with advancement of technologies.

It is a matter of immense pleasure that coinciding with its twenty years of successful journey, a publication is being brought out by TRAI highlighting its achievements, trends and future directions. This report is a testimony to the regulatory contributions of TRAI. I am sure all stakeholders will benefit from this report as it gives an opportunity to introspect and provides interesting insight for future prospects.

I take this opportunity to congratulate all employees of TRAI, past and present, and wish them greater glory in years to come.

(Col Rajyavardhan Rathore)

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आर एस शर्मा

R S Sharma

अध्यक्ष
भारतीय दूरसंचार विनियामक प्राधिकरण
Chairman
TELECOM REGULATORY AUTHORITY OF INDIA

FOREWORD

This year marks the completion of twenty years of the Telecom Regulatory Authority of India. The telecommunications sector in India has witnessed a fascinating growth story over this period. From a nascent market with a few million connections, we have become one of the largest and most competitive markets in the world, with over 1.15 billion subscribers. The number of "connected" Indians has also been growing day by day, standing at over 391 million by the end of 2016. The frantic pace of growth in the sector has been matched by its contribution to overall economic growth.

This is an opportune moment to reflect upon the evolution of the sector in the last two decades and the parallel journey of its regulator. TRAI's interventions in telecom and broadcasting have taken many forms, ranging from recommendations to the Government on key issues like licensing, spectrum valuation and competition to regulations on tariff, quality of service and consumer protection. Throughout this process, we have maintained a strong focus on transparency, awareness and debate, which are the cornerstones of a good regulatory system.

Twenty years of data on the telecom sector serves to assess past trends and help us to look into the future. As we celebrate the telecom growth story, let us also acknowledge that we still have miles to go on many fronts. Healthy growth must necessarily be inclusive. Therefore, it is critical to prioritise the expansion of high-speed Internet connectivity beyond cities and towns, to make sure those individuals, across demographic profiles, are connected to the future. Addressing this challenge lies at the heart of many of TRAI's policy endeavours.

The oft heard term "convergence" is now a reality, as we see technological convergence across networks, content and devices. Upholding principles of competition and technology neutrality in this converged world is going to be another key regulatory priority in the coming years.

I hope this report will serve both to celebrate TRAI's milestones, as well as highlight the key challenges that this sector must be geared to address in the coming years. Finally, let me extend a special thanks to the officers of TRAI and the technology policy team at the National Institute of Public Finance & Policy for their effort and support in chronicling this journey of TRAI.

21/4/2017
(RS Sharma)

New Delhi
April 2017

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Executive summary

This year, the Telecom Regulatory Authority of India (TRAI) completes twenty years of its existence. Much has changed in the last two decades since TRAI first came into being as the independent statutory body, tasked with protecting the interests of telecom service providers and consumers and promoting the orderly growth of
the sector.

Starting from a nascent market that had a little over 14.5 million phone connections in 1997 and "telephone on demand" was an early policy goal, we have grown to become the second largest telecom market in the world, boasting of over 1.15 billion subscribers today. Along with better connectivity, the Quality of Services (QoS) and affordability of telecom services has also grown by leaps and bounds. The dawn of the Internet-age ushered in a new wave of changes, creating immense opportunities for both service providers as well as users of Internet services. At the end of 2016, India had over 391 million Internet users, of whom 236 million were making use of broadband Internet services. These numbers are only growing day by day. Yet, much still needs to be done in terms of bridging the digital divide and ensuring better access to high-speed Internet connectivity across diverse demographic profiles and geographical areas. This is a challenge, as well as an opportunity, and one that is bound to shape policy debates in this coming decade.

The broadcasting and cable services sector, which came under TRAI's purview in 2004, has also witnessed a fascinating growth story. At the end of December 2016, we had a total of 899 private satellite TV channels, in addition to the many channels offered by Doordarshan (DD) - a giant leap from the public monopoly that we saw a few years back. These channels are provided to viewers by a range of distribution service providers, comprising of approximately 60,000 Local Cable Operators (LCOs), approximately 1200 Multi System Operators (MSOs), 6 Direct-to-Home (DTH) operators and 2 Head-end-In-The-Sky (HITS) operators. In addition to this, many Internet Protocol Television (IPTV) service providers and mobile distribution networks are also vying for the attention of the Indian television consumer. On the radio communications front, we currently have over 273 private Frequency Modulation (FM) radio stations. This is in addition to more than 400 stations of All India Radio (AIR) and about 200 operational community radio channels.
These growth stories have been fuelled by a mix of several important factors, which include the emergence of new growth opportunities; healthy investments in the sectors and rapid development of technology. The resulting vibrant competition among players has led to affordable prices for users. At the same time, increasing awareness about the availability and benefits of telecom and broadcasting services has continued to fuel the user demand for more and better services.

While the above figures attest to the phenomenal growth in these sectors, the other story worth telling is that of how these services, through enabling connectivity, employment and entertainment have impacted lives, productivity, and indeed, the economy as a whole. In this report we make an attempt to track the contribution of developments in telecom, Internet access and broadcasting sectors on various other sectors of the economy.

The definition of "telecommunication services", given under the TRAI Act, covers a range of sectors, including basic and cellular telecom services, provision of Internet access and broadcasting services. Over the years, the boundaries between these sectors have been gradually blurring on account of the rapid convergence of technologies. The need for the policy and regulatory framework to evolve along with this convergence has already become one of the key challenges for regulators across the globe. Yet, even as convergence is undeniable, there continue to be many significant differences between these sectors, in terms of their genesis, market structures and the regulatory frameworks governing them. Accordingly, we find it useful to highlight the developments in each of these areas through dedicated sections in the report.

In each of the sectors, TRAI had exercised its recommendatory functions to ignite and support several key decisions and processes of the Government. These recommendations have ranged from issues relating to: licensing conditions for service providers, allocation and availability of spectrum, and increasing competition and efficiency in the sectors.

On the regulatory side, fixing and regulating tariffs for telecom and broadcasting services is one of TRAI's core mandates. Recognising the value of allowing competitive forces to shape the demand and supply of telecom services, within a regulated environment, TRAI has maintained a policy of tariff forbearance in the telecom sector. This has contributed to healthy price competition in the sector, yielding some of the lowest tariffs in the world, with a direct impact on the uptake of telecom services. At the same time, TRAI has continued to ensure regulatory oversight so that service providers offer their tariffs in a transparent, competitive and non-discriminatory manner. It has also laid equal emphasis on the protection of consumers and maintaining the QoS being offered to them. Initiatives such as mobile number portability (MNP), prohibition of unsolicited communications, transparency norms and redress by service providers are some examples of measures that have gone a long way in empowering consumers of telecommunication services in India.

TRAI has also taken the lead in regulating some of the more complex policy questions confronting regulators globally, its support of net-neutrality through its prohibition of discriminatory tariffs being a recent case in point. The policy debate around this issue was hotly contested, and various stakeholders and experts, both in India and internationally, contributed their views to the Authority in a vibrant consultation process. This was typical of TRAI's general openness to a diversity of opinions in its policy making process.

TRAI has strived hard to maintain a high level of transparency and openness in the exercise of all its functions. This includes transparency through a well-defined consultative process for making recommendations, regulations or any other statutory instruments.

By doing so, the Authority offers all stakeholders, including members of the general public, an equal opportunity to contribute fruitfully to the process of policy formulation and implementation.

Chapter 1: An introduction to TRAI

Background to TRAI

The regulation of telecom services in India finds its genesis in the Indian Telegraph Act, 1885, which grants the Central Government exclusive privilege to establish telegraph services. The Government also has the power to grant licenses to other operators to carry on those services. Until the mid-nineties, the Government exercised a monopoly over this sector, with the Department of Telecommunications (DoT) being responsible for administering telecom services throughout the country.[1] International telecom services were offered by Videsh Sanchar Nigam Ltd. (VSNL), a Government-owned company.[2]

The National Telecom Policy, announced by the Government in 1994 (NTP, 1994), sought to change this position by allowing for the participation of private entities. This led to the opening up of basic telecom services in addition to Value Added Services (VAS) such as cellular services and radio paging that had already been thrown open to private participation in 1992.

The NTP, 1994 brought with it the inevitable need for an independent regulatory framework that would separate the Government's regulatory functions from its service-providing functions, in line with global best practices. This led to the creation of the TRAI, with effect from 20th February 1997, pursuant to the provisions of the Telecom Regulatory Authority of India Act, 1997 (TRAI Act). TRAI was given the responsibility of regulating telecom services, including fixation and revision of tariffs, determining QoS standards and fixing the terms and conditions for interconnectivity between providers.

Over the years, TRAI's mission has been to create and nurture conditions for growth of telecom in the country in a manner and at a pace which will enable India to play a leading role in the emerging global information society. Its objectives, as noted in Box 1.1, have evolved with its changing responsibilities, particularly the inclusion of broadcasting services within TRAI's regulatory mandate in 2004.

BOX 1.1: TRAI'S OBJECTIVES

The goals and objectives of TRAI are focused towards providing a regulatory regime that facilitates achievement of the objectives of the New Telecom Policy that was adopted in 1999 (NTP, 1999). These are as follows:

1. Increasing tele-density and access to telecom in the country at affordable prices.

2. Making available telecommunication services which in terms of range, price and quality are comparable to the best in the world.

3. Providing a fair and transparent policy environment which promotes a level playing field and facilitates fair competition.

4. Establishing an interconnection regime that allows fair, transparent, prompt and equitable interconnection.

5. Re-balancing tariffs so that the objectives of affordability and operator viability are met in a consistent manner.

6. Protecting the interest of consumers and addressing general consumer concerns relating to availability, pricing and QoS and other matters.

7. Monitoring the QoS provided by the various operators.

8. Providing a mechanism for funding of net cost areas/ public telephones so that Universal Service Obligations (USO) are discharged by telecom operators for spread of telecom facilities in remote and rural areas.

9. Preparing the grounds for smooth transition to an era of convergence of services and technologies.

10. Promoting the growth of coverage of radio in India through commercial and non-commercial channels. *(Added in 2003-04)*

11. Increasing consumer choice in reception of TV channels and choosing the operator who would provide television and other related services. *(Added in 2003-04)*

12. Migration to digital addressable systems in broadcasting. *(Added in 2010-11)*

In pursuance of its objectives, TRAI has, from time to time, issued a number of regulations, orders and directives to provide the required direction for the market's evolution from a Government-owned monopoly to a multi-operator, multi-service, open and competitive market.

Amendments to the TRAI Act

In the twenty years of its existence, the TRAI Act has gone through some key amendments. The law, as originally enacted, conferred TRAI with the quasi-judicial function to adjudicate upon telecom disputes. This position was modified by the TRAI (Amendment) Act, 2000, which divided the functions of the original TRAI between TRAI and the newly created Telecom Disputes Settlement and Appellate Tribunal (TDSAT). Following this amendment, TRAI was vested with recommendatory and regulatory functions, while dispute settlement functions were handed over to TDSAT.

The 2000 Amendment classified TRAI's functions into the following broad categories:

▸ Making recommendations on various issues;
▸ General regulatory and administrative functions;
▸ Fixing tariffs and rates for telecom services; and
▸ Any other functions entrusted by the Central Government.

Under the amended Act, a clear distinction has been made between TRAI's recommendatory functions and its regulatory ones, as provided under Section 11(1) of the TRAI Act. It also mandated the Government to seek the recommendations of TRAI in respect of certain specified matters, namely the need and timing for introduction of new service providers and the terms and conditions of licences issued to a service provider.

BOX 1.2: TRAI'S BROADCASTING MANDATE

The TRAI (Amendment) Act, 2000 revised the definition of "telecommunication service" to add that the Central Government may notify other service to be telecommunication service, including broadcasting services.

In exercise of this power, the Government, vide a Notification dated 9th January, 2004, added broadcasting and cable services within the definition of telecommunication service in terms of Section 2(k) of the TRAI Act.

Leadership and structure

Another major change brought about by the 2000 amendment was relating to the composition of the Authority. The 1997 Act provided that the Authority would consist of a Chairperson, and between two to six members, to be appointed by the Central Government. This was changed to provide for a Chairperson, two whole-time members and two part-time members, appointed by the Central Government.

The TRAI (Amendment) Act, 2014 made another change to the terms of appointment of the Chairperson and members. It was clarified that they would require the prior permission of the Government in order to accept any position with the

Government or in the telecommunication industry within a period of two years from the date on which they cease to hold office with TRAI.

Over the years, the Authority has been chaired by an excellent set of dynamic leaders all of whom have contributed in diverse ways to the shaping of the Indian telecom regulatory landscape (See figure 1.1)

FIGURE 1.1 : CHAIRPERSONS IN THE LAST TWENTY YEARS

1997 - 2000
Justice (Retd.) S.S. Sodhi

2000 - 2003
Shri M.S. Verma

2003 - 2006
Shri Pradip Baijal

2006 - 2009
Shri Nripendra Misra

2009 - 2012
Dr. J.S. Sarma

2012 - 2015
Dr. Rahul Khullar

2015 - present
Shri R.S. Sharma
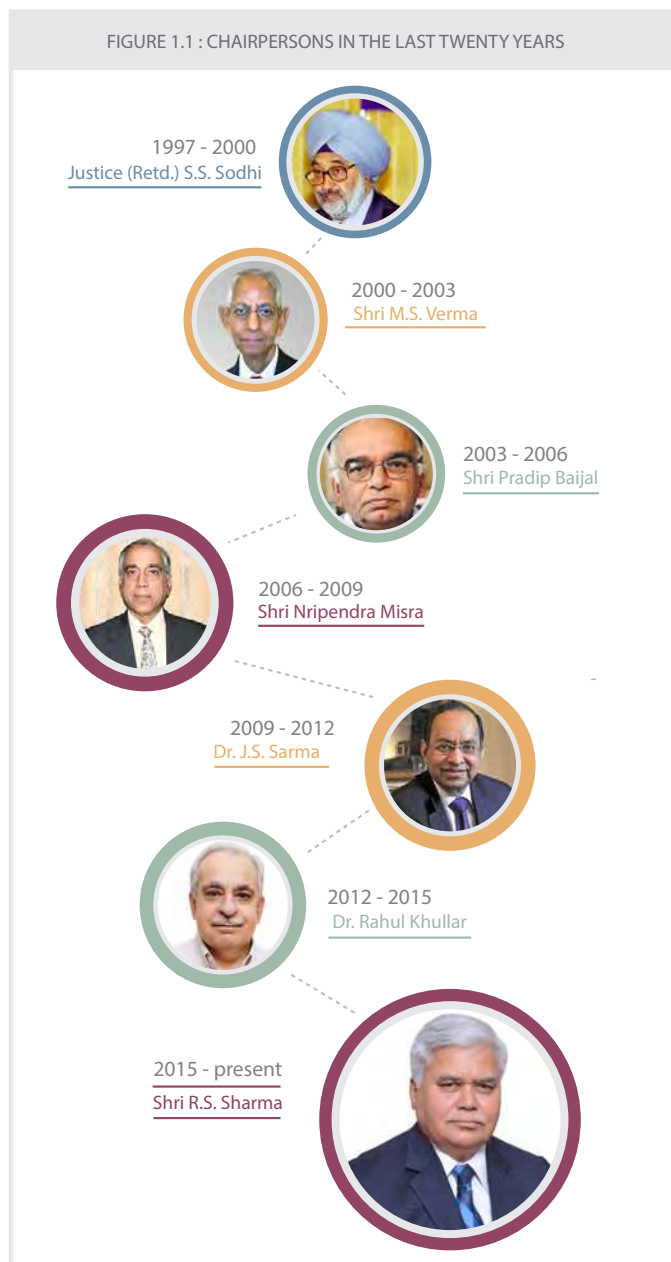
The Authority functions with a Secretariat headed by a Secretary and assisted by seven divisions which are as follows:

Administration
Responsible for all administrative and personnel-related functions, which include planning and control of human resource development within TRAI. This division also handles the responsibilities of communications, availability of information in respect of all divisions and Right to Information (RTI) related matters. In addition, it also handles international relations, which includes coordination with all organisations such as the International Telecommunication Union (ITU), World Bank, Asian Development Bank and regulatory bodies in other countries. Over the years, TRAI has been engaging with a number of these organisations to carry out development and research work relating to telecom and broadcasting sectors.

Broadcasting & Cable Services (B&CS)
Responsible for advising the Authority, for laying down the overall regulatory framework for the broadcasting, cable TV and FM radio sectors. This includes interconnection, QoS and tariff aspects, as well as compliance of license conditions by service providers. The B&CS division is also responsible for examining issues relating to the modernisation and digitisation of the sectors, protecting the interests of stakeholders and proposing recommendations relating to this sector.

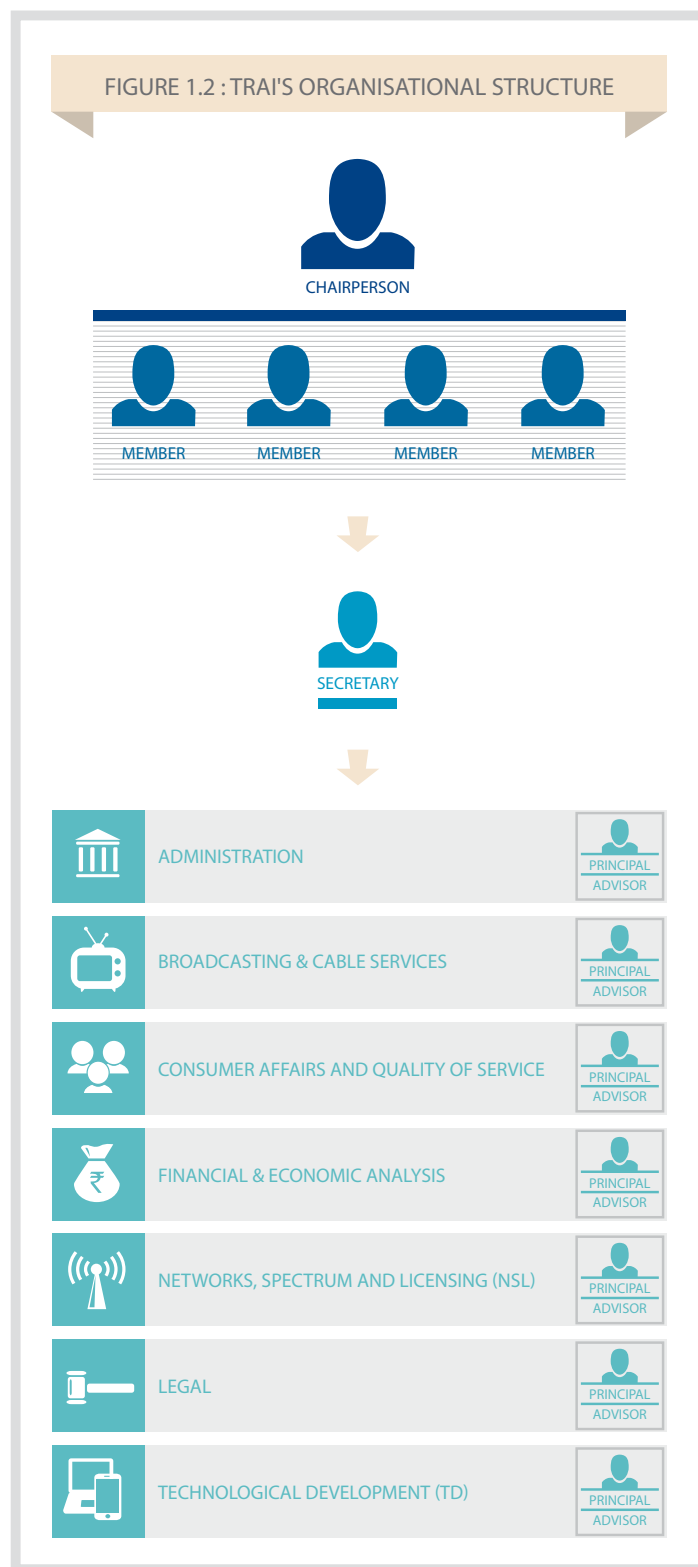*Consumer Affairs and Quality of Service (CA&QoS)*
Responsible for development of consumer advocacy in the telecommunication sector and creating general awareness amongst consumers about measures taken by TRAI to protect their interests. The division facilitates registration of consumer organisations and interactions with them. In addition, it is also responsible for laying down the standards of QoS to be provided; and conduct periodical surveys of such services. Another responsibility of this division is to maintain the register of interconnect agreements.

Financial & Economic Analysis (F&EA)
Responsible for providing advice on all aspects relating to cost methodologies and costing of telecom services, accounting separation and analysis of financial statements of service providers. The division also advises the Authority on framing of appropriate tariff policies and fixation of tariffs for services that are under tariff regulation. In addition, the division advises the Authority on matters relating to fixation of cost based interconnection charges and on measures to promote competition in various segments of telecommunication services. This division is also responsible for compiling the quarterly "Indian Telecom Services Performance Indicators Report". It is the internal financial advisor to TRAI, rendering advice on all financial and accounting matters.

Networks, Spectrum and Licensing (NSL)
Responsible for fixing the terms and conditions of interconnection and their regular review; ensuring effective interconnection between service providers; and handling interconnection-related issues. The division is also responsible

FIGURE 1.2 : TRAI'S ORGANISATIONAL STRUCTURE

CHAIRPERSON

MEMBER MEMBER MEMBER MEMBER

SECRETARY

ADMINISTRATION — PRINCIPAL ADVISOR

BROADCASTING & CABLE SERVICES — PRINCIPAL ADVISOR

CONSUMER AFFAIRS AND QUALITY OF SERVICE — PRINCIPAL ADVISOR

FINANCIAL & ECONOMIC ANALYSIS — PRINCIPAL ADVISOR

NETWORKS, SPECTRUM AND LICENSING (NSL) — PRINCIPAL ADVISOR

LEGAL — PRINCIPAL ADVISOR

TECHNOLOGICAL DEVELOPMENT (TD) — PRINCIPAL ADVISOR

for monitoring of compliance of license conditions of service providers and overseeing issues related to efficient management of spectrum, introduction of new wireless technologies and related regulatory issues. The division also handles recommendations on all related aspects and compliance with USO. In addition, the division also regulates MNP and porting charges.

Legal

Legal division is responsible for rendering legal advice to the Authority on all regulatory issues. The division manages all litigation matters in which TRAI is a party.

Technological Development (TD)

This division seeks to build up capacity for technical research in telecom with the aim of understanding and identifying technology trends to assist the Authority in making more informed decisions. It handles issues related to next generation networks, manufacturing for telecom sector, environmental issues, infrastructure management, electromagnetic radiation and public safety and convergence in various forms. The division is also responsible for managing TRAI's IT resources including local and remote servers and publication of the Technology Digest, which focuses on one technology in every issue.

Staffing of officials

TRAI officials were initially drafted on deputation from various Government Departments. These deputationists with relevant experience in the fields of telecommunication, economics, finance, administration, etc., were initially appointed for a period of two years and thereafter, if required, requests were sent to concerned Government Departments / organisations for extending their deputations. Seeking extension of deputations in respect of trained and experienced existing employees has often proved to be difficult. The Authority, therefore, constituted a cadre of officers and staff with specialised expertise and skills with the option of permanent absorption of deputationists into TRAI. Thus, today the Authority has a mix of permanent cadre of TRAI officers and officers on deputation. While the scope, scale and complexity of Authority's functions continue to grow at a fast pace, the Authority is facing the problem of losing trained and experienced personnel on deputation due to their repatriation to their parent departments on completion of their deputation.

Capacity-building

TRAI accords utmost importance to human resource initiatives to develop expertise for its staff in the fields of telecom and broadcasting especially related to tariffs and quality of services standards, new and emerging technologies, conduct of surveys on QoS and other consumer related matters. This has proved to be useful for its officers and staff to participate effectively in the consultative processes of the Authority, both through the preparation of consultation papers and analysing feedback and responses received and also during open house discussions. This has also helped in developing the policy framework to address various issues which arise in regulating the telecom sector. In selecting and designing training programmes and workshops, TRAI's endeavour is to impart diverse skills for macro level policy and handling of techno-economic operating details relevant for implementation and monitoring of policies. Special programmes need to be identified or designed and run to meet the specific needs of TRAI, the Authority sponsors its officers for international training under the 'Institutional Capacity Building Project' for further developing their expertise

within the organisation.

Over the years, TRAI officers have been deputed to attend international training programmes conducted by various institutions, including the ITU. The officers have received valuable inputs through these trainings and the inputs have enriched their skills in their respective area of regulatory work. In the recent times several officers of TRAI were also deputed for various domestic training programmes, which included the training seminar on regulatory governance at the National Institute of Public Finance and Policy (NIPFP), "Regulatory Impact Assessment" conducted through Consumer Unity & Trust Society (CUTS) International, Jaipur, "Utility Regulations & Strategy for the Regulatory Bodies of India" through OP Jindal Global University, Sonipat and online course on "Advance professional Course in Competition Law & Market Regulation" through Indian Institute of Corporate Affairs (IICA), Manesar.

Regional offices

The Head Office of TRAI is in New Delhi. In 2012, the Authority approved the opening up of 11 (eleven) Regional Offices at various locations across the country. However, after reviewing the working of the Regional Offices during 2014-15, the Authority approved the closure of 5 Regional Offices located at Chandigarh, Patna, Mumbai, Guwahati and Lucknow. The 5 regional offices that continue to remain in existence are located at Hyderabad, Kolkata, Bengaluru, Bhopal and Jaipur. These Regional Offices of TRAI are operating on pilot project basis under plan fund as part of the capacity building project of TRAI.

Funding and expenditure over the years

TRAI is an autonomous body which is wholly funded by grants received from the Consolidated Fund of India. Other sources of income include profit on assets sold, export incentives realised as well as fees and penalties from telemarketers. TRAI's expenditure accounts mainly for establishment expenses (payments made to staff), as well as administrative expenses and subsidies/grants paid out to other organisations. The expenditure incurred by TRAI had been increasing gradually over the years to account for its changing responsibilities and functions and the increase in the size of the markets that it regulates. This figure has risen from Rs. 86 million in 2001 to Rs. 545.1 million in the year 2015-16. This also includes the expenditure incurred under different training and consultancy programmes.

Introduction

The definition of "telecommunication services", given under the TRAI Act, covers a range of sectors, including basic and cellular telecom services, provision of Internet access and broadcasting services. Over the years, the boundaries between these sectors have been gradually diminishing on account of the rapid convergence between technologies. The need for the policy and regulatory framework to evolve along with this convergence has already become one of the key focus areas for regulators across the globe. However, in the current environment there continue to be many significant variations between these sectors, in terms of their genesis, market structures and the regulatory frameworks governing them. This chapter provides an overview, and tracks the evolution of the telecom, Internet access and broadcasting sector.
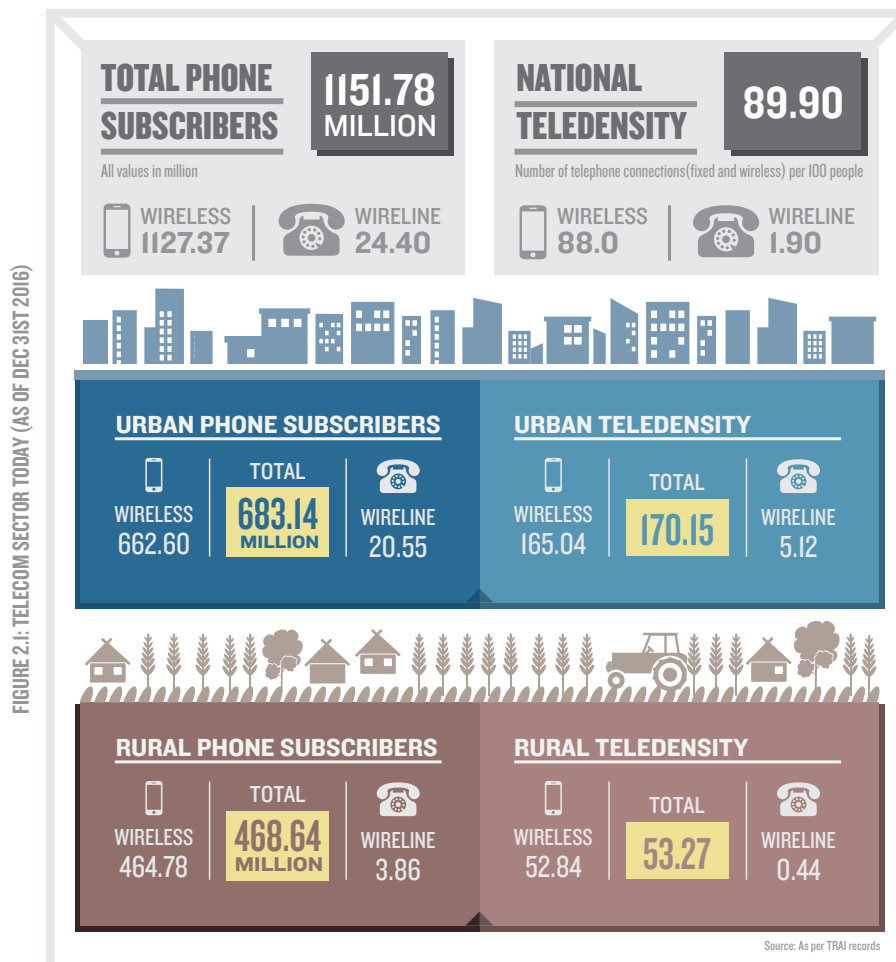
Trends in telecom services

Genesis of the sector

Starting from a subscriber base of 14.88 million users in March 1997, the total number of telephone subscribers in India stood at over 1.15 billion by December, 2016. This has been an extraordinary journey for the Indian telecom sector and its users, as we gained widespread connectivity and access to communication services at reasonable prices. In this process, the phone device has been transformed from a "luxury" to a necessary good for social and economic mobility.

The telecom growth story is best understood in the context of policy developments that have contributed to the competitiveness of the sector. The New Industrial Policy of 1991 initiated the process of liberalisation in India, starting with the de-licensing of telecom equipment manufacturing. This was followed by the pro-competition stance of the NTP, 1994, which led to the opening up of basic telecom services to the private sector, now widely recognised as a trigger point for telecom growth in India. This process was, however, brought to fruition only after adoption of the NTP, 1999.

Post NTP, 1999, the sector moved from the fixed license fee model to a revenue share model, and lower tariffs ensued. The result was that the period from 1999-2003 saw an addition of approximately 12 million new mobile subscribers as compared to less than 1 million in the preceding period of 1995-1999.

FIGURE 2.1: TELECOM SECTOR TODAY (AS OF DEC 31ST 2016)

TOTAL PHONE SUBSCRIBERS 1151.78 MILLION
All values in million
WIRELESS 1127.37 | WIRELINE 24.40

NATIONAL TELEDENSITY 89.90
Number of telephone connections (fixed and wireless) per 100 people
WIRELESS 88.0 | WIRELINE 1.90

URBAN PHONE SUBSCRIBERS
WIRELESS 662.60 | TOTAL 683.14 MILLION | WIRELINE 20.55

URBAN TELEDENSITY
WIRELESS 165.04 | TOTAL 170.15 | WIRELINE 5.12

RURAL PHONE SUBSCRIBERS
WIRELESS 464.78 | TOTAL 468.64 MILLION | WIRELINE 3.86

RURAL TELEDENSITY
WIRELESS 52.84 | TOTAL 53.27 | WIRELINE 0.44

Source: As per TRAI records

This was followed by the issuance of the Government's guidelines on licence for basic services on 25th January, 2001, in line with the recommendations made by TRAI. These guidelines provided for the opening up of the basic telephone services without any restriction on the number of operators.

The period from 2003 onwards saw further positive developments as a result of certain pragmatic decisions made by the Government and the regulator. These included, the introduction of the Calling Party Pays (CPP) regime, the unified access licensing regime, and lowering of Access Deficit Charges (ADC). By the year 2007, India's total telecom subscriber base, fixed and mobile, had made it the second largest wireless network in the world, after China.

BOX 2.1: THE RISE AND FALL OF PCOS

In the early years of the telecom sector, PCOs or Public Call Offices became ubiquitous in India's rural and urban areas. Till 2008 they witnessed steady growth, from about 1 million in 2002 to more than 6 million in 2008. Subsequently, however, with the simultaneous spread of mobile services, the number of PCOs has been on a decline. The figures from March, 2016 peg the number of PCOs at 0.59 million, which is very close to what the sector began with in 1999.

Source : As per TRAI records
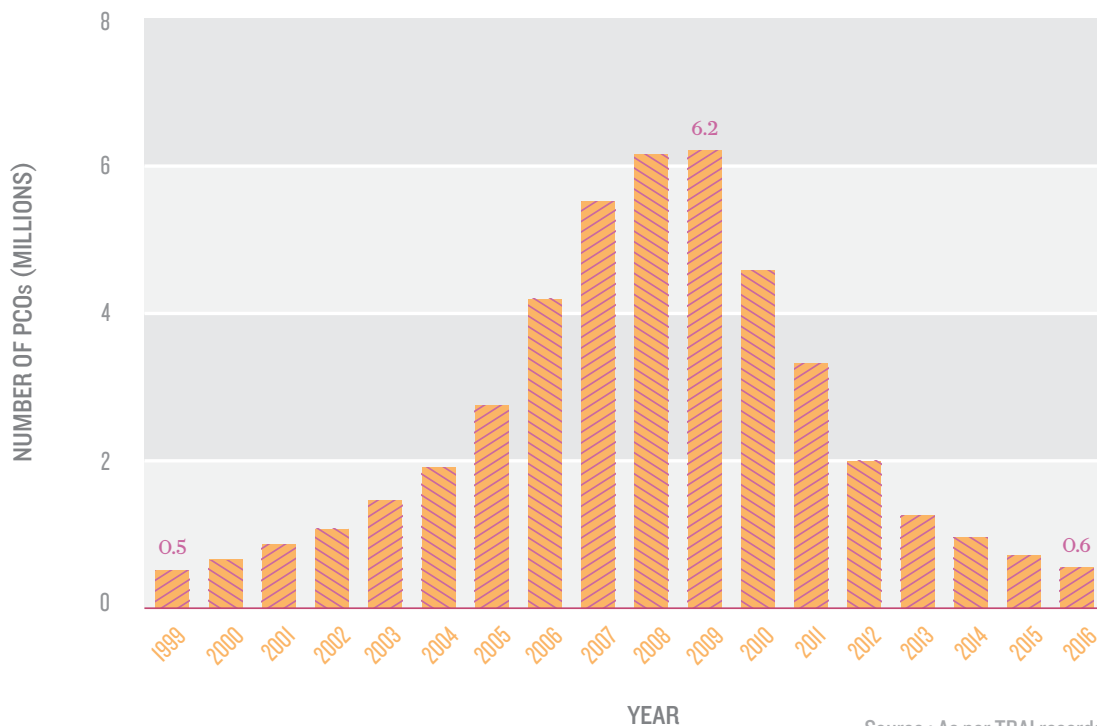
In line with the spread of voice telephony, the time has now come for adopting a similar model for the making broadband Internet services accessible to each and every person at an affordable cost. In its recent recommendations to the Government on "Proliferation of Broadband through Public Wi-Fi Networks", the Authority has suggested a light-touch framework for encouraging the development of a market for Public Data Offices (PDOs). The idea is to create a new category of small players who will be able to contribute in a big way for making broadband available to the masses through Wi-Fi access points; much like the PCOs did for voice telephony until a few years back.

Users of telecom services

In the early years, telecom connectivity was almost synonymous with fixed landline phones. This segment saw a growth from approximately 150,000 exchange lines in 1947 to about 18 million in 1997. However, with increased accessibility and affordability of mobile services, the focus of growth has rapidly shifted to the mobile/wireless segment. Fixed wireline subscriptions have been reporting a steady decline for well over a decade.

In 2000, mobile subscriptions accounted for around 10 percent of total subscriptions but this ratio has undergone a dramatic turnaround in the ensuing years. During the year 2004-05, the number of mobile subscribers exceeded the number of fixed subscribers for the first time and this gap has only widened over the years. The changing trend is depicted in figures 2.2 and 2.3. In the last decade itself, mobile subscribers have grown at high Compounded Annual Growth Rate (CAGR) of 27.62 percent. Of the 1.15 billion telecom subscribers in the country at the end of 2016, the wireline segment accounted for a paltry share of just 2.1 percent.

FIGURE 2.2 : MOBILE AND FIXED LINE SUBSCRIPTIONS

FIXED SUBSCRIBERS   MOBILE SUBSCRIBERS

27.62%
CAGR over the last decade (2006-2016) in mobile subscribers

25.2
1033.6

17.8
0.8

SUBSCRIBERS (MILLIONS)

YEAR

Source: As per TRAI records
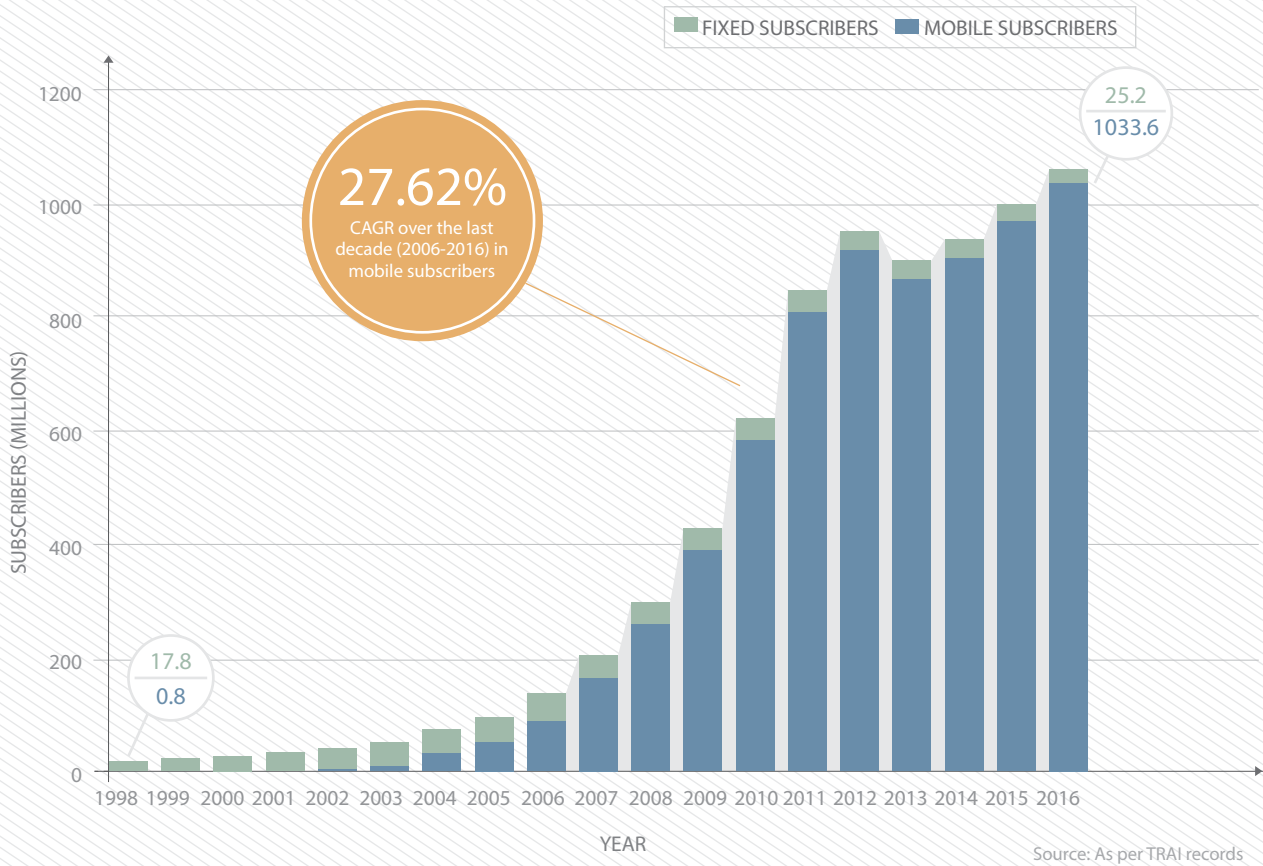
FIGURE 2.3 : PROPORTION OF FIXED VERSUS MOBILE SUBSCRIBERS

FIXED   MOBILE

PERCENTAGE

YEAR

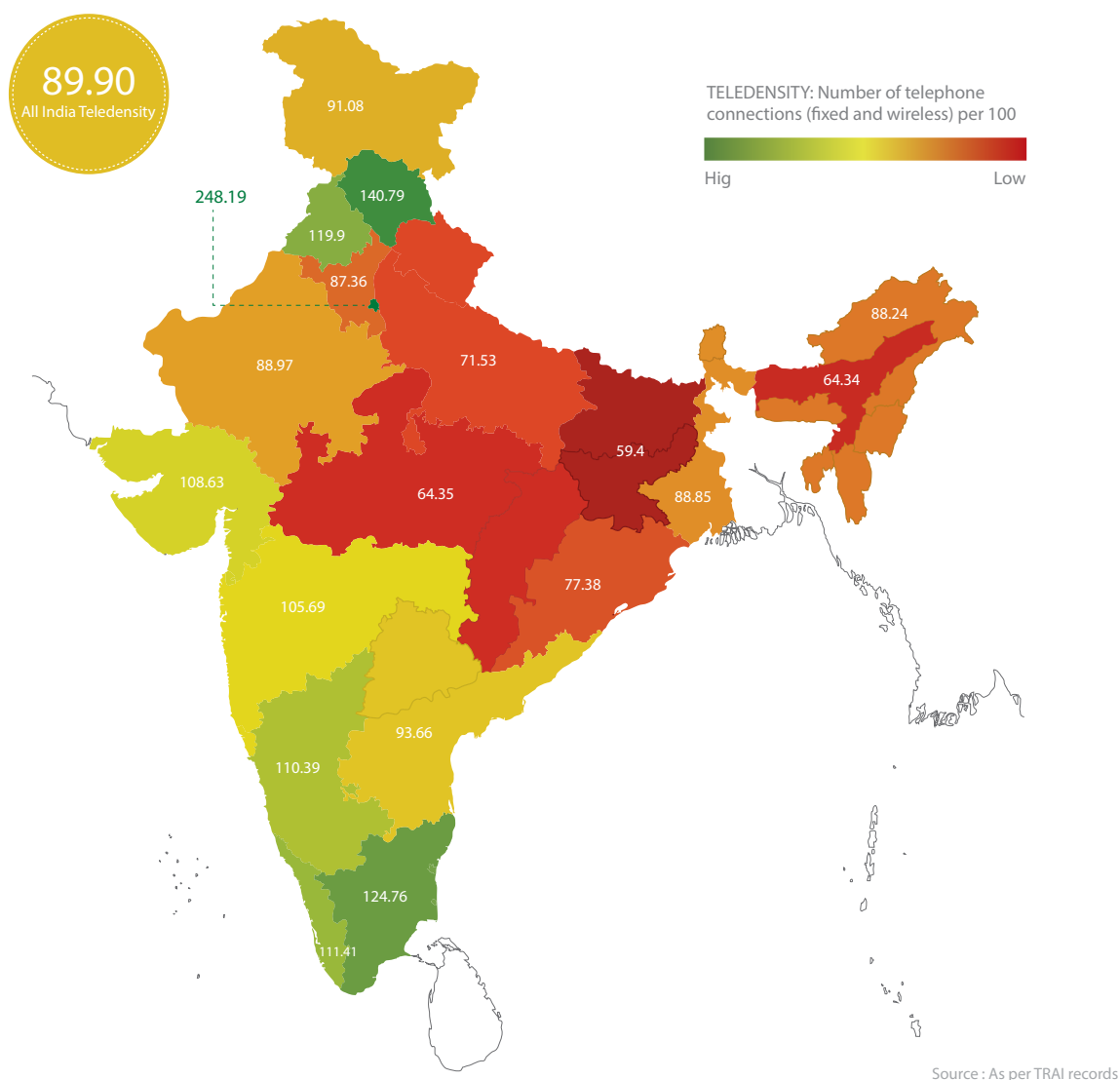Source: As per TRAI records

9
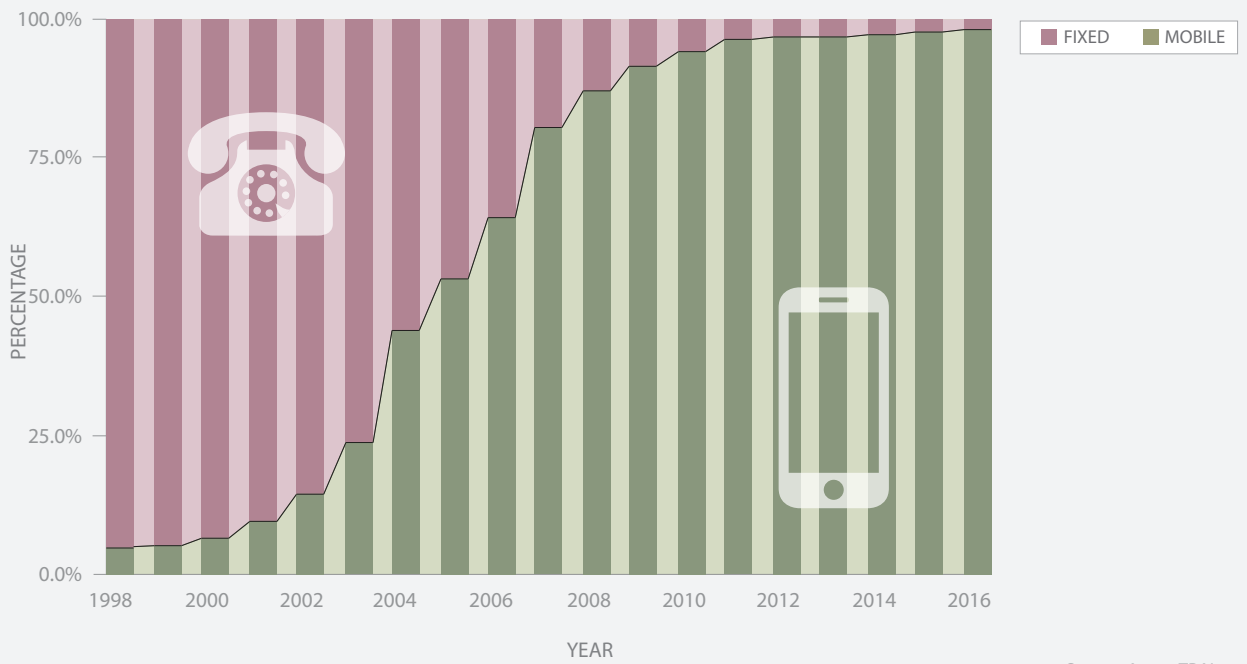
A recent ITU report found that the differences between usage and ownership of mobile are large (14 percentage points or more), indicating that many people access mobile-cellular services by sharing a device and/or Subscriber Identification Module (SIM) card. Differences between mobile-phone ownership and usage were found to be particularly large in India, where around half of the mobile-cellular users do so using someone else's SIM card or device.[3]

Mobile phone ownership and usage also varies along demographic parameters like gender and age. Connected Women 2015[4], a report by GSMA (Groupe Speciale Mobile Association), found that of the total 612 million female population in India, only 28 percent own a mobile phone as against 43 percent in the male population. The gender gap of mobile ownership is therefore 114 million. Factors such as limited resources and social norms explain why men in the household are often the first to get a mobile phone, whereas women often share or borrow mobile phones for use.

Teledensity, which is defined as the number of subscribers per hundred persons of the population is seen to be a useful indicator of the state of penetration of telecom services in urban and rural areas. Data from 1997 indicates that the overall teledensity in the country was a mere 2 percent, well below the global average of 13. It is a significant testament to the growth of telecom services that this figure increased to 89.90 by the end of 2016. In 2008, the Authority evaluated a decade of the sector's progress and found that the teledensity was at 26.22, much ahead of the target of 15 by the year 2010 set under NTP, 1999. Rural teledensity at the end of March, 2008 was 9.20 as compared to 0.40 in 1998, which too was much ahead of the NTP, 1999 target of 4 by the year 2010. The map in figure 2.4 gives us a picture of the status of teledensity in all telecom circles in the country. Circles like Bihar, Assam, Madhya Pradesh, Uttar Pradesh and Odisha are seen to be behind the overall country teledensity, indicating that more work needs to be done in these circles to improve these numbers.

FIGURE 2.4: TELEDENSITY IN INDIA - CIRCLE/STATE WISE (HEAT MAP)

TELEDENSITY: Number of telephone connections (fixed and wireless) per 100

Hig   Low

89.90
All India Teledensity

91.08
140.79
248.19
119.9
87.36
88.97
71.53
88.24
64.34
59.4
108.63
64.35
88.85
77.38
105.69
93.66
110.39
124.76
111.41

Source : As per TRAI records

3) ITU, Measuring the information society report, 2016.
4) GSMA, Connected Women, Bridging the gender gap: Mobile access and usage in low and middle-income countries, 2015.

Despite these largely positive developments, the fact that the subscriber base has remained skewed in favour of urban areas is a sobering reminder that there is still a long way to go. While the urban teledensity increased from 10 to 154 from the period between 2001 to 2016, the rural teledensity remained at much lower levels, increasing from 0.9 to 51.4. The urban teledensity remains three times that of rural teledensity, even though the share of urban and rural subscribers at the end of 2016 was at 59.31 percent and 40.69 percent, respectively. The teledensity numbers have grown steadily over the years, barring the small dip in 2013 that could be attributed to the guidelines issued by TRAI on 'de-activation of inactive SIMs'

FIGURE 2.5: RURAL AND URBAN TELEDENSITY SINCE 2001

TELEDENSITY: Number of telephone connections (fixed and wireless) per 100 people ▮ URBAN TELEDENSITY ▮ RURAL TELEDENSITY — TOTAL TELEDENSITY

RURAL 51.37
URBAN 154.01
TOTAL 83.36

RURAL 0.93
URBAN 10.37
TOTAL 3.52

PERCENTAGE

YEAR (As on March 31st)

Source : As per TRAI records
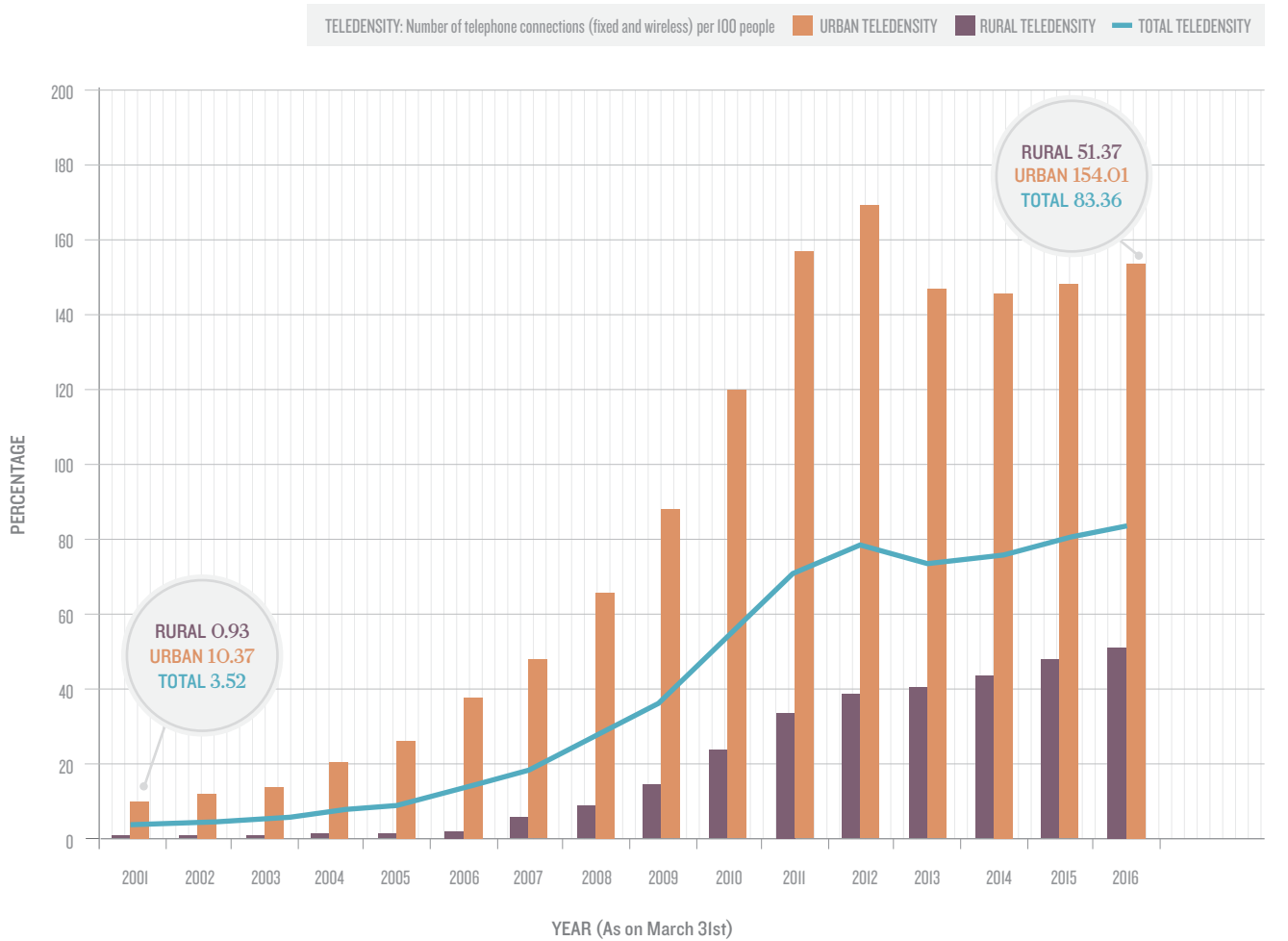
Tarrif trends

Declining tariffs over the years have been a key enabler for the rapid and widespread adoption of voice services. Local call tariffs for mobile services, which were roughly around Rs.8 per minute in 2000 are now around Rs.0.50. A one minute Subscriber Trunk Dialling (STD) call between Delhi and Mumbai, which was at the rate of Rs. 37 is now available to users at the rate of a local call, and an International Subscriber Dialling (ISD) call to the American continent costs less than Rs. 7, down from about Rs. 75 in the year 2000.

FIGURE 2.6: AVERAGE SUBSCRIBER OUTGOING TARIFF - GSM BLENDED (POSTPAID AND PREPAID)

OUTGOING TARIFF / MINUTE

₹ 8.55

₹ 2.89

₹ 0.92

₹ 0.49

₹ 0.48

2002 Forbearance of tariff - mobile services

2004 IUC regulations and introduction of CPP regime

2005 Introduction of Unified Access Licensing regime

2006 Introduction of lifetime schemes

RUPEES / MINUTE
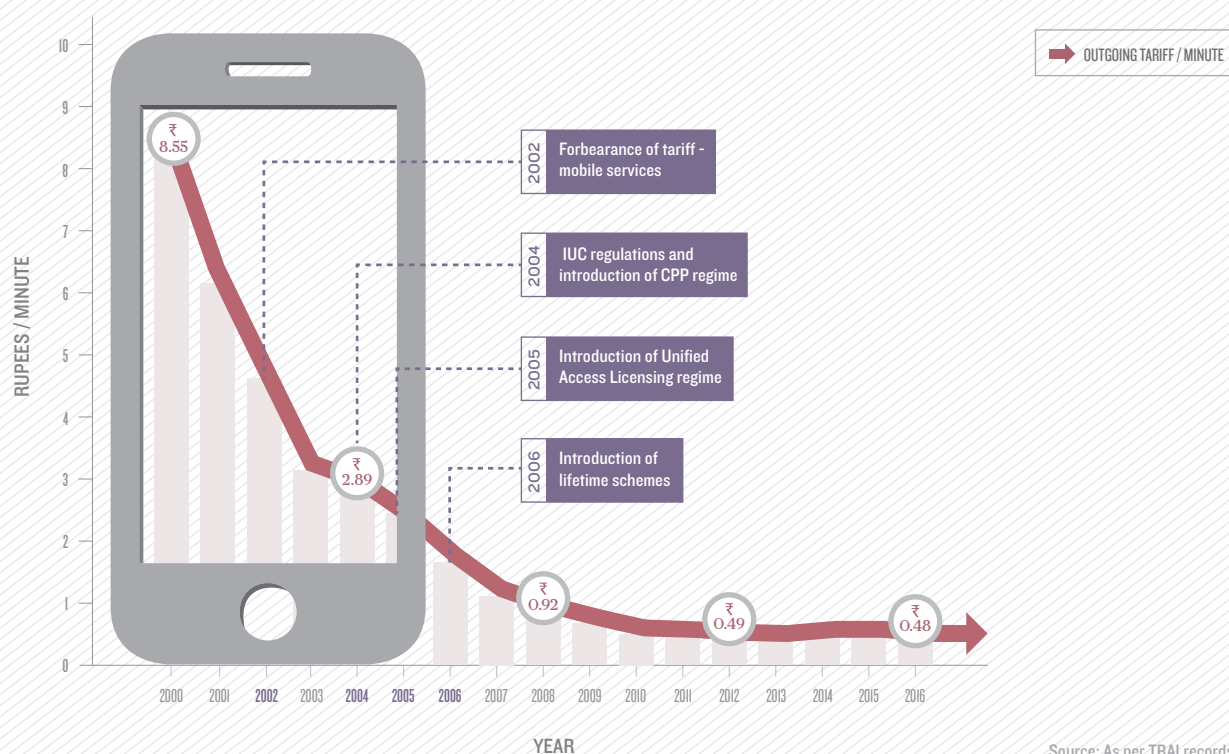
YEAR

Source: As per TRAI records

A number of significant events have contributed to the declining tariff over the years. Some of the key developments include forbearance from regulating tariffs for cellular mobile services that was announced in 2002; Interconnection Usage Charge (IUC) regulations and introduction of the CPP regime during 2004; introduction of Unified Access Licensing regime in 2005; and introduction of lifetime schemes in 2006. These have been explained in more detail in the chapter on 'Evolution of policy framework'.

During the period from 2007-2012, tariffs have steadily declined in the face of fierce competition. The minutes of usage per connection also saw a decline during and after this period, falling from 493 for Global System for Mobile (GSM) communications users and 364 for Code Division Multiple Access (CDMA) users in 2008; to 360 and 255, respectively by the end of 2016. Similarly, the Average Revenue Per User (ARPU) has also seen a decline - by 61.5percent for CDMA users and 68.1 percent for GSM users. Some explain this decline in minutes of usage per connection to multi-SIM usage patterns, which can be attributed to some extent to the tariff wars between providers. In fact, an ITU report from 2013 found that telecom tariffs in India are of the lowest in the world, with subscribers paying less than users in the US, Australia, Pakistan and China.[5]

TABLE 2.1 - INTERNATIONAL MOBILE USAGE STATISTICS - 2014 (SELECTED ECONOMIES)

Country	Monthly minutes	Country	Monthly SMS
Pakistan	228	France	251
China	190	Pakistan	190
France	188	United Kingdom	116
India	169	China	58
United Kingdom	146	India	23
Germany	126	Germany	19
Thailand	81	South Africa	15
South Africa	80	Thailand	14

Source: ITU, Measuring the information society report, 2016.

Competitiveness and growth

In 2005 the telecom sector had achieved an annual growth rate of 1.91 percent in teledensity, which was equal to the total growth seen in the 50 years before that. This healthy growth trend has continued since then with the total subscriptions in March 2016 reflecting a 6.26 percent increase over the previous year. The developments in the recent months have only added further to the burgeoning subscription figures. As of December, 2016, the total number of subscribers was 1152 million, reflecting an 8.8 percent increase from March 2016.

Figure 2.7: Profile of telecom operators

PUBLIC	TOTAL	PRIVATE
117.7 million | 10.2 %	**1151.8 million**	1034.1 million | 89.8 %

Wireline

PUBLIC	PRIVATE
17.2 million | 70.5 %	7.2 million | 29.5 %

24.4 million
TOTAL

Wireless

PUBLIC	PRIVATE
100.4 million | 8.9 %	1026.9 million | 91.1 %

1127.4 million
TOTAL

Source: As per TRAI records
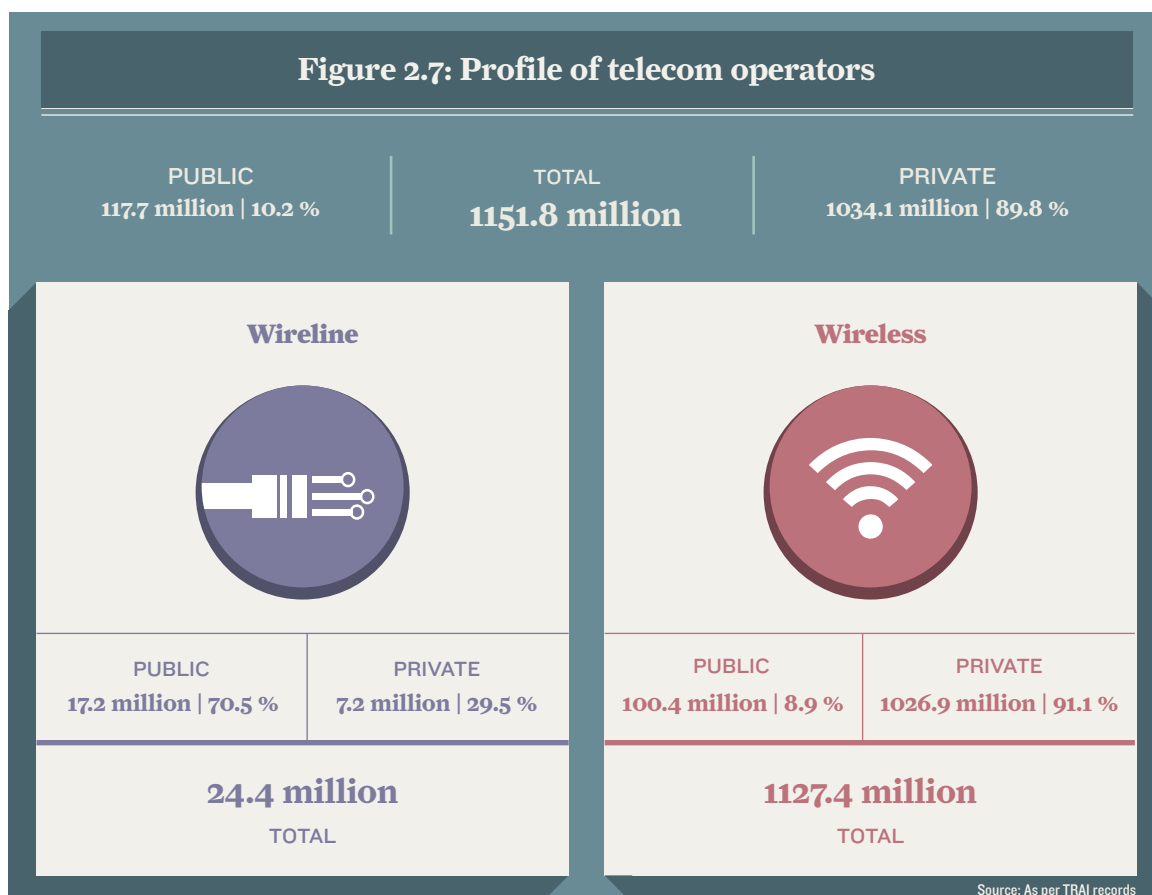
After the announcement of the NTP, 1994, the DoT issued guidelines for private sector entry into basic telecom service. In early 1995, bids were called for basic service and were received in August, 1995. By March, 1996, the successful bidders were short-listed for providing basic services and in 1997, license agreements with private Basic Service Operators (BSOs) were signed for six circles. However, unlike other services, the basic service did not take off in the manner expected soon after the licenses were awarded.

Subsequent to the announcement of the NTP, 1999, TRAI's recommendations were sought for grant of fresh licenses for basic telecom service in the 15 vacant telecom circles and for additional licenses in 6 circles where licenses had already been issued. TRAI gave its recommendations to the Government on 31st August 2000. In line with the TRAI's recommendations, the Government issued the Guidelines for issue of Licence for Basic Service on 25th January, 2001. These guidelines provided for opening the basic telephone services without any restriction on the number of operators. By the end of March 2009, licenses were awarded to 5 private BSOs namely, M/s

Reliance Infocom Ltd. (21 circles), M/s Tata Teleservices Ltd. (20 circles), M/s Bharti Airtel Ltd. (17 circles), M/s ShyamTelelink Ltd. (Rajasthan circle) and M/s HFCL Infotel Ltd. (Punjab circle). All the five private operators had migrated to the Unified Access Service (UAS) regime during 2003-04. Vodafone entered the basic services market in 2011-12 and since then, there have been six private operators apart from the two public operators, Mahanagar Telephone Nigam Limited (MTNL) and Bharat Sanchar Nigam Limited (BSNL).

Private participation in the cellular mobile market, on the other hand, has been comparatively more successful. In 1994, eight cellular licenses, two in each of the metros were awarded. Subsequently, a bidding process resulted in the award of licenses in 18 circles. For two circles, Jammu and Kashmir, and Andaman and Nicobar Islands, no bids were received, while for West Bengal and Assam, only one bid each was made.

The number of private cellular operators steadily increased, with there being around fifteen-sixteen operators present across different circles at one point of time. By any measure, this is a

highly competitive telecom market, especially relative to most of its global counterparts. A 2014 report from Merrill Lynch Global Research compares the Herfindahl-Hirschman Index (HHI) for various countries and India had the lowest market concentration at 0.22.[6] An E&Y report from 2014 noted Indian telecom to be "congested" sector with many operators having less than 10 percent subscriber market share.[7] In December 2013, an empowered Group of Ministers (EGOM) approved a previous recommendation from the Telecom Commission, which allowed two or more service providers to merge as long as their post-deal market share did not exceed 50 percent (previously 35 percent) of the country's subscribers. Since these new M&A guidelines, the sector has seen a trend towards consolidation with several exits and mergers being announced. Videocon stopped operations in 2016, and both Reliance Communications/Aircel (2016) and Vodafone/Idea (2017) have announced their intention to merge, pending regulatory approvals.

Competitive intensity in the market has allowed for innovative business models to emerge with tariffs and services that suit varying budgets. This, combined with the advent of low cost handsets, has reduced the entry barriers for new telecom subscribers.

Trends in Internet services

The Internet services landscape in India has witnessed tremendous changes since 15th August 1995 when Internet services were first launched in the country. In 1995, VSNL became the first commercial Internet Service Provider (ISP) offering public Internet services in India. Within two years, VSNL/DoT had 75,000 Internet subscribers on the network and had reached double that figure in 1998.[8] It was in November, 1998 that the Government decided to open up the sector to private participants, ending the monopoly that was enjoyed by the DoT, along with VSNL and MTNL, till that point of time. This marked the tipping point for subsequent changes in terms of increased number of service providers, burgeoning subscriber base and other positive developments in terms of speeds, quality and rates for Internet services, that have come about in the last several years.

In its very first annual report for the year 1998-99, TRAI acknowledged the role of the Internet as a "versatile and powerful tool to access and exchange information worldwide". It also laid down its mission to endeavour towards facilitating a reduction in the cost of inputs, wherever possible, to make Internet services most affordable and strive towards improving the quality of Internet services being offered to consumers. It was also around that time that the Government decided to set up of the National Task Force on Information Technology and Software Development, whose terms of reference included suggesting measures for achieving a massive expansion in the use of the Internet by all sections of society, especially in business and education, and development of Indian content on the Internet.[9]

The Task Force presented its 'IT Action Plan' to the Government in July, 1998, recommending several initiatives aimed at the creation of a liberalised policy and procedural environment. These included the ending of VSNL's monopoly on international gateway for Internet access; access to Internet through Cable TV; Internet access nodes to be opened by DoT and authorised ISPs in all district headquarters; and up gradation of STD/ISD booths into full-service 'information kiosks' offering e-mail, voice mail and Internet.

Following these developments, in November, 1998, the Government announced its decision to end its monopoly over the provision of Internet services through the implementation of the New Internet Service Provision Policy. The main features of the policy included:

- No restriction on number of service providers. The providers were, however, not permitted to offer Internet telephony.
- Three types of license - national circle-wise and district-basis. No prior experience in IT and telecom required to obtain a license. Period of license was for fifteen years, extendable by five years. No license fee for first five years.
- Service providers given the option of building or leasing capacity from infrastructure owners (BSOs, railways, energy utilities, etc.).
- Foreign equity participation capped at 49 per cent.
- Freedom to fix tariff, subject to TRAI's ability to review and fix tariff at any time during the license.
- Service providers allowed to set up international gateways after obtaining security clearance.

The opening up of the sector led to the issuance of licenses to private operators -- 94 ISP licenses were issued in the first year, of which, 16 were Category A licenses (whole country), 31 were Category B licenses (20 telecom circles and 4 metro towns) and the remaining 47 were Category C covering secondary switching areas. These providers collectively served a subscriber base of around 270 thousand with another 400 thousand users being catered to by the public sector. In a drastic shift from that position, we now have 391.5 million Internet subscribers, as per the numbers reported by 149 ISPs.

The initial launch of Internet in 1995 was through dial-up access with speeds of up to 9.6 Kilobits per second (Kbps). Integrated Services Digital Network (ISDN) access was introduced in 1997. With the availability of upgraded modems and access technologies, we gradually began seeing faster access speeds. The rolling out of networks using Third Generation (3G) and Broadband Wireless Access (BWA) spectrum, which started in the year 2011-2012, proved to be a pivotal moment in the proliferation of wireless Internet connectivity. Today, wireless services far exceed the number of fixed line connections.

6) Ravi, Shamika and Darrell M. West, Spectrum policy in India, August 2015.
7) EY, Inside Telecommunications in India, 2014.
8) Wolcott, Peter, The provision of Internet services in India, 2005.

9) Notification on appointment of a National Task Force on Information Technology and Software Development, Prime Minister's Office, 22 May, 1998.

TABLE 2.2: MODE OF WIRED INTERNET ACCESS*
Total wired Internet subscribers: 21,510
DSL -13,330
Dial-up - 3,210
Ethernet/LAN - 3,050
Cable modem - 1,490
Fiber - 350
Leased line - 80

TABLE 2.3: MODE OF MOBILE WIRELESS INTERNET ACCESS*
Mobile wireless Internet subscribers: 369,400
GPRS/EDGE – 152,000
HSPA/WCDMA -127,980
LTE – 86,750
EVDO/CDMA – 1,560
HSIA -1080
CDMA 1X- 30

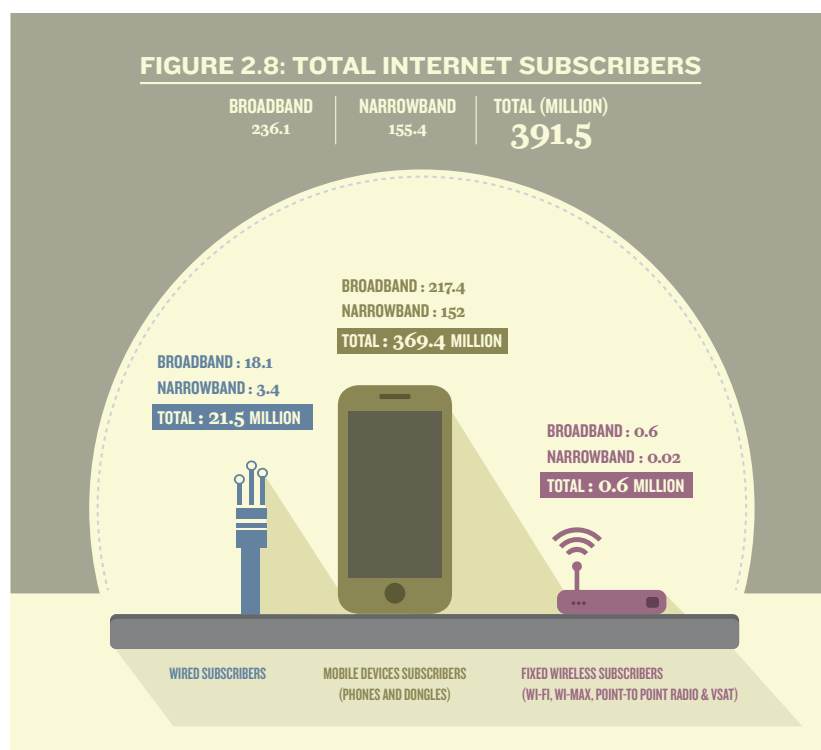| TABLE 2.4: MODE OF FIXED WIRELESS INTERNET ACCESS* |
| --- |
| **Fixed wireless Internet subscribers: 611** |
| Wi-Fi - 546 |
| Radio - 35 |
| FW/LTE - 16 |
| Wi-Max - 9 |
| V-Sat - 5 |

* Figures in thousands

Until about 2011 the provision of Internet and broadband services in the country continued to be predominantly through Digital Subscriber Line (DSL) technologies over copper wires, which were limited in number and geographical spread. Other access technologies have seen some growth since then but the wired access market still continues to be dominated by DSL. As of December 31st, 2016 there were 13.33 million DSL subscribers in India as compared to only 0.35 million subscribers accessing the Internet through fiber technology. While fiber infrastructure is expensive to set up, the speeds offered by it are unmatched by any of the other mediums. With this in mind, the Government has taken strong initiatives towards building optic fiber infrastructure in remote areas of the country through the ***BharatNet project***, which is talked about in more detail in subsequent sections of the report.

The availability of faster Internet speeds also led to a rethinking of the definition of "broadband" services. Initially, Internet speeds of more than 256 Kbps were classified as broadband services. This figure was revised in the financial year 2013-14 when the minimum download speed for broadband services was increased to 512 Kbps. It was in the same year that information relating to wireless data services started being

included in the revised definition of broadband services, as notified by the Government.

The decision on how to define broadband services has not been without its share of controversy- given that India lags behind many of its global counterparts on this count. The NTP, 2012 specifically mentioned revising minimum download speeds to 2 Megabits per second (Mbps) by the year 2015 and making available high speeds of at least 100 Mbps on demand. In September, 2014 the Authority recognised these benchmarks to be appropriate for India, however, the 512 Kbps continues to be in use. Anything below this benchmark is classified as narrowband. Elsewhere in the world, broadband is being defined at much higher speeds- in 2015 the US for example changed its benchmark speeds from 4Mbps to 25Mbps for downloading.

As per the revised definition of broadband services that was adopted in 2013, the total broadband subscriber base of the country at that point of time was 60.87 million vis-a-vis 15.05 million in the previous year (based on the pre-revised definition of 256 Kbps). We now have 391.50 million internet subscribers in the country as reported by 149 ISPs as on December, 2016.

FIGURE 2.8: TOTAL INTERNET SUBSCRIBERS

BROADBAND 236.1 | NARROWBAND 155.4 | TOTAL (MILLION) **391.5**

BROADBAND : 217.4
NARROWBAND : 152
TOTAL : 369.4 MILLION

BROADBAND : 18.1
NARROWBAND : 3.4
TOTAL : 21.5 MILLION

BROADBAND : 0.6
NARROWBAND : 0.02
TOTAL : 0.6 MILLION

WIRED SUBSCRIBERS | MOBILE DEVICES SUBSCRIBERS (PHONES AND DONGLES) | FIXED WIRELESS SUBSCRIBERS (WI-FI, WI-MAX, POINT-TO POINT RADIO & VSAT)

Source : As per TRAI records

Internet data usage has also been on the rise since 2013. This has corresponded with the decline in data tariff and the inverse relationship between the two is explained in the graph below. For GSM service, while the data tariff has gone down from Rs. 0.29 per MB to Rs. 0.16 per MB from December 2013 to 2016, the monthly data usage per subscriber during the same period has increased from 50MB a month to 884MB a month. The huge jump in data usage from June 2016 onwards was mainly on account of the entry of a new player - the average usage increased from 239MB per month in September, 2016 (figure 2.9) to 884 MB per month in the next quarter. The cost strategy of the new entrant has led the competitors to revisit the drawing boards and introduce newer cheaper plans in order to compete with it. These new strategies are likely to lead to a greater reduction in tariff and increase in data usage for the subsequent quarters.

FIGURE 2.9: DATA TARIFF AND USAGE TRENDS: FOR GSM SERVICE
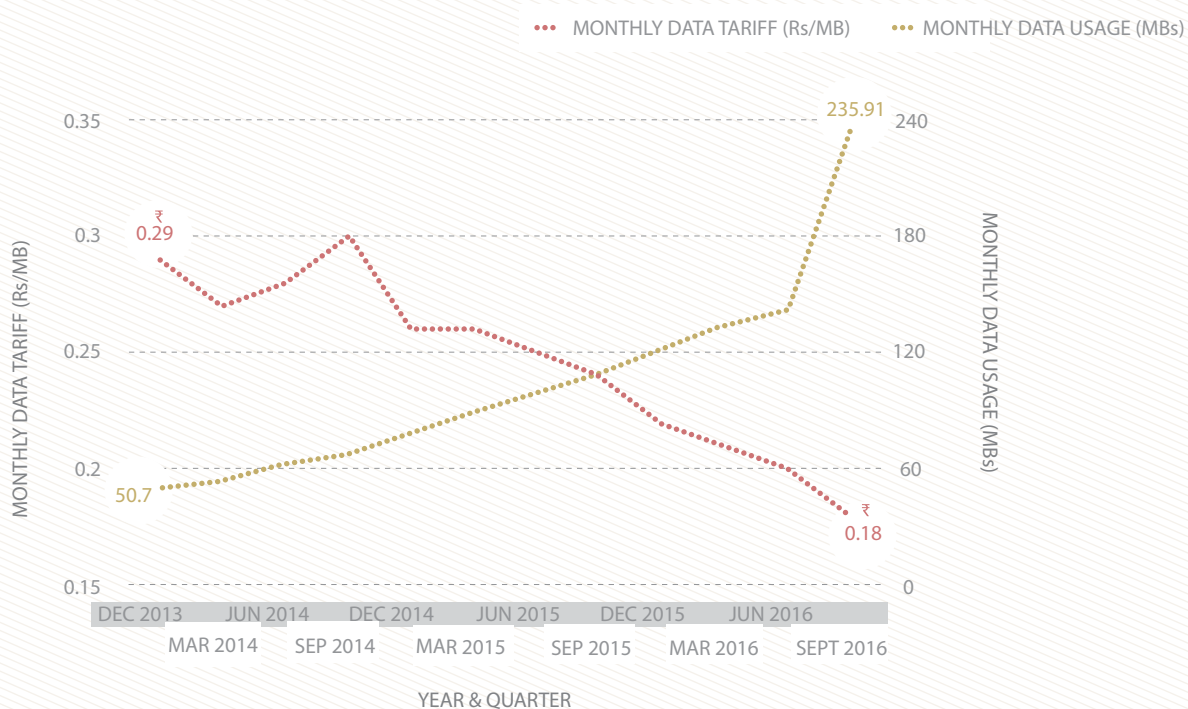
Despite the many leaps that have been made in terms of providing greater and better quality Internet connectivity to users in the country, there still remains a large part of the population that is unconnected to the online ecosystem, particularly in rural areas. Out of a total Internet subscriber base of 391.5 million at the end of December, 2016, 276.44 million were based in urban areas while 115.06 were in rural areas. The difference is even more stark if we take into account the rural-urban divide among the subscribers of broadband Internet, which had 189.44 million urban subscribers as compared to only 46.65 million rural ones.

TABLE 2.5: BREAK UP OF RURAL-URBAN INTERNET SUBSCRIBER BASE [IN MILLIONS]

Telecom Service Area	Narrowband		Broadband		Total (Dec 2016)		Total (Sep 2016)	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Andhra Pradesh	4.99	6.64	4.67	13.85	9.66	20.49	9.68	17.78
Assam	2.34	0.85	1.19	3.07	3.53	3.92	3.82	3.43
Bihar	6.99	5.77	2.63	7.40	9.61	13.17	9.46	11.67
Delhi	0.32	6.45	0.38	17.90	0.70	24.35	0.67	21.59
Gujarat	3.57	5.25	3.05	12.53	6.62	17.78	6.94	16.23
Haryana	1.42	1.61	1.78	3.77	3.20	5.39	3.40	4.90
Himachal Pradesh	0.91	0.63	0.75	1.13	1.67	1.76	1.86	1.42
Jammu & Kashmir	0.59	0.59	0.44	1.39	1.03	1.99	0.68	1.10
Karnataka	3.05	5.10	2.27	15.06	5.32	20.16	5.68	18.29
Kerala	2.08	2.61	3.78	7.68	5.86	10.29	6.54	9.73
Kolkata	0.16	3.46	0.33	7.08	0.48	10.53	0.49	9.63
Madhya Pradesh	4.98	5.14	2.06	11.31	7.03	16.46	6.84	15.40
Maharashtra	5.48	7.07	4.77	15.29	10.25	22.35	10.30	20.33
Mumbai	0.16	5.13	0.17	13.04	0.33	18.17	0.32	16.25
North East	1.20	0.76	0.84	1.67	2.04	2.43	2.18	2.15
Orissa	2.67	1.73	0.78	4.37	3.45	6.10	3.88	5.17
Punjab	2.47	3.37	1.67	7.85	4.14	11.22	4.64	10.08
Rajasthan	4.77	4.86	2.30	7.61	7.07	12.47	7.52	10.83
Tamil Nadu	3.26	7.68	4.02	15.76	7.28	23.44	6.97	22.21
UP (East)	8.26	5.90	3.32	8.25	11.59	14.15	12.32	12.18
UP (West)	4.74	4.67	1.88	6.95	6.62	11.62	6.75	10.21
West Bengal	4.02	1.76	3.57	6.47	7.59	8.22	8.83	7.12
	68.40	87.01	46.65	189.44	115.06	276.44	119.79	247.69

Total	155.41		236.09		391.50		367.48	

Competitiveness and growth

The liberalisation of the ISP regime in 1998, with no license fee, entry fee and liberal roll out obligations and no cap on the number of ISPs in a license area, encouraged private participation. More than 700 licenses were issued within the first three years of opening the sector. As of December, 2016, the top ten service providers together hold 98.09 percent of total Internet subscriber base.[10]

Both the public as well as the private sector have made significant contributions to the growth of the Internet services sector. The key difference however has been that the growth of the private sector has been concentrated in the wireless segment, while public provider BSNL still holds 61.13 per cent of the wireline market share with 13.15 million wireline Internet subscribers.

10) As per reports received from 149 operators.

ISP	No. of subscribers (in millions)	Share (%)
Bharti Airtel Limited	84.83	21.67
Reliance Jio	72.15	18.43
Vodafone	65.05	16.62
Idea Cellular	48.60	12.41
BSNL	32.89	8.40
Reliance Communications	32.08	8.20
Aircel Ltd	18.16	4.64
Tata Teleservices	14.77	3.77
Telenor	13.46	3.44
MTNL	1.99	0.51
Total of Top 10 ISPs	384.02	98.09
Others	7.48	1.91
Grand Total	391.50	100

As per TRAI records

Trends in broadcasting and cable services

Genesis of the sector

Broadcasting refers to a mass communication medium used for the distribution of audio and video signals to a dispersed set of users. Radio broadcasting commenced in India in the 1920s, with the setting up of amateur radio clubs. This was followed by the incorporation of the Indian Broadcasting Company in 1927, which later went on to become AIR. The sector was taken over by the Government in 1936 and remained a public monopoly till 2000, when FM broadcasting sector was opened up for private participation. AIR today has a network of 143 medium wave (MW), 48 short wave (SW), 421 FM transmitters and about 30 digital transmitters. As on date, apart from AIR, 273 private FM channels are operating in the country in 84 cities by 33 private FM radio broadcasters. Also about 201 Community Radio Stations (CRSs) are being operated by community based organisations including universities. CRSs serve as an important instrument for local empowerment and development, helping focus on the day to day concerns of its audience and their specific information needs.

FIGURE 2.10

BROADCASTING & CABLE SERVICES

Television
899 PRIVATE SATELLITE TV CHANNELS
281 PAY TV CHANNELS
30 DOORDARSHAN CHANNELS

Radio
273 PRIVATE FM STATIONS
201 COMMUNITY RADIO STATIONS
418 ALL INDIA RADIO STATIONS

Source: As per TRAI records
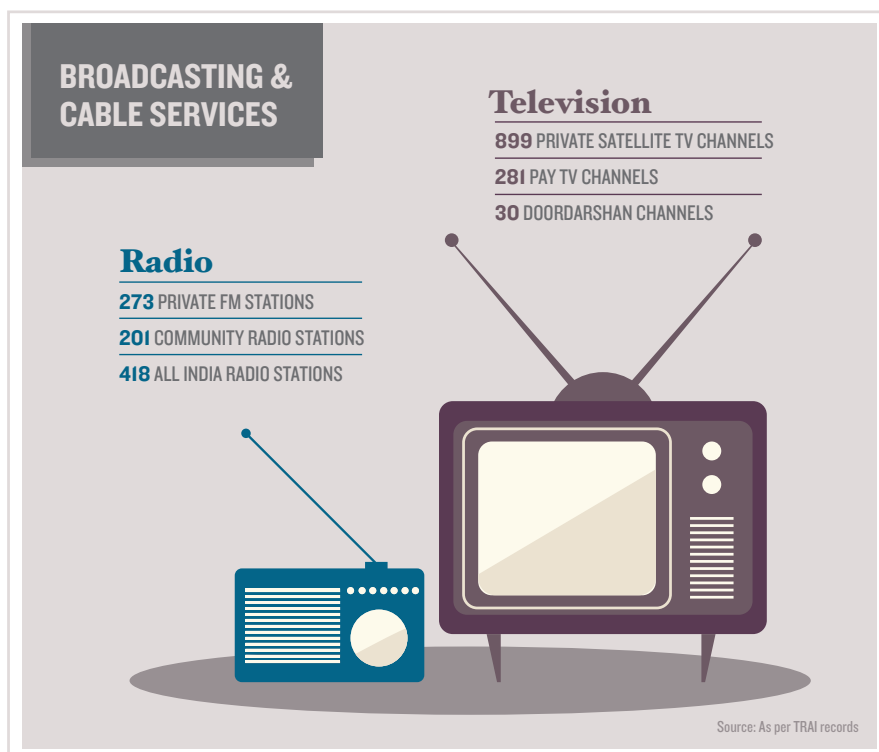
Television broadcasting in India has followed a similar trajectory as radio services in terms of its transition from a public monopoly to a competitive market. Television broadcasting in India commenced on 15 September 1959 with experimental transmission of terrestrial TV signal and subsequently regular TV broadcasts were started in 1965. Major expansion of terrestrial TV services took place around 1982 when national telecasts and color TV were introduced. The use of satellite communication for direct broadcasting started much later, in 1975, through the launch of "The Satellite Instructional Television Experiment" (SITE), a project for community viewing of TV programs in schools and Panchayat centres across six Indian States. Cable TV came into prominence starting from 1989 as entrepreneurs began setting up small analog cable TV networks for distributing local video channels and content.

The subsequent liberalisation of the economy through the 1991 reforms led to the entry of a number of satellite broadcasting services, which became the trigger point for the growth of a vibrant, competitive broadcasting market. By March, 2006, the number of cable and satellite channels available for viewing in the country had increased to 160. A decade later, this figure now stands at over 899 satellite channels. In addition, DD is presently operating 30 satellite TV channels and has a terrestrial network of 66 studio centres and 1412 transmitters. All these channels find their way to over 181 million households in the country through different distribution networks.

In terms of the number of players in the system, the TV broadcasting and cable television services sector currently consists of 47 pay broadcasters, an estimated 60,000 cable operators, appoximately 1200 MSOs and 6 pay DTH operators, apart from DD, which offers a free-to-air (FTA) DTH service.

TV broadcasting services

India currently constitutes the second largest TV market in the world, after China. The sector has witnessed significant growth over the years, in terms of availability of services, revenues and number of subscribers. As per industry estimates, at the end of the last financial year, of the 284 million households in India, around 181 million had TV sets being catered to by different distribution platforms. It is estimated that this figure will grow to about 200 million by 2020.[11]

FIGURE 2.11

INDIA'S TV USER BASE

HOUSEHOLDS WITH TV	CABLE TV SUBSCRIBERS
2016: **181 million**	2016: **102 million**
2006: **108 million**	2006: **61 million**

| Platform	No. of subscribers
Cable TV	102 million
DTH	62.65 million active subscribers
IPTV	500 thousand
HITS	1.05 million

Source: As per TRAI records
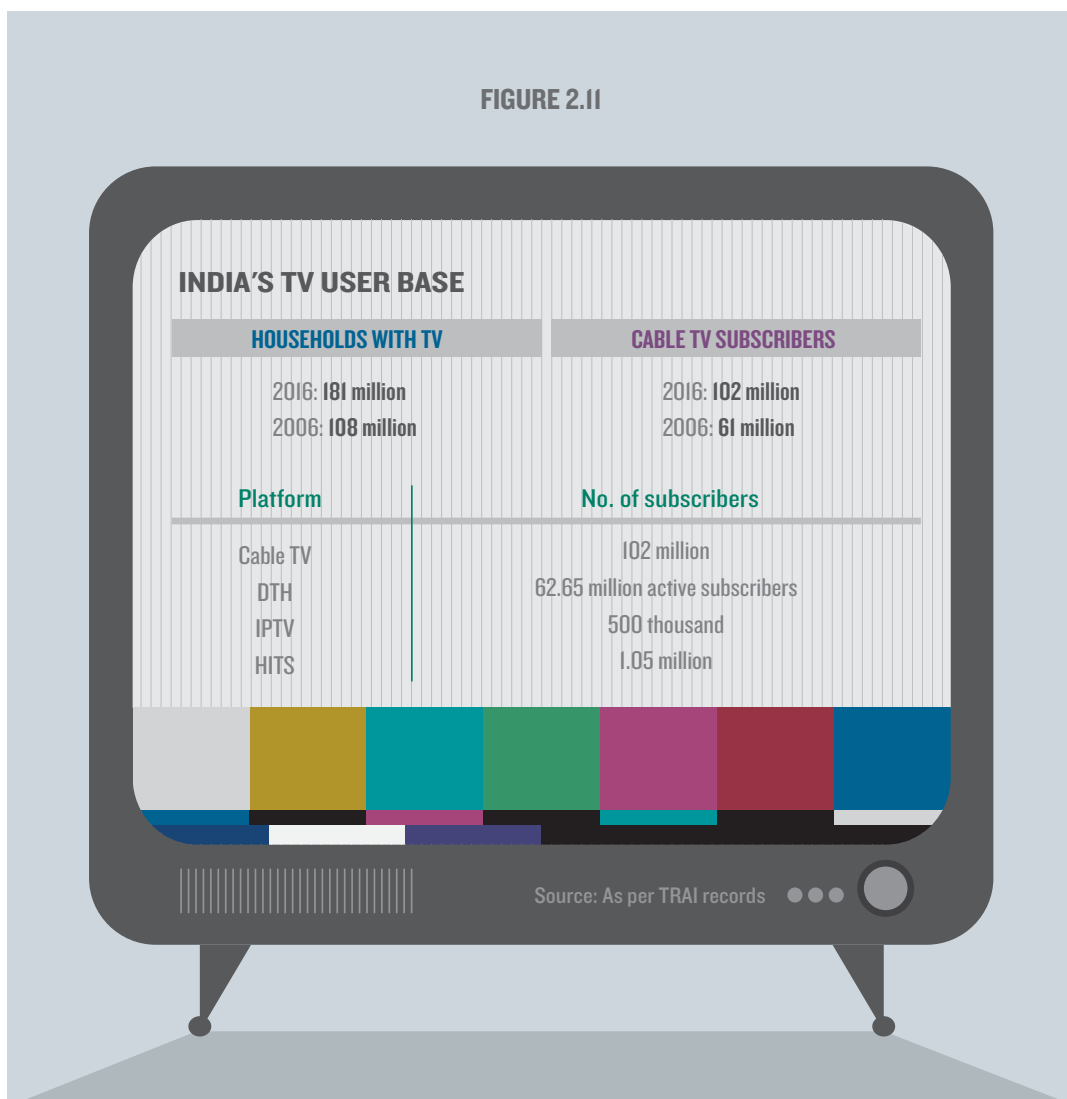
Initially, analog cable TV services remained the predominant form of distribution of TV channels to Indian viewers. This position has come to change over time with the transition to Conditional Access Systems (CAS) and digitised services. The present cable TV distribution network consists of a network of LCOs and MSOs, where MSOs downlink the signals from broadcasters and provide a bundled feed to the LCOs. LCOs, in turn provide last mile cable distribution services to users by obtaining signals through arrangements with various MSOs. In some cases, MSOs may also provide the broadcast services directly to the consumers.

More recently, DTH operators have become a prominent delivery platform for TV services. DTH platforms distribute multi-channel TV programmes by providing TV signals directly to the subscribers, without passing through any intermediaries. A few players are also offering IPTV services, which deliver live and on-demand content to users through the use of Internet Protocol (IP) technology. HITS, is another delivery platform that is being used to distribute signals to consumers through cable operators. The HITS operator uplinks the TV broadcast to a satellite, which is downlinked by a LCO and distributed to individual subscribers through a cable network.

At present, the terrestrial network of DD serves about 92.6 percent of the country's population. Among the private distribution platforms, cable TV providers and DTH operators serve the largest portions of the user base, with cable TV continuing to maintain a significant lead in terms of total number of subscribers. DTH services have, however, witnessed a phenomenal growth rate, since their introduction in 2003.

A review of the number of cable TV subscribers in the last eight years shows that the numbers have continued to increase gradually from about 80 million in 2009 to a little over 100 million in 2016. The DTH subscriber base, on the other hand, has witnessed a much greater expansion, reflecting a CAGR of 31.4 percent in the same period. The current figure of active DTH subscribers stands at about 63 million. Industry estimates project that the gap between cable and DTH subscribers will continue to grow narrower over the next few years. It is projected that by 2021, there will be a total of 84 million cable TV subscribers while the number of DTH subscribers (pay and free) will be over 115 million.[12]

FIGURE 2.12: GROWTH OF CABLE AND DTH SUBSCRIBERS
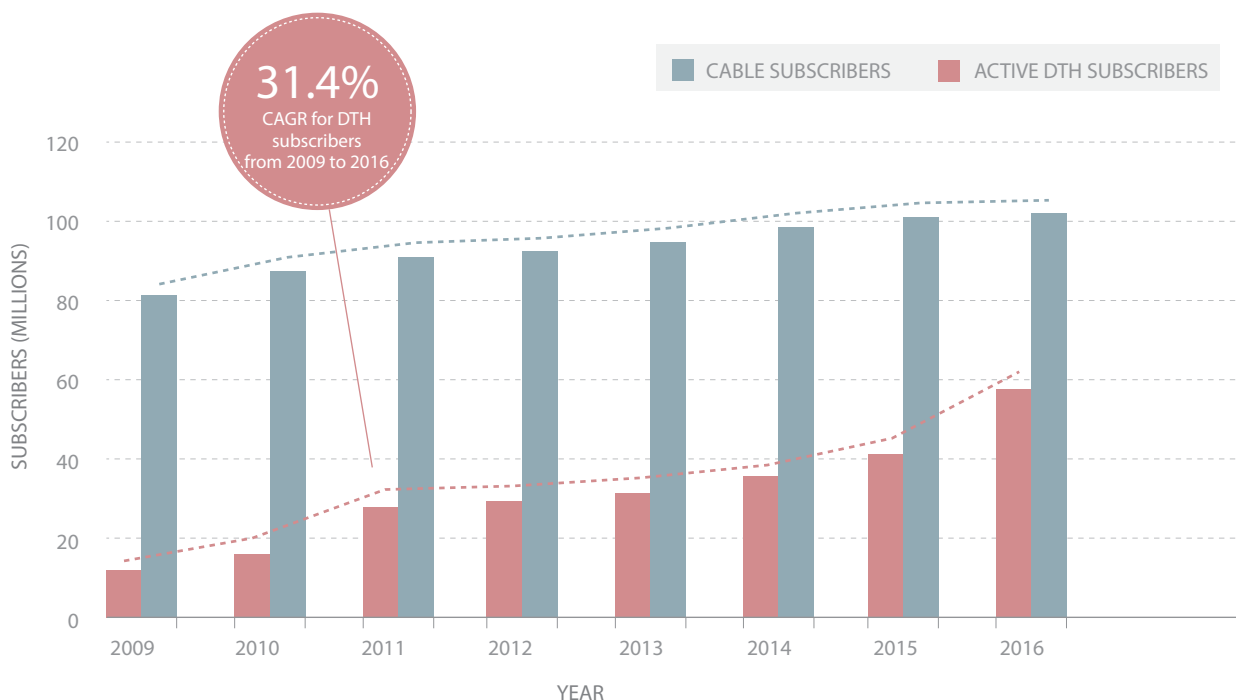
Source : As per TRAI records

In the last eight years, the revenue trend in the TV industry has reflected a near steady mix of subscription and advertising revenues, in the ratio of approximately 65 percent: 35 percent of the total revenue, respectively. For instance, last year, the industry saw subscription revenues of Rs. 387 billion while

approximately Rs. 201 billion were earned through advertising revenues. The revenue of TV industry is projected to increase at a CAGR of 14.7 percent and reach Rs. 1,166 billion by 2021.[13]

12) KPMG-FICCI, Media for masses: The promise unfolds, Indian media and entertainment industry report, 2017.
13) Id.

Radio broadcasting

FM radio plays an important role in providing access to information and entertainment to a wide range of audiences. The affordability of radio devices and advertising-based model of revenue generation makes radio services easily accessible to listeners. In addition, radio services also offer the benefits of wide coverage, low set-up costs and terminal portability, all of which adds to their popularity.

Radio broadcasting services were opened to private sector in the year 2000 when the Government auctioned 108 FM radio channels in the Very High Frequency (VHF) band (88 −108 MHz) in 40 cities in Phase-I of FM radio. Out of these, only 21 FM radio channels became operational and subsequently migrated to Phase-II in 2005. In Phase-II of FM radio, a total of 337 channels were put on bid across 91 cities having population equal to or more than 3 lakh. 222 of these channels later became operational. To further expand the reach of FM radio broadcasting in the country, the Government has embarked upon Phase-III of the process to enable setting up of private FM radio channels in all cities with a population of more than 1 lakh. The Government has recently announced the successful bidders of the second batch of Phase III of the private FM radio auctions.

As of December, 2016, there were a total of 33 companies operating 273 FM Radio channels in 84 cities. In addition to this, AIR has a network of 262 radio stations, through which it reaches out to almost the entire population of the country and nearly 92 percent of the total area.[14]

The growth of the FM services sector pursuant to the expansion of Phase II and III of FM services is reflected in the radio industry's growing revenues. As shown in the figure below, FM radio services have witnessed a healthy rise in advertising revenues in the last few years, increasing from Rs. 10 billion in March, 2011 to Rs. 19 billion by March, 2016. It is expected that these figures will continue to grow in the coming years, driven by the increasing popularity of radio services in smaller towns and cities. Estimates suggest that the revenues of the radio broadcasting sector will grow at a CAGR of 18 percent, to reach Rs. 39.5 billion by 2019.[15]

TABLE 2.7: ADVERTISEMENT REVENUE OF PRIVATE FM OPERATORS [IN RS. BILLION]

Year	FM advertisement revenue
2010-11	10.17
2011-12	10.78
2012-13	11.91
2013-14	14.06
2014-15	16.33
2015-16	19.24

14) AIR, Growth and development profile, AIR website.
15) TRAI, Consultation paper on issues related to radio audience measurement and ratings in India, 2016.

Telecom services have significantly changed the way individuals lead their lives and engage in economic activities. It has created new ways in which people can interact with one another and socialise; facilitated innovative business models and services and offered more productive ways for firms and workers to operate. The growth of Internet data services and the widespread use of mobile phones have also changed the way in which public services like education, transportation and healthcare are being delivered. The Internet and broadband services in particular, have therefore become an essential part of how economies function. Recognising the value of Internet and telephony services in enabling economic growth and social development, countries all over the world, including India, have floated plans to boost investment in these sectors. Similarly, the proliferation of broadcasting services has provided users with a host of television and radio channel choices and has contributed significantly to the expansion of the content industry.

This chapter discusses the financial health of the telecom sector and traces its growth over the years. Next, it assesses the contribution of telecommunication and broadcasting services to the Indian economy, both directly such as through employment and Foreign Direct Investment (FDI), as well as indirectly through their enabling effect on allied sectors such as education, agriculture, health, financial and government services.

Financial health of the sector

Over the years, the Indian telecom sector has registered significant growth. As discussed in the preceding chapters, several enabling factors have contributed to this development, starting from liberalisation in 1991; NTP, 1994 and subsequent award of cellular licenses; and establishment of TRAI in 1997. All of this led to considerable competition in the sector thereby benefitting the consumers in terms of access, QoS and affordability, propelling the sector to a high-growth trajectory.

In addition, factors such as India's large population, high economic growth in the country, intense competition in the sector, low tariffs, infrastructure sharing and the introduction of enabling regulatory reforms, are also widely acknowledged as being responsible for the growth seen in the Indian telecom industry.[16]

In the last decade, the sector's revenues have grown from Rs. 873.12 billion to Rs. 2453.51 billion, at a CAGR of more than 10 percent. Further, it has been estimated that revenues in India will grow at more than twice the rate of all other markets in the central and southern Asia region.[17]

FIGURE 3.1: REVENUE OF TELECOM SERVICE SECTOR (IN RS. BILLION)

10.88%
CAGR over the last ten years (2006-16)
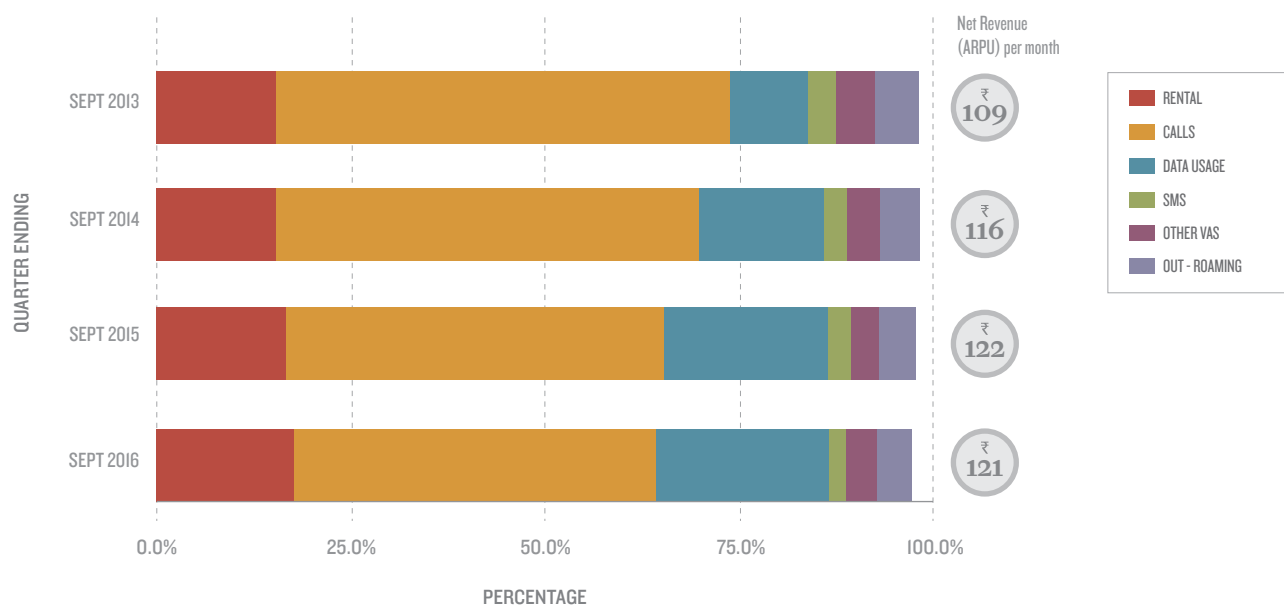
Source: As per TRAI records
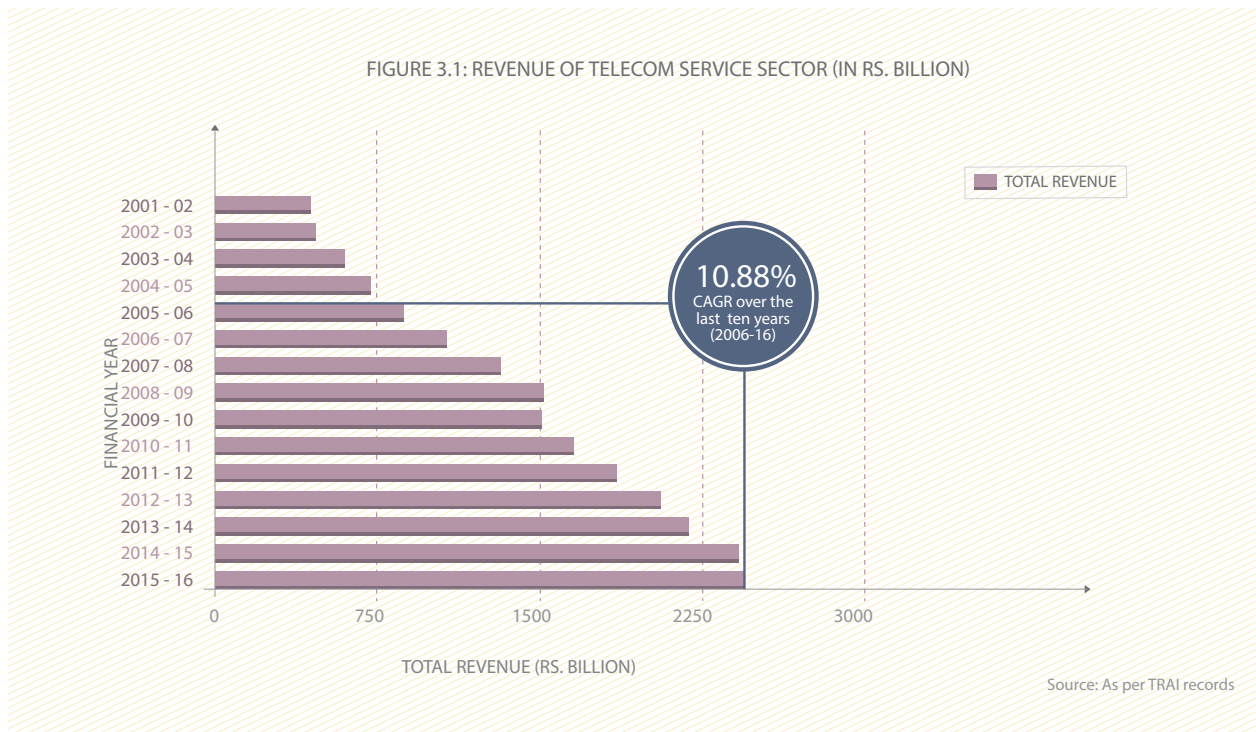
On account of higher uptake of smartphones and lower cost of data services, the revenue from data usage in GSM services has seen a significant rise in past couple of years. In the quarter ending September, 2016, data revenues accounted for around 22 percent of the total revenue from the subscribers as compared to 10.2 percent in the quarter ending September, 2013. As for CDMA subscribers, who comprise less than 2 percent of the total wireless subscribers, the revenue from data usage has increased from approximately 33 percent to 57 percent between September, 2013 to September, 2016. This pattern of increased data usage as compared to voice is likely to continue as data prices get lower and IP based calling becomes more prevalent.

**FIGURE 3.2: COMPOSITION OF TOTAL REVENUE FROM GSM SERVICE**

Source : As per TRAI records

In addition to growth in revenue, the earnings from the sector, measured by the Earnings before Interest, Taxes, Depreciation and Amortization (EBITDA), have continuously been on the rise in the last five years. Because of the directly inverse relationship between EBITDA margins and operating expenditure (opex) ratios, the increase in one leads to an equivalent decrease in the other. As seen from figure 3.3, the EBITDA margin in the telecom sector has been increasing steadily over the last five years. These trends are indicative of the fact that firms in the telecom industry are achieving a higher degree of operational efficiencies. This allows for firms to opt for higher leverage thereby giving them flexibility to change their capital structure.

With the steady increase in number of subscribers and demand for enhanced QoS, proactive investment is required from both public and private players in order to upgrade and expand network infrastructure. As can be seen from the figure below, capital investment in gross fixed assets has been continuously increasing since the turn of the century. During 2001-2016, it has increased by more than seven times, from an amount of Rs. 1031 billion to above Rs. 7600 billion.

FIGURE 3.3: EBITDA MARGIN AND OPEX RATIO IN LAST FIVE YEARS
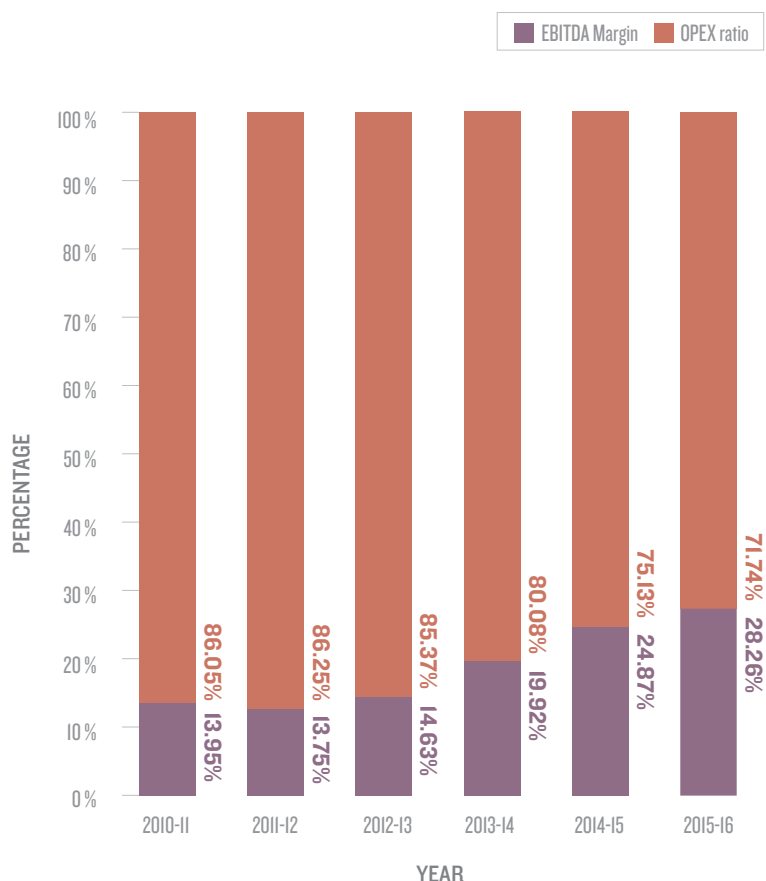
Source : As per TRAI records

FIGURE 3.4: CAPITAL INVESTMENT IN GROSS FIXED ASSETS [IN RS. BILLION]
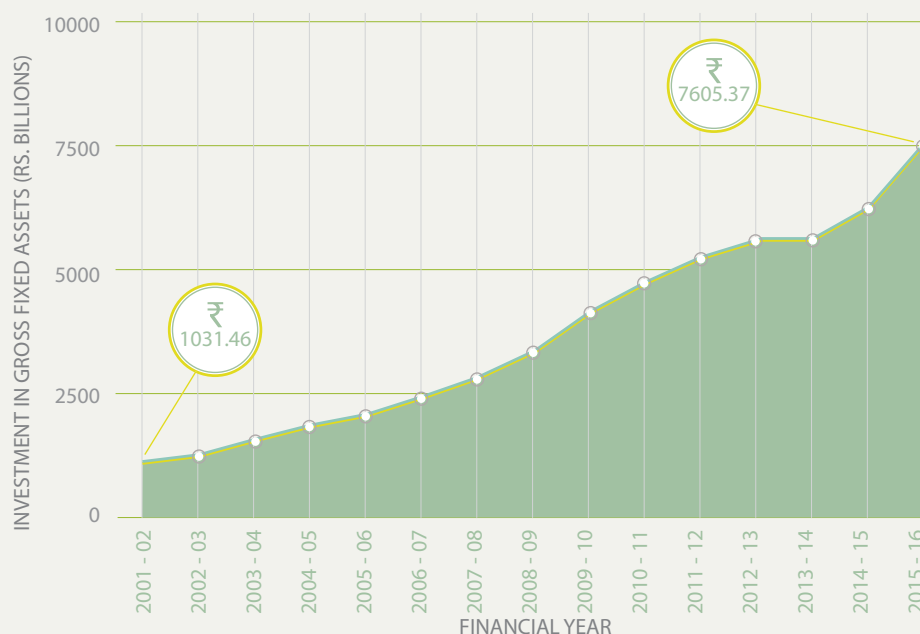
Source: As per TRAI records

The trends for the fixed asset turnover ratio over the last five years are also worth noting. The fixed asset turnover ratio compares the net revenue to the net fixed assets. A higher ratio is indicative of better efficiency in terms of management of fixed assets as the industry is able to churn more revenue from its asset base. A lower ratio on the other hand may signal over investment in fixed assets. An optimal asset turnover ratio differs from industry to industry.

TABLE 3.1: FIXED ASSET TURNOVER RATIO (INDUSTRY)

Year	Ratio (Public sector)	Ratio (Private sector)	Ratio (Overall)
2011-12	34.16%	70.50%	59.74%
2012-13	36.75%	77.28%	66.22%
2013-14	47.93%	88.13%	78.64%
2014-15	56.47%	79.94%	75.61%
2015-16	64.74%	58.38%	59.19%

Source: As per TRAI records

From the above table, we can see that the fixed asset turnover ratio in the private sector has been more than the public sector in all years except the previous one. This can be attributed to the larger asset base for the private sector due to increased investments in both network and spectrum. The overall ratio also took a hit in the last year due to the fact that the private sector makes up a majority of its weight. It is also very encouraging to see the public sector ratio steadily climb over the last five years. This is indicative of more efficient fixed asset management for the public sector service providers.
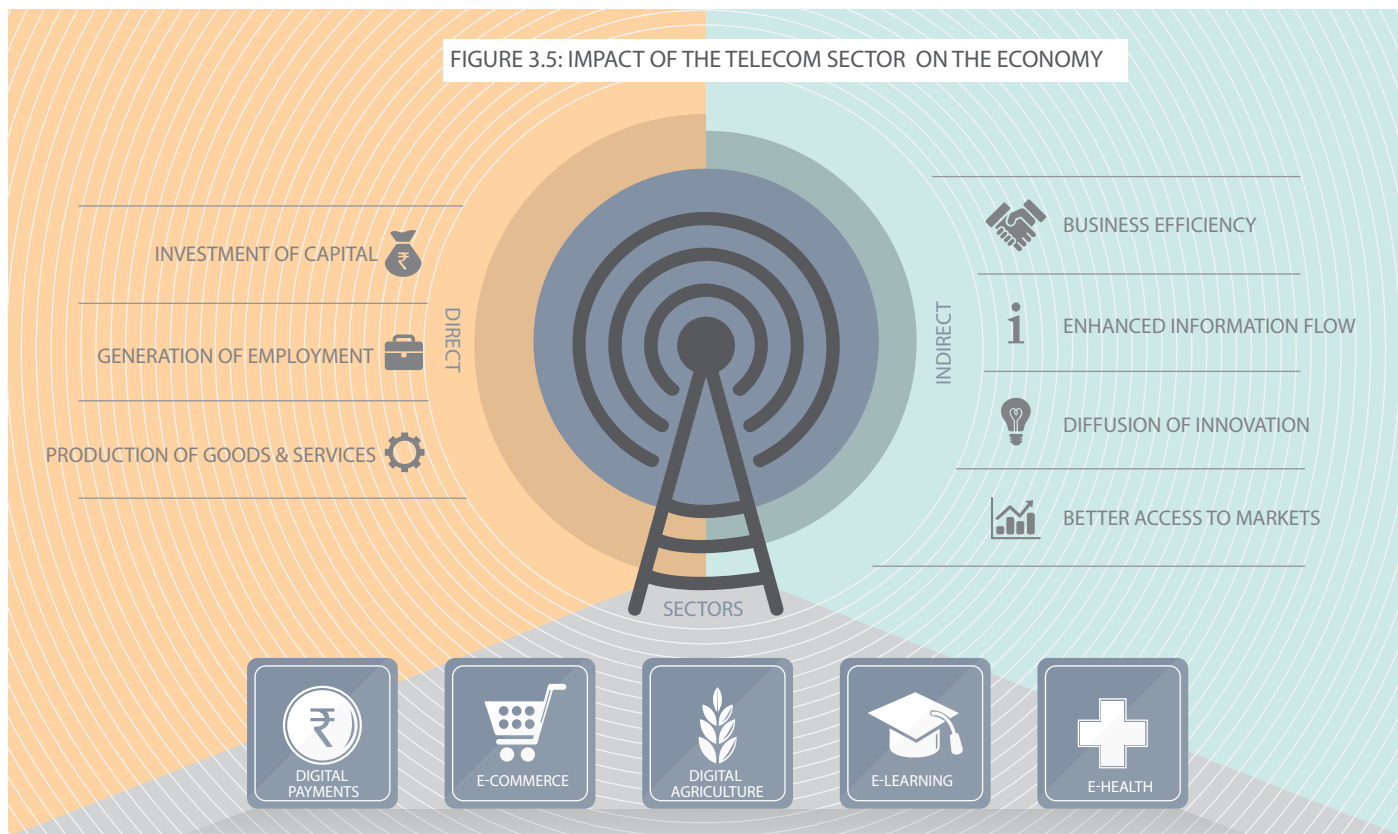
Contribution to the economy

The telecom industry contributes to the output of an economy in both direct and indirect ways. Direct channels include capital investment, production of goods and services, generation of employment and international trade, among others. Indirect ways of contributing to the economy include an increase in business efficiency, enhanced speed and quality of information flows, better access to markets and diffusion of innovation.[18]

Undeniably, telecom services, through fixed-line telephony, mobile phones, wireline and wireless Internet have had a significant impact on the economies of countries globally. There have been attempts to measure this in terms of effect on the Gross Domestic Product (GDP), and by isolating the impact of factors such as usage, Internet speeds and penetration. The following sections will detail some of these studies done both globally and in India.

FIGURE 3.5: IMPACT OF THE TELECOM SECTOR ON THE ECONOMY

DIRECT
- INVESTMENT OF CAPITAL
- GENERATION OF EMPLOYMENT
- PRODUCTION OF GOODS & SERVICES

INDIRECT
- BUSINESS EFFICIENCY
- ENHANCED INFORMATION FLOW
- DIFFUSION OF INNOVATION
- BETTER ACCESS TO MARKETS

SECTORS
- DIGITAL PAYMENTS
- E-COMMERCE
- DIGITAL AGRICULTURE
- E-LEARNING
- E-HEALTH

Employment generation

Although leaps in technology are often associated with decreased opportunities for employment, studies reveal that the quantum of jobs created by the telecom sector is not insignificant. With a large number of TSPs and ISPs and a growing telecom equipment manufacturing sector, the telecom sector in India provides direct employment opportunities to a significant number of workers. Employment is generated in a diversity of ways, creating jobs for engineers, infrastructure and cyber security professionals, application developers, sales executives, handset manufacturing technicians, call centre executives and service and repair technicians, among others. In addition to this, employment opportunities are also being generated in various sectors dependent on and allied with telecom services - for example e-commerce, online content industry, etc. In 2015, the mobile industry in India provided direct and indirect employment to 4 million people, and is estimated to add 1 million more jobs by 2020.[19]

Further, several studies have estimated the impact of effective broadband deployment on the generation of employment, with one of them finding that 2.5 to 4 additional jobs are created for each broadband job.[20] Kathuria et al. (2015) found that the mobile application economy accounted for 75,000 jobs in India.[21] As per the study, the aggregate number of jobs that apps would create in India during the period 2014-16 would be between 91,476 and 604,867, the upper limit being close to eight times the then existing levels of employment generated by the app economy.

Mobile telephony and economic growth

Studies have found a positive relationship between the amount of mobile data consumption and economic growth - mobile data usage per 3G connection has a positive effect on the growth rate of GDP per capita. This implies that countries with a higher average level of mobile data consumption per 3G connection experience a larger impact on GDP per capita growth as this consumption increases.[22] These findings are testament to the transformative impact of mobile phones on the productivity and efficiency of businesses and users in an economy. Beyond cheaper and more convenient voice communications, mobile phones through data connectivity are now playing a pivotal role in broadening the Internet access in the country, accompanied by its attendant benefits.

The study discussed above also looks specifically at the impact of mobile penetration on technological progress and more efficient utilisation of resources in the economy. This is assessed by the impact on the country's Total Factor Productivity (TFP), a measure of economic productivity which accounts for effects in total output not caused by traditionally measured inputs such as capital and labour. TFP is often used to measure an economy's long-term technological dynamism. Increase in TFP leads to an increase in GDP through better utilisation of capital and labour inputs. Using a sample of developing countries and figures on penetration, the study finds that mobile phone penetration has a significant and positive effect on TFP.

In the Indian context, a study performed on Indian states indicates that states with higher mobile penetration can be

19) GSMA, The mobile economy, 2016.
20) Kelly, Tim and Carlo Maria Rossotto, eds., Broadband strategies handbook, World Bank, 2012.
21) Kathuria et al. An inquiry into the impact of India's app economy, 2015.
22) Deloitte, GSMA and Cisco, What is the impact of mobile telephony on economic growth?, 2012.

expected to grow faster, with a growth rate 1.2 percent points higher for every 10 percent increase in the mobile penetration rate. The study also finds evidence of a critical mass, around a penetration rate of 25 percent, beyond which the impact of mobile on growth is amplified by network effects.[23]

Internet and economic growth

Other studies look specifically at the remarkable contribution that broadband Internet has made to economic growth. The Internet has facilitated searching, matching, and sharing of information and contributed to greater collaboration among economic agents.[24] Broadband is increasingly being regarded as a powerful general-purpose technology. It has led to widespread changes in the Information Technology (IT) sector, enabling services such as cloud computing and mobile apps. Equally, broadband is also influencing innovation across many other sectors including health, transport, big data analytics and government services.[25] On account of its widespread usage and varied utility, the Internet today has become an indispensable part of economic activities.

Qiang et al. (2009) at the World Bank did a cross sectional analysis to examine the impact of various ICTs including fixed broadband on GDP growth during the period 1980-2006 for 120 developing and developed countries.[26] The study finds that a 10 percentage point increase in fixed broadband penetration would increase GDP growth by 1.21 percent in developed economies and 1.38 percent in developing ones. This study was updated using more recent data (Scott 2012), deploying the same model but with data for 86 countries for 1980–2011. The results saw a 10 percentage point increase in fixed broadband generating a 1.35 percent increase in per capita GDP for developing countries and a 1.19 percent increase for developed countries.[27] Another study, Czernich et al. (2009) looked at 25

Organisation for Economic Co-operation and Development (OECD) countries covering the period 1996–2007 to estimate various broadband impacts and relationships. It found the GDP per capita to be 2.7 to 3.9 percent higher on average after the introduction of broadband.[28]

Studies done closer to home echo these conclusions. Indian Council for Research on International Economic Relations (ICRIER), in 2016, performed a study to examine the impact of growth of Internet subscribers on the growth of state per capita income in India. The study finds that a 10 percent increase in number of Internet subscribers results in a 2.4 percent increase in growth of state per capita GDP.[29] Another study by the ITU in 2012 established a positive relationship between broadband penetration in the economy and the employment rate. According to the econometric model in the study, an increase of 10 percentage points in broadband penetration growth results in 0.28 percentage points increase in the employment rate.[30]

Impact on economic output

Apart from GDP, Gross Value Added (GVA) is another useful metric for understanding value addition in the telecom sector. For estimating the contribution of the sector to the economy, the GVA, which measures the value of output less intermediate consumption,[31] is useful for sector-level analysis. GVA acts as the main component when calculating the GDP, where GDP is the sum of the GVA at basic prices, plus all product taxes, less all product subsidies.[32] As the table below shows, the value of goods and services contributed by the telecom industry, as a proportion of the total GVA in the economy has been steadily increasing from 2011-12 to 2014-15.

TABLE 3.2: CONTRIBUTION TO ECONOMIC OUTPUT BY TELECOM INDUSTRY - GVA FIGURES WITH RESPECT TO BASE YEAR 2011-12 (RS. BILLION)

Year	GVA - telecom industry	Total GVA	Contribution of telecom industry
2011-12	913.5	81066.6	1.13%
2012-13	975.4	85482.3	1.14%
2013-14	1101.8	90792.5	1.21%
2014-15	1220.9	97093.5	1.26%

Source: Centre for Monitoring Indian Economy (CMIE).

As digital technology advances and many economic activities continue to become increasingly dependent on information technology, the contribution of telecom industry to the overall economy is only expected to grow.

Foreign Direct Investment in telecom

FDI is an important component of economic growth and an important vehicle for the transfer of technology. It also brings

with it considerable benefits through raising productivity, strengthening infrastructure, enhancing competitiveness of the domestic economy and generating new employment opportunities. Since the telecommunication industry is heavily dependent on technology, FDI in telecom is one of the key tools for accelerating its growth.

23) Kathuria et al., An econometric analysis of the impact of mobile. The Policy Paper Series, Number 9, Vodafone, 2009.
24) World Bank Group, World Development Report, Digital dividends, 2016.
25) Minges, Michael, Exploring the relationship between broadband and economic growth, 2015.
26) Qiang et al., Economic impacts of broadband, in Information and communications for development, Washington DC: World Bank, 2009.
27) Scott, Colin, Does broadband Internet access actually spur economic growth?, 2012.
28) Czernich, Nina et al., Broadband infrastructure and economic growth, CESifo Working Paper Series No. 2861, 2009.

29) Kathuria et al., Quantifying the value of an open Internet for India, 2016.
30) ITU, The impact of broadband on the economy, 2012.
31) European Commission, IMF, OECD, UN and World Bank, System of National Accounts, 2008.
32) Product taxes or subsidies are paid or received per unit of product. Some examples of product taxes are excise tax, sales tax; and product subsidies like petroleum and fertiliser subsidies. See Ministry of Statistics, Government of India, Press Note, 30 January, 2015.

Current FDI policy

In India, FDI in the telecommunication sector has been regulated since its inception. Up until 2005, foreign investors were only allowed to hold up to 49 percent of the equity of a telecom licensee. In 2005, the Government of India increased the FDI cap to 74 percent. This limit has been further increased to 100 percent in 2013. The motivation behind enhancement of FDI cap was to encourage capital inflows along with availability of lower cost capital to existing service providers. The current policy with respect to FDI in telecommunication sector is as follows:

TABLE 3.3: TELECOMMUNICATION FDI POLICY

Sector / Activity	FDI Cap / Equity	Entry route	Other Conditions
All telecom services including Telecom Infrastructure Providers Category-I, viz. Basic, Cellular, Unified Access Services, Unified license(Access services),Unified License, National/ International Long Distance, Commercial V-Sat, Public Mobile Radio Trunked Services (PMRTS), Global Mobile Personal Communications Services (GMPCS), All types of ISP licences, Voice Mail/Audiotex/ UMS, Resale of IPLC, Mobile Number Portability services, Infrastructure Provider Category – I (providing dark fibre, right of way, duct space, tower) except Other Service Providers.	100%	Automatic up to 49% FIPB beyond 49%	FDI up to 100% with 49% under automatic route and beyond 49% through FIPB route. This is subject to observance of licensing and security conditions by licensee as well as investors as notified by the Department of Telecommunications (DoT) from time to time.

FIGURE 3.6: FDI TRENDS
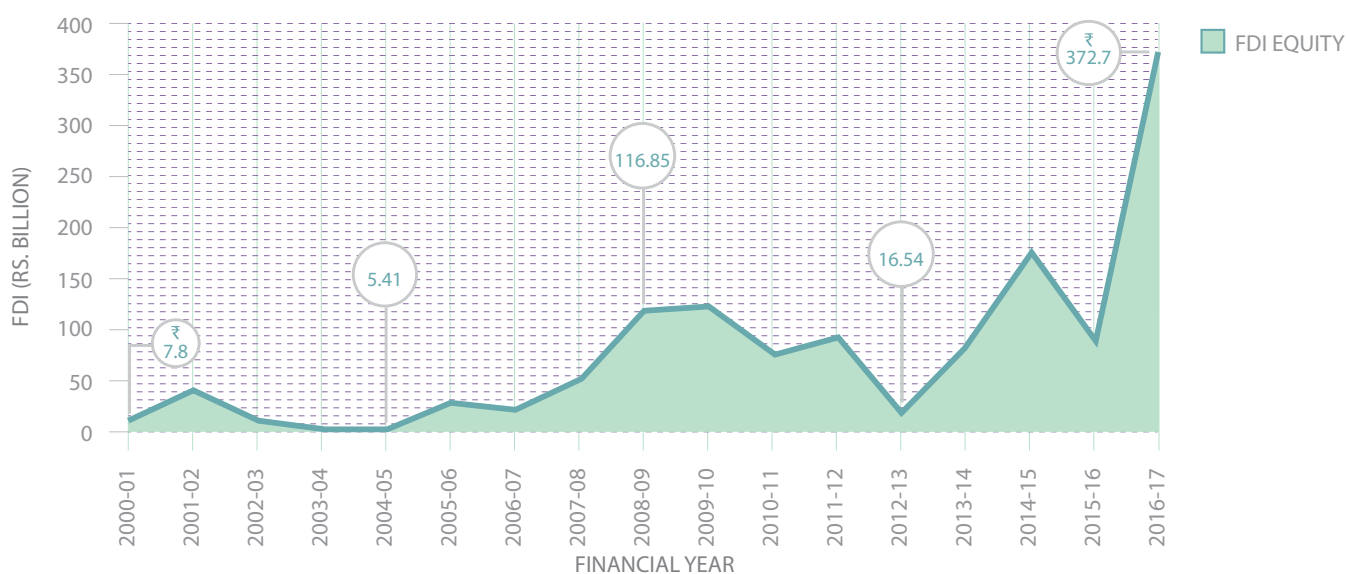
Source : Department of Industrial Policy and Promotion

The overall trend of FDI in the telecom sector for the period from 2000-01 to 2016-17 has been positive, though there has not been a steady growth year on year. The country did see a sharp decline in FDI in 2012-2013 - the Economic Survey noted that FDI inflows plummeted 96 percent in the April to November 2012 period.[33] Some analysts relate this to the cancellation of telecom licenses as per the Supreme Court's orders in the 2G case.[34] After this slump, however, FDI in the last few financial years has been encouraging. In fact, as figure 3.6 shows, in the most recent financial year (nine months up to December 2016), FDI in telecom equity has grown more than four times as compared to the previous year. In terms of cumulative investment, between April, 2000 and December, 2016, the total FDI in telecommunication sector was Rs. 1300 billion, which constituted 7.4 percent of the country's total FDI inflows.

33) PTI, Economic Survey 2013: FDI in telecom sector plunges by 96% to $70.46 million, 2013.
34) Jha, Somesh, Major sectors saw decline in FDI inflows in FY '13 despite reforms, 2013.

Enabling effect on other sectors

The digital world today offers a host of opportunities in various sectors of the economy such as agriculture, e-governance, health, mobile banking and online education. These services offer great promise for the goal of sustainable growth by opening doors to economic growth and the socio-economic development of the society. As noted in a recent report on ICTs and Sustainable Development Goals (SDGs)[35], ICTs can implement SDGs by efficient upscaling of critical services in health, education, financial services and agriculture; reducing deployment costs in urban and rural settings; enhanced public awareness and faster upgrading of services and jobs.

Agriculture

Both mobile telephony and Internet can have potentially transformative effects on agriculture, especially in a developing country like India where a significant fraction of the population still depends on agriculture for their livelihood.

Telecommunication services can enable access to market pricing information, weather forecasts, disease control information and livestock tracking. Small scale farmers can access this type of information and markets directly instead of through intermediaries. Studies suggest that in India, better access of information in the form of weather conditions tracking and wholesale prices comparison increased the profits for farmers and fisherman by 8 percent resulting in 4 percent drop in prices for consumers.[36] These benefits have the potential to be even greater with more sophisticated Internet-based applications.

In 2015, the Digital India campaign was initiated by the Government of India to transform India into a digitally empowered society and knowledge economy. The digital

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BOX 3.1: AGMARKNET

Market Information about the price and arrival of commodities etc. for the agricultural produce is essential for farmers to make decisions pertaining to production and marketing. The collection and dissemination of complete and accurate market information is key to achieve both operational and pricing efficiency in the marketing system.

Agmarknet is a portal launched under the Marketing, Research and Information Network (MRIN) scheme implemented by Directorate of Marketing & Inspection with technical assistance from the National Informatics Centre (NIC) and in association with the State Agricultural Marketing Boards/Directorates and APMCs. The portal provides market information to the farmers, traders, policy makers and other stakeholders. The scheme covers more than 3200 markets and 350 commodities.

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services initiatives under this project include a dedicated farmer portal that serves informational needs on issues relating to agriculture, animal husbandry and fisheries; and mobile apps for information on weather conditions, markets, prices and crop insurance.

The non-government sector has also played an empowering role in using technology to enable the sharing of information among the agricultural community. RML (formerly Reuters Market Light), is one such subscription-based SMS service that providers farmers with information designed to help them increase productivity, maximize revenue, manage risk, and reduce waste.[37] Similarly, there are other initiatives that bring together technology and social organisations to improve information dissemination, for instance, by using participatory videos where farmers explain best management practices to other farmers.[38]

India currently ranks 138th on Information and Communication Technology (ICT) Development Index, out of a total of 175 countries.[39] Lower penetration in rural areas is among the factors responsible for this situation. With sustained efforts towards increased ICT penetration, India will not only see an improvement in its position on the ICT index, it will also be better placed to take positive steps towards the digitisation of the agricultural sector. This can play a significant role in increasing employment opportunities, improving the standard of living in the agricultural sector and reducing the risk and uncertainties that farmers face at present.

Banking and financial services

Financial and banking services are being transformed by IT applications and services. India's financial services sector has used information technology to digitise business operations and to create new delivery models and services, such as online brokerage, mobile banking, and online insurance sales.[40] The growth of innovative information technologies, along with broadband Internet access, is also helping address the challenges of financial inclusion.

Given the ubiquity of mobile phones across the breadth of the country, with around 1.15 billion mobile subscribers at the end of December 2016, the mobile phone has triggered a new revolution in financial inclusion. The Jan Dhan-Aadhaar-Mobile (JAM) trinity was designed to further this goal of financial inclusion in the country and for enabling more efficient transfer of benefits.

TRAI has also played its role in encouraging the use of telecom services for financial transactions. It has mandated banks to use Short Message Service (SMS), Interactive Voice Response (IVR) and Unstructured Supplementary Service Data (USSD), while Wireless Access Protocol (WAP), mobile apps and SIM

35) The Earth Institute Columbia University & Ericsson, ICTs and SDGs, 2016.
36) Deloitte, Value of connectivity: Economic and social benefits of expanding Internet access, 2014.
37) World Bank, ICT in agriculture, e-Sourcebook, 2011.
38) Gandhi, Rikin et al., Digital green: Participatory video and mediated instruction for agricultural extension, 2009.

39) The ICT Development Index (IDI), is a composite index that combines 11 indicators into one benchmark measure. It is used to monitor and compare developments in ICT between countries and over time.
40) McKinsey Global Institute, India's technology opportunity: Transforming work, empowering people, 2014.

tool kit (STK) are optional. USSD and SMS have proven to be very popular and successful modes of communication in developing countries, including for carrying out financial transaction, as they require only a basic mobile device, are easy to use and comparatively cheap.

USSD BASED FINANCIAL SERVICES

*99#

Along with the growth of Internet services, mobile banking has also seen a steady growth over the last few years. It empowers users in terms of ease of access to banking and financial transactions, allowing account holders to transfer funds, check bank statements, request for new cheque books by logging into their bank account. The introduction of Unified Payment Interface (UPI) now allows funds to be transferred on the basis of only a user ID, creating an advanced architecture for instant online payments. The interface has been developed by National Payments Corporation of India (NPCI), the umbrella organisation for the country's retail payments. UPI aims to allow users to send and receive money, make utility payments and more using a single password and identification. UPI works 24 hours a day and seven days a week, unlike existing money transfer platforms such as Real Time Gross Settlement (RTGS) and National Electronic Funds Transfer (NEFT) and since it is built on top of IMPS, the money transfer takes place immediately.

The shift to digital payments depends to a large extent on digital literacy, connectivity and people's comfort with technology. Trends for digital payments are however, encouraging. A comparison of cashless payments in October 2016 (prior to demonetisation[41]) as against October 2015, points towards a greater acceptance of digital payment modes. Also, while consumption (expenditure) grew 2.8 percent in the second quarter of 2016-17, the payments on digital platforms for the same quarter grew by 6 percent, showing that digital consumption rose faster than consumption.[42]

Internet growth has also had significant impact on other aspects of financial markets. For instance, it has had a tremendous impact on online stock trading with the number of online trades growing year by year. Online initial public offerings (IPOs) have also increased in the recent years. The link between the adoption of information technology and the

TABLE 3.4: BANKING TRANSACTIONS - INCREASE FROM OCT 15 TO OCT 16

Transaction type	October 16 over October 15
Cashless	22%
Mobile Banking	175%
Money transacted using mobile banking	369%
IMPS transactions	116%
IMPS transfers	150%
NEFT	16%
Point of sale	35%

Source: RBI Monthly bulletins

growth in the Indian capital market has also been established through empirical studies. For instance, Bhunia, 2011 finds that the growth in market capitalisation is influenced to a significant extent by Internet access, telephone, mobile and access to the websites of stockbrokers.[43]

E-commerce

The growth in telecom services along with online banking services has also led to a proliferation of e-commerce in the country. The Internet has given users in the country a platform for making various forms of purchases without having to physically step out into a market place. Today's Internet savvy citizen purchases groceries, clothes and accessories, tickets, shoes as well as electronic equipment and gadgets through online means. The availability of digital and online payment platforms as mentioned in the previous section allows sellers to receive payments upfront and not wait until the product has been delivered. The advent of complementary technologies and tools like hyper-local logistics, analytics driven customer engagement and digital advertisements have enabled the

e-commerce industry to grow at a much faster rate. Cash on Delivery (CoD) in particular was a game changer in driving acceptability of ecommerce transactions and content apps are evaluating CoD options.

Given the convenience offered by e-commerce services, it is expected that as the number of people "online" increases, so will the number of online shoppers which will further boost the e-commerce industry. According to a 2015 report by Kleiner Perkins Caufield & Byers (KPCB), India has the highest share of mobile based e-commerce sales globally at 41 percent. The leading e-commerce companies have reportedly stated that almost 70-75 percent of their online traffic comes from mobile phones and thus higher revenues are coming from mobile applications.[44] An industry report by Confederation of Indian Industry (CII) estimates that e-commerce will become the largest part of the Indian Internet market, with a value of approximately $ 100 billion by 2020.[45] These trends are shown in the table below.

TABLE 3.5: E-COMMERCE TRENDS IN INDIA

B2C retail (excluding online travel and classifieds)	2013	2014	2018*	2020*
Total e-commerce size ($ Billions)	2.9	16	40.3	101.9
Number of online shoppers (Million)	20	39	140	220
Online shoppers of total Internet (As a %)	9%	11%	25%	36%

* estimated

41) On 8th November 2016, the Government decided to cancel the legal tender character of Rs. 500 and Rs. 1000 banknotes. See Department of Economic Affairs, Government of India, Press Release, 8 November, 2016.

42) Central Statistics Office, Press note on estimates of GDP for the second quarter of 2016-17, 30 November 2016.

43 Bhunia, Amalendu, An impact of ICT on the growth of capital market-empirical evidence from Indian stock exchange, Information and Knowledge Management, Vol 1, No. 2, 2011.

44) Kleiner Perkins Caufield & Byers (KPCB), Internet trends 2015 - Code Conference, 2015.

45) Confederation of Indian Industry (CII), e-Commerce in India - A game changer for the economy, 2016.

The CII report goes on to say that the industry in India has been propelled by the rise in Internet penetration due to major improvements in the telecom infrastructure. The widening reach of both 3G and 4G data networks, along with reduced data tariffs has led to significant growth on Internet data spend. The report also states that while India ranks the lowest in Asia when it comes to Internet speed, data rates in India are 2 times cheaper than in China and 3 times cheaper than in the US. Government schemes such as National Optical Fibre Network (NOFN) can significantly increase Internet penetration in the rural communities as well as provide a means to e-commerce companies to tap into the potential of reaching rural consumers.

BOX 3.3: INTERNET OF THINGS (IoT)

IoT refers to the connection of everyday objects to the Internet and to one another, and is aimed at providing users with smarter, more efficient experiences. The underlying idea behind IoT is to allow autonomous and secure connection and exchange of data between real world devices and applications. According to the ITU, some of the fundamental characteristics of IoT are interconnectivity between ICT infrastructure, heterogeneity of platforms and networks, dynamic changes in the state of devices (location, speed, and connectedness) and enormous scale. The types of objects span a wide range of categories, from wearable health trackers to light bulbs to home appliances. IoT is also being applied to vertical markets like the medical and health-care industry and to transportation systems. A very simple example of IoT would be a thermostat that one can control through a mobile application. This allows a user to regulate the temperature remotely and in cases when he or she may have left the house. IoT may also be able to help e-commerce firms streamline their logistics, allowing them to track inventory and movement of goods through Global Positioning System (GPS) and Radio-frequency Identification (RFID) techniques as well as to monitor other variables which may impact sales. It is predicted that by 2020, every smartphone user will have at least five IoT connected objects. IoT can also be used in cities to monitor the number of available parking spaces, air and water quality, and traffic.

In summary, IoT will:
a) Connect both inanimate and living things
b) Use sensors for data collection
c) Identify, track and communicate with objects over the IP network.

Machine-2-Machine (M2M), the basis for automated information exchange between machines, is foundational for IoT with uses across industry verticals like smart city, smart grid, smart water, smart transportation, smart health etc. Government of India has recognised the potential of M2M and emphasised the same in the NTP, 2012.

TRAI received a reference from the DoT on 5th January, 2016 seeking recommendations on the following aspects related to M2M communications:

a) M2M spectrum requirements
b) M2M roaming requirements
c) QoS in M2M services

Apart from the specific issues referred by DoT through the reference, the Authority realised that certain other regulatory aspects including the policy and licensing framework for M2M service providers, various technical challenges in implementation, allocation and utilisation of various network codes, data protection, and privacy issues also required deliberation. TRAI had, on 18th October, 2016, released a consultation paper in this regard and sought comments from stakeholders. After due consultation and internal examination, TRAI will provide its recommendations to the Government.

Healthcare

There still remains a great disparity in the distribution of healthcare resources in the country, particularly on account of socio-economic status and geographical location. The patient to bed ratio in the country is very high and healthcare providers often do not have the means to treat, monitor and diagnose preliminary healthcare needs in rural locations. World Bank data reveals that the number of hospital beds per thousand people in India is much lower than the world average.[46]

Use of online healthcare tools can help address this situation. Online healthcare refers to several distinct practices such as collaboration by doctors on online networks to discuss healthcare related issues; mobile apps that connect patients to doctors without necessitating patient visits and several IoT devices that monitor vital health-related parameters and can lead to patient empowerment.

According to a report by the research analyst firm Gartner, healthcare providers in India were expected to spend $120 crore on IT products and services in 2016, an increase of 3.4 percent over 2015. This in turn means that healthcare services, hospitals and emergency response services will deploy more IT, data centres, devices and telecom services to upgrade their existing services.

The Ministry of Health & Family Welfare has been taking several impactful initiatives in the field of digital health. The Government has envisioned use of electronic health platforms to meet the key challenges posed to the health sector, such as shortage of health human resources, accessibility of healthcare infrastructure, affordability of healthcare services, etc. Electronic health records of citizens are envisaged to be created for ensuring continuity of care and other associated benefits. Delivery of services to citizens through the "online mode" is at the core of the overall electronic health ecosystem discussed above.

A number of online health initiatives have also been taken up by the Government under the Digital India Programme. The National Health Portal (NHP) was setup to provide healthcare information to every citizen of the country by acting as a single point of access for all health related information. E-blood banking is an initiative from the National AIDS Control Organisation and NHP. It is an online system designed to provide information related to updated stock of blood available, list of blood banks, building donor network and other informational resources.

BOX 3.4: MOBILE APPLICATIONS IN HEALTH

The availability of a number of health-related applications has revolutionalised the manner in which citizens access, understand and engage with the health system. Some mobile applications setup in the health space include:

- The Vaccine Tracker mobile application, which supports parents in tracking the immunisation status of their children and helps them in ensuring complete and timely vaccination.
- The India Fights Dengue mobile application provides interactive information on identification of symptoms of dengue and links users to nearest hospitals and blood banks.
- The Swasth Bharat (Health India) mobile application provides detailed information on healthy lifestyle, disease conditions and their symptoms, treatment options, first aid and public health alerts.
- The Kilkari mobile app initiative allows audio messages about pregnancy, childbirth and childcare to be sent directly to families and parents. A mobile based audio training course has also been developed for expanding the knowledge of the village based voluntary health workforce.

There have also been significant initiatives in the public health space such as Online Registration System (ORS) for public hospitals, which was launched in July 2015. This has been able to bring about a significant change in the patient registration and appointment system and as a result patients now do not need to queue up at hospitals to take appointments. Today, all AIIMS, most central government hospitals and many state government hospitals are linked through ORS.

Education

Telecom services have encouraged various new ways of fostering education in our country. From AIR broadcasts to blogs as a means of education, there seems to be no limit to the powers of telecommunication as a vehicle to accelerate educational initiatives and democratise the use of learning resources.

While farmers have benefitted through radio, today students are able to enrol themselves into long distance study programmes and Massive Open Online Courses (MOOCs) because of the availability of the Internet.

As per a 2016 IBEF report, the e-learning market in India was estimated at close to $3 billion during the middle of 2016.[47] Accordingly, India has become the second largest market for e-learning after the US. The sector is currently pegged at US$ 2-3 billion, and is expected to touch US$ 40 billion by 2017. Further, the report finds that the distance education market in India is expected to grow at a CAGR of around 34 per cent during 2013-14 to 2017-18. Moreover, the aim of the government to raise its current gross enrolment ratio to 30 per cent by 2020 will also boost the growth of distance education in India.

Online education helps people gain access to a world-class learning experience when traditional higher education is simply not possible due to financial or personal constraints. Some

46) World Bank Data, Hospital beds per thousand people, 1970-2005.
47) IBEF, Education sector in India, last updated March 2017.

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may also suffer from physical or mental disabilities that could pose challenges to learning in a traditional classroom setting. For these students, online courses, specialisations and degree programs can offer an incredible opportunity to continue their education. Increasing connectivity, particularly in rural areas, therefore offers significant educational benefits by breaking the numerous barriers that prevent people from receiving quality education in the physically bound classrooms.

With the Digital India programme's vision to transform India into a digitally empowered society and knowledge economy, the education sector in India is poised to witness major growth in the years to come.

e-Governance

The government usually provides services that are typically non-tradable and are not subject to market competition. As a result, raising efficiency in the public sector is challenging. It

has been recognised that telecommunications and especially the Internet can play an important role in this regard. The Internet provides the government with better tools for communicating with citizens, providing information as well as better participation by the citizen in government assisted programs. The Internet also helps citizens to connect online and organise themselves for collective action to ensure that government performance meets people's expectations.

In India, both the Centre and State Governments have taken a large number of initiatives towards ushering in an era of e-governance. The growth of the telecom sector has helped in this process from computerisation of government departments to initiatives that encapsulate the finer points of governance, such as citizen centricity, service orientation and transparency. Lessons from previous e-governance initiatives have also played an important role in shaping the progressive e-governance strategy of the country.

BOX 3.5: NATIONAL E-GOVERNANCE PLAN [48]

The National e-Governance Plan (NeGP), takes a holistic view of e-Governance initiatives across the country, integrating them into a collective vision, a shared cause. Around this idea, a massive countrywide infrastructure reaching down to the remotest of villages is evolving, and large-scale digitisation of records is taking place to enable easy, reliable access over the Internet. The ultimate objective is to bring public services closer home to citizens, as articulated in the Vision Statement of NeGP:

"Make all Government services accessible to the common man in his locality, through common service delivery outlets, and ensure efficiency, transparency, and reliability of such services at affordable costs to realise the basic needs of the common man"

The Government approved the NeGP, comprising of 27 Mission Mode Projects and 8 components, on May 18, 2006. In the year 2011, 4 projects - Health, Education, PDS and Posts were introduced to make the list of 27 Mission Mode Projects to 31.

In order to promote e-Governance in a holistic manner, various policy initiatives and projects have been undertaken to develop core and support infrastructure. The major core infrastructure components are State Data Centres, State Wide Area Networks, Common Services Centres and middleware gateways i.e. National e-Governance Service Delivery Gateway, State e-Governance Service Delivery Gateway, and Mobile e-Governance Service Delivery Gateway. The important support components include core policies and guidelines on security, HR, citizen engagement, social media as well as standards related to metadata, interoperability, enterprise architecture, information security etc.

New initiatives include a framework for authentication through e-Pramaan and G-I cloud, an initiative which will ensure benefits of cloud computing for e-Governance projects.

Chapter 4 - Evolution of the policy and regulatory framework

Telecom services

National telecom policies

The successive national telecom policies have laid down the Government's high-level vision on liberalisation, competition and growth in this sector. Prior to the opening up of the sector, the Government was performing multiple roles of being the sole telecom operator, licensor and policy maker in this field. This was changed by the NTP, 1994 which called for bringing in private investment into the telecom sector and bridging the resource gap with the goal of making telecommunication services accessible to all. In line with these goals, the Government began issuing licenses to private operators for providing basic telecom services. This was in addition to the opening up of VAS like radio paging, and cellular mobile services, which had already been announced in 1992.

The pace of privatisation and its outcomes in the initial years, however, did not fully meet the expectations of the NTP, 1994. This led to a review by the Government of its policy priorities and targets through the NTP, 1999. Often pegged as a seminal moment in the Indian telecom history, the NTP, 1999 proposed several tangible targets towards securing affordable access for all citizens. It highlighted the need for striking a healthy balance between the provision of universal service to all uncovered areas and the availability of high-level services to meet the needs of a growing economy. In addition, the policy document also acknowledged the increasing convergence of the telecommunication, information technology and broadcasting sectors and the need for the policy framework to keep pace with these developments.

Thirteen years later, the Government once again reviewed its policies and goals for the telecom sector through the NTP, 2012. This policy document contained the idea of *one nation - one license*, reflecting the move towards a unified licence regime to exploit the attendant benefits of convergence, spectrum liberalisation and to facilitate delinking of the licensing of networks from the delivery of services. Another key feature of the NTP, 2012 was to increase the availability of adequate spectrum and ensure its allocation in a transparent manner through market-related processes. The policy also spoke about provisioning on-demand broadband services; developing an ecosystem for design, research and development of telecom equipment; using renewable sources of energy for powering telecom networks; and strengthening the framework for protection of consumer interests. Each of these policies has served as the backbone for a series of Government and regulatory initiatives, which are discussed in the subsequent sections of this chapter.

BOX 4.1: A TIMELINE OF LIBERALISATION

Cellular mobile services: First phase of liberalisation in mobile services took place in November 1994. 8 private licenses issued for Delhi, Mumbai, Kolkata and Chennai.

Fixed services licences were first awarded to the private service providers In the year 1997-98.

Internet services: VSNL launched Internet services in 1995. The Government permitted private operators to enter the sector in November 1998.

National Long Distance (NLD): Opened to the private sector from 13th August, 2000, allowing them to carry inter-circle traffic within the country.

International Long Distance (ILD): Network carriage service providing international connectivity to foreign carrier networks, opened up from 1st April, 2002.

Guidelines for Unified Access (Basic & Cellular) Services (UAS) licenses were issued on 11th November, 2003.

Guidelines on Unified License were issued in 2013

Spectrum sharing guidelines were issued in September 2015 and spectrum trading guidelines were issued in October 2015.

Virtual Network Operators (VNOs): Guidelines for Unified License for virtual network operator were issued in May 2016.

Licensing framework

As noted earlier, different telecom services were opened up for private participation at different points of time. As a result, the initial years of the sector saw a fragmented licensing system, with operators being required to obtain separate licenses for different categories of services, including basic (fixed) services and Cellular Mobile Telephone Services (CMTS). All licenses are issued by the DoT, in exercise of the powers conferred upon the Government under Section 4 of the Indian Telegraph Act.

The first phase of liberalisation in mobile telephone services started with the issue of licenses for CMTS in the four metro cities of Delhi, Mumbai, Kolkata and Chennai to 8 private companies in November 1994. Subsequently, 34 licenses for 18 territorial telecom circles were issued to 14 private companies during 1995 to 1998.

MTNL and BSNL were issued licenses for provision of CMTS. Further, 17 fresh licenses were issued to private companies in 2001, one each in four metro cities, and 13 telecom circles.

On 27th October 2003, TRAI sent its recommendations on a Unified Licensing Regime to DoT. On 11th November, 2003, the Guidelines for Unified Access (Basic & Cellular) Services licenses (UASL) were issued. A UASL licensee was permitted to provide wireline as well as wireless services in a service area. Pursuant to this decision, basic and cellular services licensees were permitted to migrate to the UASL regime. Till 2008 UASL were issued administratively on a first-come first-served basis. With a view to achieve the objective of NTP, 2012 to create one nation – one licence across services and service areas, the DoT issued guidelines on Unified License in 2013 based on TRAI's recommendations dated 16th April 2012. As per these guidelines, the allocation of spectrum has been delinked from the licence and has to be obtained separately as per the prescribed procedure, i.e., bidding process. Only one UASL is required for all telecom services in the entire country. In addition, authorisation for various services, like access services, NLD services, ILD services, ISP services, is required separately. Single authorisation for UASL (All services) category would cover all telecom services except ISP (B) and ISP (C) services.

BOX 4.2: VIRTUAL NETWORK OPERATORS

One of the strategies envisaged in the NTP, 2012 has been to facilitate delinking of the licensing of networks from the delivery of services so as to enable TSPs to optimally and efficiently utilise their networks and spectrum by sharing active and passive infrastructure. After considering TRAI's recommendations dated 1st May 2015, guidelines for Unified License for virtual network operator have been issued by DoT on 31st May 2016. VNOs are service delivery operators, who do not own the underlying core network(s) but rely on the network and support of the infrastructure providers for providing telecom services to end users/customers. VNOs can offer any or all telecom services that are being provided by the existing telecom service providers.

The license fee framework has also undergone many changes over the years. Cellular service licensees were initially required to pay a fixed annual license fee, based on the amount agreed during the bidding process. Over time, it was recognised that the fixed license fee regime was proving to be an unsustainable model due to the significant losses that were being incurred by the service providers. Subsequently, they were permitted to migrate to NTP, 1999 regime wherein they were required to pay license fee based on revenue share, effective from 1st August, 1999.

Three levies are charged from operators for carrying out licensed telecom services: entry fee, annual license fee and annual spectrum usage charges for cellular services. Initially, the license fee component differed across various service areas, till the Government decided to progressively move towards a uniform licensee fee model (equal to 8 percent of Adjusted Gross Revenue (AGR) starting from the year 2012-13).

Spectrum allotment and management

For the purpose of award of spectrum rights, the country is divided into 22 geographical units, referred to as service areas.

Spectrum allocation for 2G services in India was initially done by bundling start-up spectrum with the license. The initial allotment of spectrum along with the licence was 2 x 4.4 MHz for GSM and 2 x 2.5 MHz for CDMA. For additional spectrum, licensees were required to meet the subscriberlinked criterion laid down by DoT.

Assignment of 3G and BWA spectrum was done through auctions held in 2010. However, administrative assignment of 2G spectrum continued till 2012 until, the Hon'ble Supreme Court of India, through its order dated 2nd February 2012, ordered that spectrum, being a scarce natural resource, must be assigned through market-based mechanisms.

Mobile broadband is likely to play a pivotal role in achieving the NTP, 2012 objectives of boosting broadband subscriber numbers to 175 million by 2017 and to 600 million by 2020. Spectrum is the most crucial input for mobile communications. Major policy initiatives taken in the recent past are discussed below.

1. Spectrum delinked from licence: In February, 2012, a policy decision was taken that in future, the spectrum will

not be bundled with the licence. The licence to be issued to telecom service providers will be in the nature of a 'Unified Licence' and the licence holder will be free to offer any of the multifarious telecom services. In the event the licence holder would like to offer wireless services, it will have to obtain spectrum through a market-driven process.

2. Significant amount of spectrum has been made available for commercial purpose: A number of spectrum auctions have been held since 2012. Through this process, significant amount of additional spectrum has been made available for commercial services. Presently, per operator holding of spectrum has become around 28 MHz to 45 MHz in each service area.

3. Spectrum trading: After considering TRAI's recommendations dated 28th January 2014, DoT issued spectrum trading guidelines in October 2015. Spectrum trading refers to the transfer of rights to use the liberalised spectrum. When a block of spectrum is traded, the associated rights and obligations of the spectrum block stands transferred from the seller to the buyer.

4. Spectrum sharing: After considering TRAI's recommendations dated 21st July 2014, DoT issued spectrum

sharing guidelines in September 2015. The basic objective of spectrum sharing is to provide an opportunity to the TSPs to pool their spectrum holdings and thereby improve spectral efficiency. Sharing can also provide additional network capacities in places where there is network congestion due to a spectrum crunch. Both licensees use the shared spectrum resources. All access spectrum i.e. spectrum in the bands of 800/900/1800/2100/2300/2500 MHz is sharable provided that both the licensees are having spectrum in the same band. The inception of 'spectrum trading' and 'spectrum sharing' amongst the TSPs in the country has paved the way for better utilisation of the spectrum which is a scarce natural resource.

5. Liberalisation of administratively allotted spectrum: The use of administratively assigned spectrum in 800, 900 and 1800 MHz bands was restricted for GSM and CDMA technology only. In November 2015, TSPs were permitted to convert their existing spectrum holding into liberalised spectrum for the balance validity period of the spectrum assignment. This was done on payment of the auction determined amount after adjusting entry fee paid pro-rated for the balance validity period. The auction determined amount will be prorated for the balance validity period of spectrum assignment.

TABLE 4.1: - RADIO FREQUENCY BANDS IN INDIA

Frequency	Range of frequency (MHz)	Paired / Unpaired	Primary usage in India
800 MHz	Uplink: 824-844 Downlink: 869-889	Paired	CDMA and EVDO services FD-LTE
900 MHz	Uplink: 890-915 Downlink: 935-960	Paired	2G 3G (HSPA+)
1800 MHz	Uplink: 1710-1785 Downlink: 1805-1880	Paired	2G 4G FD-LTE
2100 MHz	Uplink: 1920-1980 Downlink: 2110-2170	Paired	3G services(HSPA+)
2300 MHz	2200-2300	Unpaired	TD-LTE
2500 MHz	2500-2690	Unpaired	TD-LTE

Universal Service Obligation

ITU defines universal access as the situation where "*everyone can access the service somewhere at a public place, also called public, community or shared access*". In India, the concept of providing universal access was modified to democratise information and make it freely and easily available to the people at large, in order to improve transparency, accountability, collaboration, cooperation, productivity and efficiency.

The NTP, 1999 had universal service as one of its main objectives, as reproduced below -

"Strive to provide a balance between the provision of Universal Service to all uncovered areas, including the rural areas, and the provision of high-level services capable of meeting the needs of the country's economy and encourage development of telecommunication facilities in remote, hilly and tribal areas of the country".

The journey to realising universal access is far from over, although the establishment of the Universal Service Obligation Fund (USOF) has been a key development. The following table tracks the context around its establishment, and subsequent institutional developments.

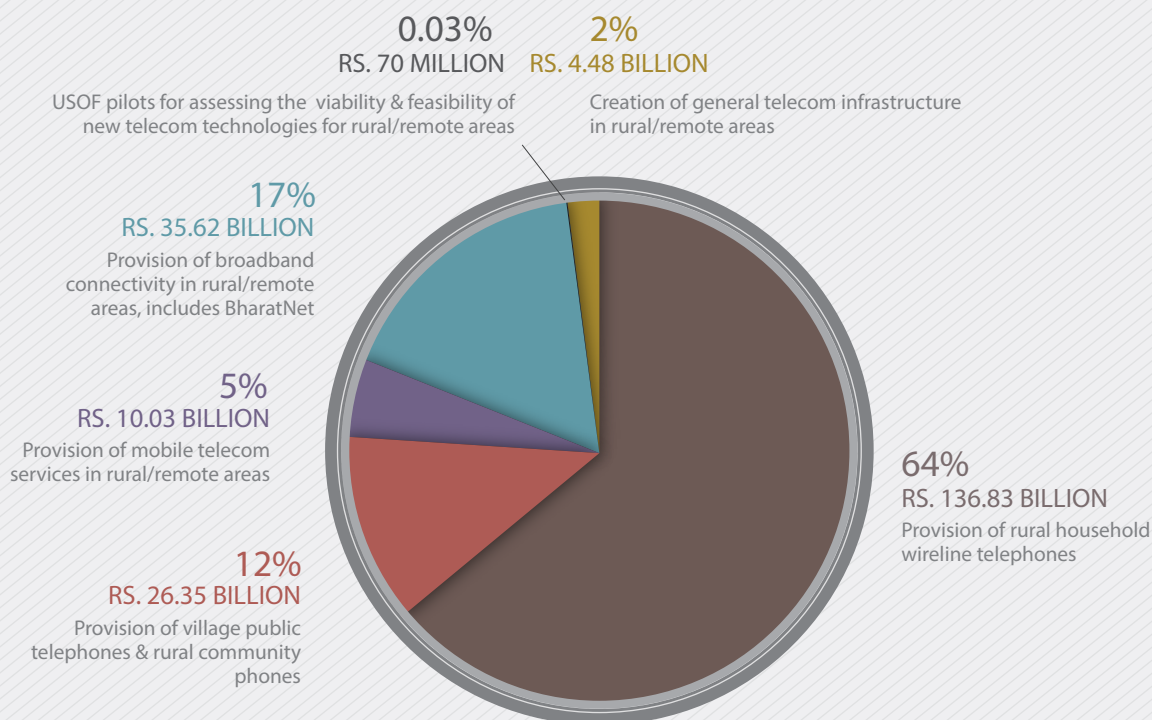| BOX 4.3: USOF: HISTORY AND ADMINISTRATIVE DEVELOPMENTS[49]	
Year	**Development**
1994	One of the objectives of the NTP, 1994 was Universal Service.
1999	NTP, 1999 envisaged universal access in terms of providing "a balance between the provision of universal service and the provision of high-level services capable of meeting the country's economic needs".
	NTP, 1999 provided that the resources for meeting the USO were to be generated through a Universal Access Levy (UAL), at a prescribed percentage of the revenue earned by the telecom licensees.
	Implementation of USO for rural and remote areas would be undertaken by all fixed service providers who would be reimbursed from the USOF.
2002	TRAI recommendations for establishment of USOF and UAL @ 5% of AGR of TSPs, excluding pure VAS providers.
	The Universal Service Support Policy came into effect from April, 2002. The guidelines for universal service support policy were issued by DoT on 27th March 2002. The Administrator, USOF was appointed on 1st June, 2002.
2003	The Indian Telegraph (Amendment) Act gave USOF a statutory status. The Act defines USO as the obligation to provide access to telegraph services to people in rural and remote areas at affordable and reasonable prices. As per the Indian Telegraph Act 1885 (as amended in 2003, 2006), the Fund is to be utilised exclusively for meeting the USO.
2004	The rules for the administration of the USOF were notified. Two streams of the USOF obligation were established.
2006	Four more streams added to USOF.
2011	USOF activities came under the Budget Plan from 2011-12.
2012	Definition of eligible operators in the USOF rules modified to mean "entities having valid license or registration or authorisation from Central Government for providing telecom services".
	NTP, 2012 Right to broadband enshrined and envisaged provisioning of converged communication services in commercially unviable rural and remote areas using the USOF.

Initially, USOF was designed to be implemented as two streams, Stream I and II focussed on fixed and fixed wireless covering both public and private services. Amendments were made to the Indian Telegraph (Amendment) Act in 2006 and the USOF rules that paved the way for inclusion of provision of mobile services (Stream III). Later, Streams IV, V and VI were added to cover provision of broadband connectivity to villages in a phased manner, creation of general infrastructure in rural and remote areas for development of telecommunication facilities and induction of new technological developments in the telecom sector in rural and remote areas respectively.

Projects undertaken under the USO include Shared Mobile Infrastructure Scheme, provision of rural community phones,

provision of individual rural direct exchange lines, rural wireline broadband scheme, village public telephones, the NOFN, the scheme for mobile communication services in left wing extremism affected areas, and comprehensive telecom development plan for the North Eastern region. Most recently, in 2016, the Union Cabinet approved the proposal to extend subsidy support of Rs.1250 crore to BSNL from the USOF as compensation for the deficit incurred by BSNL in operating rural wireline connections installed prior to 1st April 2002. The Cabinet clarified that no further request from BSNL for financial/subsidy support from USOF on this count shall be considered. The NOFN project (later renamed BharatNet) was provided funds under Stream V of the USOF, and is detailed in the subsequent section.

FIGURE 4.1: STREAM WISE SHARE IN TOTAL SUBSIDY DISBURSED BY USOF

0.03%
RS. 70 MILLION
USOF pilots for assessing the viability & feasibility of new telecom technologies for rural/remote areas

2%
RS. 4.48 BILLION
Creation of general telecom infrastructure in rural/remote areas

17%
RS. 35.62 BILLION
Provision of broadband connectivity in rural/remote areas, includes BharatNet

5%
RS. 10.03 BILLION
Provision of mobile telecom services in rural/remote areas

12%
RS. 26.35 BILLION
Provision of village public telephones & rural community phones

64%
RS. 136.83 BILLION
Provision of rural household wireline telephones

Source - DoT presentation 2016, USOF

Value Added Services

The definition of VAS and the licensing regime governing them has gone through several changes over the years. In this process telecommunication services have moved beyond their fundamental role of voice communications to a range of "non-core services", which are described as VAS.

Broadly speaking, there are two categories of VAS - services like SMS that stand alone from an operational perspective; and those that are provided as an optional service along with the voice service. VAS can be provided either directly by the telecom operators themselves or by a third party VAS provider that connects to the core equipment of telecom operators through various protocols.

In 2008-09, the Authority forwarded its suo moto recommendations to the Government on the growth of VAS and related regulatory issues. These recommendations were designed to pave the way for orderly growth of VAS and benefit consumers from new and enhanced services at competitive rates. Subsequent to this, TRAI issued a direction to all service providers on 27th April 2009 and further an amendment direction dated 4th September 2009 regarding alternative procedure for providing VAS through

pressing of key(s) in the mobile handset/telephone instrument and obtaining explicit consent of the consumers, before provisioning of VAS.

The issue of the procedure for activating VAS has also received the attention of TRAI from time to time. Many consumers underlined the need for further strengthening of the provision to seek their explicit consent for activation or renewal of VAS. Therefore, the Authority issued a direction in 2011 mandating the service providers to take confirmation from consumers within 24 hours of activation of service, failing which the service would be discontinued without any cost to the consumers.

The licensing framework for certain VAS - audio conferencing/ audiotex/voice mail services has been dealt with separately. In 2016, the Authority felt the need to review the technical specifications, financial terms and conditions, scope and guidelines for the existing voice mail/audiotex/unified messaging services licence. TRAI recommended the licensing framework for such services should be under the unified licence. TRAI further recommended that the annual licence fee for the authorisation for these services under the Unified License should be made same as that in other licence authorisations.

Internet access services

Development of the policy framework

Both the Government and TRAI have taken a number of proactive measures over the years in order to proliferate Internet access in India with the recent years seeing a particular focus on high-speed Internet, i.e. broadband services.

In 1998, the DoT permitted private operators to provide Internet services, subject to satisfaction of the specified eligibility criteria laid out in the standard application form and licence agreement for ISPs. This followed from the announcement of the New Internet Policy Guidelines framework that was designed to ensure maximum participation in the provision of Internet services. In line with this goal, there was no requirement for the applicant to have any prior experience in information technology or telecommunication services. The cost of application and processing was also kept at a minimum and the licence fee was waived for a period of five years.

The Government also decided to permit ISPs to process and carry voice signals (Restricted Internet Telephony Service) with effect from 1st April, 2002, based on TRAI's recommendations on "Introduction of Internet Telephony" dated 20th February 2002. Only existing ISPs were permitted to offer Internet Telephony service by migrating to this license within their service area. The Government took TRAI's recommendations into account and issued guidelines in 2007 to permit all ISPs signing a new license to provide Internet Telephony services and removed the restrictions on devices being used for Internet Telephony.

In order to provide an impetus to the growth of high-speed Internet access and make ISP licenses technology-neutral in the last-mile, TRAI issued a recommendation to the Government in the year 2003 that ISPs should be allowed to use any media (including fiber, radio and copper cable) for establishing their own last mile to customers. This was accepted by the Government and appropriate amendments were made to the ISP license.

After a consultation process and detailed study of the experience of other countries, in 2004 the Authority identified major hurdles in the growth of Internet and broadband services in India. TRAI submitted its recommendations on "Accelerating growth of Internet and broadband" to the Government in April, 2004. Based on these recommendations, the Government announced the Broadband Policy 2004. Broadband was defined at that point to mean an "always-on" data connection that is able to support interactive services, including Internet access, and has the capability of minimum download speed of 256 Kbps. The term "interactive services" excluded any services for which a separate license would specifically require. For instance, real-time voice transmission was excluded except to the extent that it was permitted under the ISP license with Internet telephony.

BOX 4.4: KEY FEATURES OF THE NATIONAL BROADBAND POLICY

THE MAIN RECOMMENDATIONS INCLUDED

Improving last-mile access to consumers - Enabling the use of infrastructure on the incumbent's copper cables to reach customers via DSL; decreasing artificial costs in the operation of DTH and Very Small Aperture Terminal (VSAT) platforms while allowing broadband services to be offered through them; allowing terrestrial wireless solutions; and enabling a RoW clearance system.

Identifying steps to make National Internet Exchange of India (NIXI) more effective and attractive for ISPs of all sizes.

Encouraging the availability of low cost access devices through depreciation, donation and recycling of used PCs.

Decreasing duties on mobile phones, imported items used in broadband networks.

Even after the adoption of this policy, it was noticed that broadband penetration continued to progress at a very slow pace. Concerned, TRAI submitted a recommendation to the Government on 3rd November, 2005, suggesting a review of some of the provisions of the Broadband Policy, 2004 and requesting them to reconsider the earlier recommendations pertaining to local loop unbundling and fiscal incentives for broadband.

TRAI noted in its annual report for the year 2006-07 that even though a large number of ISPs had been licensed to provide Internet services, only the top 20 ISPs were providing Internet services to 98 per cent of the subscribers. Further, while Internet Telephony has been permitted to 125 ISPs, only 25 of them were in fact providing the service. The growth of Internet and broadband services was, therefore, slow and still far from the target of 18 million Internet subscribers and 9 million Broadband connections by 2007. In order to address these issues, TRAI initiated another consultation process on 'Review of Internet Services' and gave its recommendations to the Government on 10th May 2007. These recommendations were designed to enable the Government to finalise the position on revisions to the ISP licensing regime, which had been under review for some time. TRAI considered key issues like licensing provisions for various services under ISP licence, recent technological developments, enabling Internet

services in India to scale to global standards, financial viability, issues of grey market and competition including level playing field vis-à-vis other telecom service providers. The Authority encouraged a liberal licensing framework for ISPs to boost Internet penetration (particularly in rural areas) as well as one that would not stifle the trend towards converged services. The major recommendations made by the Authority were that there should be no cap on the number of access service providers in any service area; and all spectrum excluding the spectrum in 800 MHz, 900 MHz and 1800 MHz bands should be auctioned in future so as to ensure efficient utilisation of this scarce resource.

Addressing impediments to growth of broadband

TRAI continues to initiate consultation processes and issue recommendations to promote better proliferation of broadband. For instance, its recommendations on 'Growth of Broadband' released in 2008, and subsequently, 'Delivering Broadband quickly: What do we need to do?' in 2015 were aimed at identifying the various impediments affecting the growth of broadband and adopting a forward looking approach to address these. The recommendations highlighted issues like availability of spectrum, institutional revamping of the Wireless Planning & Co-ordination Commission (WPC), streamlining the Right of Way (RoW) procedure, tower allocation, subsidy from USOF, etc. Some, like RoW barriers to the laying of access technologies like fibre, require coordination not just with Central Government but also with various nodal state agencies and municipal bodies. Tedious application processes, excessively high administrative charges and often hostile environments for gaining permissions, were identified by the Authority to be a significant hurdle to roll outs, both in urban and rural contexts.

In a welcome move, in 2016, the DoT notified rules to simplify and coordinate the RoW regime across the country. The rules stipulate that local and state authorities must now appoint nodal officers for implementing the rules, in order to improve coordination between companies and authorities; establish a single electronic application process and pay a one-time capped fee for administrative expenses, among other changes.

Further, in order to improve in-building coverage, installation of in-building solutions (IBS) for wireless services and laying of cables such as copper cables, optical fibre cables (OFC), LAN cables etc. is required, the execution of which requires permission of the owner of the building. The Authority took note that building owners were adopting generally restrictive practices and only selective TSPs were being given access. Such practices not only limit competition, it also leaves no choice to consumers except to avail services from the TSP with whom the building owner has contracted. In order to address this issue, the Authority, suo-motu, brought out its recommendations on "In-Building Access by Telecom Service Providers" on 20th January 2017. In these recommendations, the Authority, *inter-alia,* recommended that TSPs/Infrastructure Providers -I (IP-Is) should be mandated to share the in-building infrastructure with other TSPs, in large public places, commercial complexes and residential complexes in transparent, fair and non-

discriminatory manner. Indulgence into exclusive contract with building owners prohibiting access to other TSPs may be treated as violation of the license agreement/registration. The Authority also recommended that suitable provisions for the creation of a Common Telecom Infrastructure (CTI) inside the building should form part of the model building bye-laws and that the access to building including CTI facilities be available to the TSPs on a fair, transparent and non-discriminatory manner and minimum three TSPs/IP-Is should have presence in the building.

Identifying new backhaul spectrum bands

TRAI has also been pro-active in identifying new bands with potential to proliferate broadband access. On a specific reference from DoT, TRAI issued its recommendations on "Allocation and pricing of Microwave Access (MWA) and Microwave Backbone (MWB) RF carriers" on 29th August, 2014. The Authority, inter-alia, recommended that the assignment of MWA and MWB carriers should continue to be done on administrative basis and assignment of both types of carriers should be done simultaneously, within a period of one month from the date a TSP makes the payment for access spectrum. The Authority also recommended that the higher frequency bands viz. 26 GHz, 28 GHz, 32 GHz, 38 GHz and 42 GHz should also be earmarked for fixed point-to-point MW carriers. The Authority recommended that in order to increase broadband penetration in India, the usage of high capacity backhaul E-band (71-76 / 81-86 GHz) and V-band (57-64MHz) may be explored for allocation to the telecom service providers. E-band and V-band should be opened with 'light touch regulation'. Further, for access applications like wi-fi hotspots etc., V band should be delicensed for indoor use. V-band in particular was seen to hold great promise for the proliferation of Wi-Fi hotspots in the country.

In addition to the initiatives discussed above, there has also been a focus on creating a positive policy environment for the adoption of modern technology and protocols that can boost the growth of Internet services in the country. Facilitating the migration towards IPv6, which was the next generation version of the Internet Protocol (IP), was one such initiative. IPv6 improves on the addressing capacities of IPv4 by allocating 128 bits to IP addresses instead of 32, thereby opening up an almost infinite pool of IP addresses. IPv6 also provides various enhancements with respect to security, routing, mobility and QoS. In 2005-06, TRAI gave its recommendations on the issues relating to transition from IPv4 to IPv6, following which a Task Force was formed by the Department of Information Technology to facilitate the migration to IPv6 in the country.

In the Authority's exercise on fostering growth of Internet services in the country which was completed in August 2002, a domestic Internet exchange was proposed as being one of the key factors to reduce cost and improving QoS of Internet.The purpose of this exchange was that Internet traffic that originates in India and has a destination in India should stay within India throughout its route.

On the recommendation of the Authority, the Government funded the setting up of NIXI for the purpose of containing the domestic Internet traffic within the country. The four nodes of NIXI became operational each at Delhi (NOIDA), Mumbai, Chennai & Kolkata, respectively.

Over the years it was observed that only a limited number of ISPs joined NIXI resulting in sub-optimal utilisation of its infrastructure. Hence, to make NIXI more efficient and effective, TRAI initiated a consultation with stakeholders. On 20th April, 2007, TRAI submitted its recommendations on "Improvement in the effectiveness of National Internet Exchange of India" to the DoT. Its major recommendations included the following:

- All ISPs or their upstream providers (ISP who is carrying the traffic to International Internet Bandwidth providers or NIXI) shall either connect to NIXI or with International Internet bandwidth providers through direct peering link.

- Compulsory announcement and acceptance of all the routes at NIXI nodes to facilitate effective exchange of domestic Internet traffic without requiring direct connectivity of ISPs at NIXI.

- QoS parameters of NIXI nodes to ensure effective functioning of the NIXI.

International Private Leased Circuits (IPLCs) are one of the most significant elements of international connectivity for Internet, Broadband and IP enabled services. At the time when International Long Distance (ILD) services were liberalised in 2002, the Government recognised that submarine Cable Landing Stations (CLS) were essentially a bottleneck facility and access to international connectivity would be severely influenced by the monopolistic position of the incumbent International Long Distance (ILD) operators. In order to enhance competition in the international connectivity segment, TRAI made recommendations to DoT on measures to promote competition in International Private Leased Circuits in India on December 16, 2005. DoT, in 2007 subsequently amended relevant clauses in the ILD licence to enable TRAI to bring out regulations to ensure efficient, transparent and non-discriminatory Access to Essential Facilities (including landing facilities) for submarine cables at CLSs.

In 2007, TRAI issued the International Telecommunication Access to Essential Facilities at Cable Landing Stations Regulations. The most significant provisions of this landmark Regulations were mandatory fair and non-discriminatory access at the CLS; provisioning of bandwidth to end consumers at competitive rates; boosting of competition and therefore reduction in the price of IPLCs and options to ILD operators to purchase international bandwidth at competitive prices on a range of diversified submarine cables.

In 2010, many service providers submitted to the Authority that increased capacity utilization in the international bandwidth market should have translated in proportional reduction in Access Facilitation charges and Operation and Maintenance (O&M) charges but that they remained unchanged. TRAI looked into this issue and in 2012, the International Telecommunication Access to Essential Facilities at Cable Landing Stations (Amendment) Regulations, 2012 were issued wherein, suitable provisions were added so that access facilitation charges, co-location charges and other related charges like cancellation charges and restoration charges could be specified by TRAI.

On the basis of cost data and comments received from stakeholders, TRAI estimated access facilitation charges and co-location charges at CLSs. TRAI, then, issued The International Telecommunication Cable Landing Stations Access Facilitation Charges and Co location Charges Regulations, 2012. The charges thus stipulated provided for a significant reduction in the prevailing charges levied by owners of the CLSs, thus paving for significant reduction in access facilitation charges in line with the reduction of bandwidth charges over the last decade.

National broadband plan: NOFN, Bharatnet and beyond

At the core of governance structure in rural India are the 250,000 Gram Panchayats (GPs) - the foundational nodes of information collection and dissemination and the service delivery points for Government administration. With this in mind, the NOFN project was approved on October 25, 2011 with the main objective of extending the existing optical fibre network to panchayats by utilising USOF and creating an institutional mechanism for management and operation of NOFN. Bharat Broadband Network Limited (BBNL), a Special Purpose Vehicle (SPV), was set up by the Government of India in 2011, for the establishment, management and operation of NOFN. The NOFN and its reviewed implementation, in terms of the subsequent changes with BharatNet can be collectively termed as the National Broadband Plan (NBP) to expand the footprint of broadband networks nationally.

The NOFN project was supposed to be commissioned in 2 years at a cost tentatively estimated at Rs. 20,000 crores. The project has met with significant delays, with RoW hurdles posing a significant hurdle. Phase I aimed to cover 1 lakh GPs by 2017 but as of March 2017, 16429 GP's are active, 78,220 are connected through optical fibre connectivity and trenching and ducting have been completed for 96,080 GPs.

In the meanwhile, the Government of India has launched the Digital India programme with the vision of transforming India into a digitally empowered society and knowledge economy. Establishment of broadband highways forms the first pillar of Digital India which will depend on timely commissioning of NOFN. In this backdrop, the TRAI came out with a Consultation Paper on 24th September 2014 on 'Delivering Broadband Quickly: What do we need to do?' The Consultation Paper raised the question of whether PSUs were the ideal choice for implementing NOFN, ways in which to reduce infrastructure development costs and delivery costs, and the potential to piggyback on the existing private sector access networks so as to minimise costs in reaching remote rural locations. After a consultative process, recommendations were issued on 17th April 2015.

A subsequent consultation paper issued in 2015 was focussed on strategies to find the best model for implementation of BharatNet. On 1st February 2016, the Authority released recommendations on the implementation of BharatNet. Significantly, it recommended Public-Private Partnership (PPP) model that aligns private incentives with long-term service delivery in the vein of the Build-Own-Operate-Transfer (BOOT)/Build-Operate-Transfer models of implementation, to be preferred for the roll out of the BharatNet project. It found that since the provision of rural broadband is evidently subject to both government and market failures, a PPP-based model was the most viable model to address both.

Broadcasting and cable services

The Indian Telegraph Act, 1885 provides the Central Government with the exclusive privilege of establishing and maintaining broadcasting services, which are covered within the meaning of "telegraphs" under that Act. Accordingly, much like telecom services, which were being provided by the DoT, broadcasting services in India were also being provided by Government entities. The subsequent opening up of the television and radio broadcasting sectors led to a need to create a sound legal framework to govern them, ultimately leading up to the inclusion of broadcasting and cable services as "telecommunication services" under the TRAI Act. This was followed by a number of policy and regulatory developments, which are discussed further in this section.

Television broadcasting

The cable television market in India emerged in the early 1990s. In order to regulate operations of cable television network in the country, Government promulgated the Cable Television Networks (Regulation) Ordinance 1994, on 29th September 1994. The Cable Television Networks (Regulation) Act, 1995 (Cable Act) was brought into force with effect from 25th March, 1995 by replacing the Ordinance. The Cable Act was enacted with a view to regulate the operation of cable television networks in the country so as to bring uniformity in their operation and to avoid undesirable programmes from being made available to the viewers. Another goal was to enable the optimum exploitation of this technology, which had the potential of making a vast pool of information and entertainment available to the subscribers. This paved the way for subsequent regulatory framework in cable TV sector contributing towards consolidation, emergence of MSOs and modernisation of distribution networks.

While the passage of the Cable Act was a significant step towards regulating broadcasting and cable services in India, one of the major changes in the policy outlook towards broadcasting and cable services was brought about by the NTP, 1999. The NTP, 1999 recognised that in view of convergence, it was likely that two-way communication (including voice, data and information services) through cable network would emerge in a significant way in future. Accordingly, the NTP, 1999 categorised cable service providers as "access providers" – together with cellular mobile service providers and fixed access providers. In particular, it recommended that cable service providers be allowed to: (a) provide last mile linkages and switched services within their service areas of operation; (b) operate one-way entertainment related services; and (c) have direct interconnections and share infrastructure with any other type of service provider in their area of operation.

With regard to interconnection between service providers in different service areas, the NTP, 1999 recommended that the matter, along with other matters such as appropriate licensing for cable network operators, etc. be reviewed in consultation with the Authority, given the suggested approach of aligning

the regulatory treatment of telecom, broadcasting and cable services.

Conditional access systems

The next major change in the policy framework was brought about on account of numerous complaints received by the Government from different stakeholders in relation to pricing of services, bundling of channels, and concealment of revenue derived by cable service providers. This led to the Government establishing a Special Task Force that noted that in order to resolve issues of transparency and consumer choice, cable service providers should be mandated to provide content through CAS.

The recommendations of the Special Task Force were thereafter incorporated in the Cable Act, by way of an amendment in December 2002, which required cable service providers to provide channels through CAS, which were addressable, and thereby allowed for greater transparency in distribution of channels. The stated objective of the 2002 amendment was to address the frequent and arbitrary increase in cable charges. While FTA channels continued to be available to all customers with a CAS terminal, they could watch any pay channel by paying a specified charge to the cable service providers. This was done by the introduction of Section 4A in the Cable Act, allowing cable service providers to provide pay channels to consumers through addressable systems. This was followed by constitution of another Task Force for the implementation of CAS in an orderly and timely fashion.

In July, 2003 the Government issued a notification requiring cable operators in Chennai, Mumbai, Delhi and Kolkata to transmit pay channels only though addressable systems. This requirement, however, faced significant opposition from cable service providers and consumers alike, leading to the Government indefinitely suspending the operation of the notification. The Government's decision was subsequently challenged in the Delhi High Court, leading them to ultimately refer the matter of implementing CAS to TRAI in January 2004.

Two other notable changes in the policy regime that have aided the Government's sustained efforts on achieving digitisation, were the introduction of DTH services followed by the permission for operation of HITS services. In January 2001, the Government granted permission for the reception and distribution of television signals in the "Ku band" marking the beginning of DTH broadcasting services in India. Following this, in the year 2003, the Government issued permission to two companies to operate HITS service for fast implementation of CAS. Policy guidelines for HITS services were issued by Ministry of Information and Broadcasting (MIB) in November, 2009.

TRAI's mandate, as set out in the TRAI Act, 1997, originally extended to "telecommunication service(s)", which was defined in Section 2(k) to "not include broadcasting services." Therefore, broadcasting and cable services were explicitly excluded from the scope of the Authority's jurisdiction. However, as noted earlier, the definition of "telecommunication service" was amended by way of 2000 amendment to the TRAI Act to include a proviso which enabled the Central Government to notify any other service, including broadcasting services, as a "telecommunication service". Accordingly, in order to enable the Authority to act upon the reference received in relation to implementing CAS, the Government issued its Notification dated 9th January 2004 under Section 11(d) of the TRAI Act, wherein broadcasting and cable services were notified as being "telecommunication service(s)".

BOX 4.7: DEVELOPMENTS IN TV BROADCASTING AND CABLE SERVICES

1995 - Cable Television Networks (Regulation) Act, 1995 provided the legal basis for the Government to regulate cable networks.

NTP, 1999 - Categorised cable service providers as "access providers" along with fixed and cellular services.

2001 - Permission for operation of DTH services in the "Ku band".

2002 - Insertion of Section 4A in the Cable Act. Empowered the Government to make it obligatory for all cable operators to employ addressable systems. This followed from the recommendations of the Task Force on CAS.

2003 - Government notification ordered CAS implementation in six months. This decision was however deferred due to opposition from stakeholders.

2004 - Grant of broadcasting and cable services mandate to TRAI.

2009 - Issuance of HITS guidelines. Permission had already been issued to two operators in 2003.

2011 - Amendment to Cable Television Networks (Regulation) Act, 1995, enabling the implementation of Digital Addressable Cable TV Systems (DAS) in India.

This development marked the next major shift in the policy landscape surrounding broadcasting and cable services in India. It was found that the inherent limitations of the analogue cable TV systems continued to pose several challenges in the cable TV sector, mainly due to capacity constraints and non-addressable nature of the network. To address this situation, TRAI initiated a systematic process to encourage the migration of the broadcasting sector from analog to DAS.

The Authority's recommendations dated 5th August 2010, set out a phased implementation plan for DAS, so as to ensure an orderly and proper transition by December 2013. The recommendations relating to digitisation were accepted by the Government leading to necessary amendments to the Cable Act and notification of complete addressable digitisation by December 2014. As on date, three phases of digitisation have been successfully completed, and the fourth and final phase is due for completion in April, 2017.

In January, 2008, TRAI issued its recommendations on IPTV services suggesting the removal of any additional licensing requirements upon ISPs and cable operators already licensed by the Government, for providing IPTV services. The

Authority also touched upon issues of content regulation to be applicable to TSPs providing IPTV services, and recommended suitable amendments to the uplinking/ downlinking guidelines, so as to enable broadcasters to provide signals to all classes of distribution platform operators (HITS, DTH, IPTV and MSOs).

In the same month, the Authority also issued another set of recommendations on mobile television services and certain issues relating to DTH services. The focus was on situations where TSPs provide television content by the "broadcast" method, i.e. by using a dedicated spectrum bandwidth to provide content, instead of existing spectrum allowed under the CMTS/ UAS licences. The DTH recommendations covered issues such as technical interoperability of the Set-top Boxes (STBs), continuity of existing arrangement of the supply of DTH operators' signals only to the consumers directly and not to any other intermediary, permitting band neutrality to DTH operator and allowing DTH operator to operate in both the available bands.

An overview of policy evolution for television broadcasting sector is indicated in figure 4.2 below.

FIGURE 4.2: POLICY EVOLUTION FOR BROADCASTING SECTOR (TELEVISION)

Source : As per TRAI records
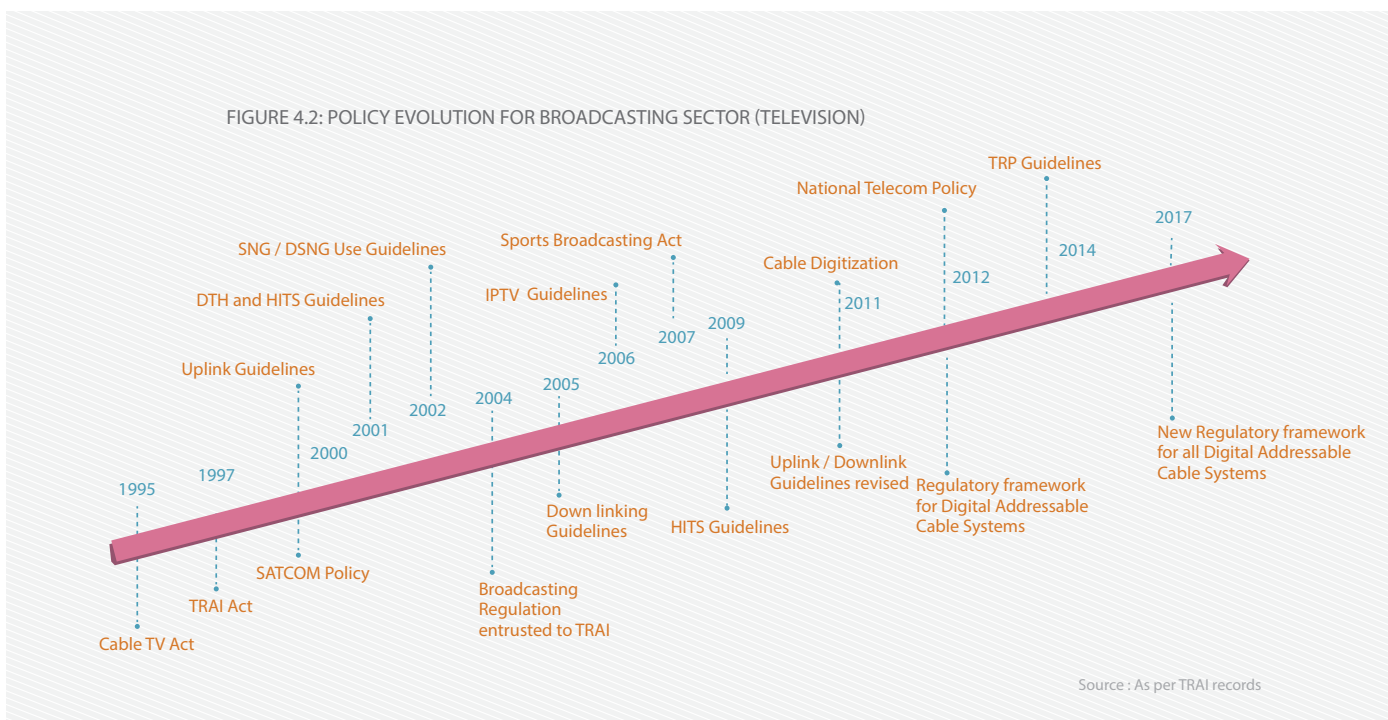
Uplinking / downlinking norms

The Government's liberalisation of uplinking/downlinking norms for private sector broadcasters has been another area of policy evolution over the years. Initially, private broadcasters were not permitted to uplink television programming and were later permitted to uplink exclusively through the facilities of VSNL. It was in March, 1999 that the MIB permitted private broadcasters to utilise their own uplink facilities using the C-band. The Government then notified the guidelines for uplinking from India in July 2000 followed by a separate set of

guidelines for uplinking of news and current affairs channels in March 2003.

Subsequent amendments to the guidelines were made over the next two years leading up to the adoption of a consolidated set of uplinking guidelines that were notified on 2nd December, 2005. In the same year, the MIB also issued policy guidelines for downlinking of TV channels pursuant to which, no person/ entity is allowed to downlink a channel unless it is registered by the MIB under the said guidelines.

In 2010, the MIB sought TRAI's recommendations on possible updations to the uplinking/downlinking guidelines, with a particular emphasis on number of channels; eligibility criteria; approval process; revocation and renewal; and transfer of permission. The Authority's recommendations on these issues formed the basis of amendments to the uplinking/ downlinking framework, which were accepted by the Union Cabinet in October, 2011.

The updated regime defined net worth criteria for uplinking of "non-news and current affairs" and "news and current affairs" channels and for the setting up of teleports. It also introduced new requirements on operationalising television channels within one year of obtaining permission, and such permissions were to be valid for 10 years. Other aspects covered by the updated policy included specifications for top management officials, approval of merger, demerger and amalgamations by the MIB, and conditions for renewal of permissions for television channels.

Developments in radio broadcasting

The area of radio broadcasting has also seen a number of policy changes. Radio broadcasting in India started with AIR operations in July 1927. Private radio broadcasters were permitted to enter the market in 1999. For that purpose, the MIB invited bids for licenses to operate FM stations in 40 cities. Subsequent to screening processes, and evaluation of applications, FM licenses were granted to 16 enterprises, for operating 37 channels. However, most of the licensees failed to meet their license fee obligations, and consequently demanded a reduction in license fees. This led to MIB establishing the Radio Broadcast Policy Committee headed by Amit Mitra in July 2003, to study the desirability of modifying the existing licensing regime, and study the possibility of granting further licenses.

Subsequent to TRAI being vested with the mandate of regulating broadcasting services in 2004, the recommendations of the Amit Mitra Committee were shared with the Authority for its recommendations. Accordingly, in August 2004, the Authority recommended the creation of a migration scheme that would enable existing FM licensees to migrate to a revenue sharing formula (similar to the approach that had been previously adopted for telecom service providers). One of the key recommendations of the TRAI in this regard, was removal of the restriction on broadcasting news and current affairs programs on FM radio. TRAI also recommended relaxations in ownership restrictions that prevented FM licensees from owning multiple frequencies in one city, made recommendations on FDI in FM radio, and proposed a pan-India cap of 25 percent on the total frequencies held by a single licensee.

Most of these recommendations were subsequently adopted by the MIB in July 2005, while issuing the final policy on radio broadcasting. The policy covered aspects relating to ownership conditions and cross-media ownership. However, the Authority's recommendations with regard to removal of restrictions on broadcasting news and current affairs programs were not accepted by the Government.

The Government subsequently sought TRAI's opinion during the third phase of FM radio broadcast licensing in 2008. In its recommendations dated 28th November, 2008 the Authority re-emphasised the need to remove restrictions on the broadcast of news and current affairs programs on FM radio. It also highlighted the need for augmentation of private FM broadcasting, permitting additional channels in the same city; issues relating to change in ownership of broadcasting enterprises; relaxation of fee structures in Jammu and Kashmir, and the North-eastern States; an upward revision in the FDI ceiling; allowing for co-channel spacing and co-location of transmitters; and auto renewal of permissions for FM broadcasting. This formed the basis for MIB's 2011 policy guidelines on the expansion of FM radio broadcasting services through private agencies (Phase-III). The MIB initiated the third phase of FM licensing in January 2015, although, the recommendations on news and current affairs on FM radio were not accepted.

The Government has, from time to time, sought the recommendations of the Authority with regard to the introduction of new service categories within broadcasting and cable services, such as the introduction of CRSs, and satellite radio services. Based on the recommendations of the Authority, the MIB has introduced licensing and policy guidelines for the launch of these services in India.

Community radio station

The diversity of languages, cultures and social groups within the country highlights the need to have avenues for generating and distributing locally relevant content. CRSs serve this purpose by providing a voice to people from those sections of society who do not have adequate space in the mainstream media. In doing so, they serve as the repository of local culture, traditions, language and traditional knowledge.

CRSs were first allowed by the Government in 2001 by authorising educational institutions to seek licenses for the establishment of such stations. In December, 2004, TRAI submitted its recommendations on licensing issues relating to CRSs, which covered aspects relating to eligibility conditions, licensing process, funding, regulation and monitoring of CRSs. This formed the basis for MIB's 2006 guidelines on the operation of CRSs, which allowed 'non-profit' organisations like civil society and voluntary organisations to also offer CRSs.

In August 2014, TRAI issued a new set of recommendations on the term of permission granted to CRSs under the Grant of Permission Agreement (GOPA) and extension/ renewal of the permissions. The Authority also issued recommendations on CRSs being allowed to broadcast news and current affairs; duration of advertisements and use of CRSs in disaster management. On the procedural side, the Authority recommended the establishment of an online 'single window' system to integrate the process of filing of the application, grant of license and signing of the GOPA. The Government recently amended its CRS guidelines on 19th January, 2017 to incorporate the following changes:

▸ Provisions for GOPA extension – initially for a period of 5 years followed by a 10 year term for a second renewal.

▸ Permission to relocate CRSs in disaster situations with the permission of the District Magistrate, subject to providing that information to MIB.

▸ Permission to broadcast news and current affairs contents sourced exclusively from AIR in its original form or translated into the local language/dialect. The scope of broadcasts that will be treated as non-news and current affairs has also been clarified.

▸ Limited advertising and announcements relating to local events, local businesses and services and employment opportunities allowed for a maximum duration of 7 (seven) minutes per hour of broadcast.

The table below provides an overview of the key recommendations that have been made by TRAI to support the policy making process of the Government on issues relating to broadcasting and cable services.

BOX 4.10: TRAI'S KEY BROADCASTING RECOMMENDATIONS AT A GLANCE		
Year	**Date**	**Activity**
2007	17.10.2007	Recommendations on "Headend-In-The-Sky (HITS)"
2008	04.01.2008	Recommendations on "Provision of IPTV services"
	23.01.2008	Recommendations on "Issues relating to mobile television service".
	22.02.2008	Recommendations on "3rd Phase of private FM radio broadcasting"
	12.11.2008	Recommendations on "Issues relating to entry of certain entities into broadcasting and distribution activities". Restriction on entities like State Governments, urban and local bodies, political bodies and religious bodies from undertaking broadcasting activities.
2010	30.06.2010	Recommendations on "Foreign Investment Limits for Broadcasting Sector". Limit of 74% for foreign investment for the broadcast carriage services.
	22.07.2010	Recommendations on "Issues relating to Uplinking/ Downlinking of Television channels in India". Cap on number of channels, net-worth requirement for news and non news channels and eligibility criteria.
	05.08.2010	Recommendations on "Implementation of Digital Addressable Cable TV Systems in India". Detailed roadmap for digitisation.
2012	19.04.2012	Recommendations on "Prescribing Minimum Channel Spacing, within a License Service Area, in FM Radio Sector in India".
		TRAI prescribed Regulatory framework for DAS Cable TV systems

Year	Date	Activity
2013	22.08.2013	Recommendations on "Foreign Direct Investments (FDI) in Broadcasting Sector in India". FDI limit of 100% for broadcast carriage services and 49% for uplinking of News and Current Affairs TV Channels and FM radio services.
	11.09.2013	Recommendations on "Guidelines for Television Rating Agencies"
	26.11.2013	Recommendations on "Monopoly/Market dominance in cable TV services"
2014	09.01.2014	Policy guidelines for TV rating agencies notified
	20.02.2014	Recommendations on "Migration of FM Radio Broadcasters from Phase-II to Phase-III"
	23.07.2014	Recommendations on "Issues related to New DTH Licenses"
	12.08.2014	Recommendations on "Issues Relating to Media Ownership"
	29.08.2014	Recommendations on "Issues related to Community Radio Stations"
	19.11.2014	Recommendations on "Regulatory Framework for Platform Services". Regulatory framework for Platform services and ground based broadcasters.
2015	24.03.2015	Recommendations on "Reserve Prices for auction of FM Radio channels" in New Cities. Reserve price for auction of FM Radio channels in 264 new cities in Phase-III.
2016	15.09.2016	Recommendations on "Issues related to Radio Audience Measurement and Ratings in India".
2017	31.01.2017	Recommendations on "Issues related to Digital Terrestrial Broadcasting in India". Roadmap for migration to DTT.
	29.03.2017	Recomendations on Sharing of Infrastructure in Television Broadcasting Distribution Sector
		TRAI prescribed Rregulatory framework for DAS Cable TV systems

In the last twenty years, TRAI has played a critical and formative role in shaping the regulatory and policy framework governing the telecom sector in India. The same is also true with regard to the broadcasting and cable services sector in the thirteen years since TRAI acquired jurisdiction over regulating these sectors. Owing to the division of regulatory responsibilities between the Government and TRAI in both these areas, TRAI's interventions have included making recommendations to the Government on critical aspects like licensing and spectrum policy, which have had a positive influence on the nature and level of competition in the sectors; in addition to the discharge of its core regulatory functions provided under the TRAI Act.

Section 11 of the TRAI Act, as amended in 2000, contains a clear statement of the Authority's regulatory and recommendatory functions. TRAI's core regulatory functions include, ensuring compliance of terms and conditions of licence; terms and conditions of inter-connectivity and effective inter-connection between providers; laying down the standards of QoS; ensuring effective compliance of USO; and such other functions as may be entrusted to it by the Central Government. In addition to these, section 11(2) confers TRAI with the explicit mandate to notify the rates at which the telecommunication services are to be provided. This section charts out key milestones in TRAI's journey as a regulator of these areas.

Telecom services

Tariff regulation

The tariff regulation for the telecommunication services in India was initiated with the notification of Telecommunication Tariff Order 1999 (TTO, 1999). This order provided the broad and long-term policy framework for telecommunication services in the country. The tariff reforms initiated vide TTO 1999, aimed to provide a consistent and transparent framework for regulating tariffs in order to achieve affordable prices and improve the availability of services to the customer. From a system of 'fixation of tariff rates', TRAI has moved, over the years, to 'forbearance with prior approval stage' and finally to a 'forbearance regime with post-facto reporting obligation' with regulatory oversight.

Currently, except for the tariffs for national roaming, fixed rural telephony and leased lines, tariffs for other telecommunication service are under forbearance. This has resulted in emergence of new and innovative products in the market that are designed to provide telecom services at affordable and competitive prices to the consumers.

First phase: Fixation of tariff rates
Re-balancing of tariff was a focus area in the initial years, in order to balance affordability of services for users with

reasonable return on investment for market players. In its original form, the TTO specified standard tariff packages for various services, which the TSPs were mandated to offer to the consumers. In addition to the offer of standard tariff packages, the TSPs were given flexibility to offer alternative tariff packages to different classes of subscribers, subject to the specified ceiling rates.

The TTO 1999 categorised the users as rural and urban (based on classification as per census) and further within each category, the users were divided into low, general, and commercial. The rentals for the different categories varied and also depended on the exchange capacity to which the subscriber was connected.

Second phase: Forbearance
Over a period of time, competition amongst the TSPs led to a number of tariff plans being made available in the market, many of which were more attractive to consumers than the TRAI-specified standard packages. This prompted the first structural review of cellular mobile tariffs in the year 2002. Taking note of the emerging market scenario, the Authority came to the conclusion that a stage had been reached when market forces could effectively regulate cellular tariff. Accordingly, TRAI forbore from regulating tariffs for cellular mobile services vide the 23rd Amendment to TTO dated 6th September, 2002.

In the case of basic wireline services, TRAI decided in the year 2003 that mandating a standard package was no longer necessary for urban basic service subscribers, as most of the subscribers were enrolled in alternatives, thus making the standard tariff package largely redundant. Accordingly, through the 28th Amendment to TTO dated 5th November 2003, TRAI decided to forbear with respect to basic services except for rural subscribers for whom the standard pack was continued.

The tariff forbearance policy, however, does not preclude TRAI from monitoring tariffs for that service. As per the TTO, service providers are mandated to file the tariffs with TRAI within 7 days of implementation of the said tariff. All tariffs filed with TRAI under this requirement are examined and wherever necessary, due intervention is effected.

National Roaming Services
The TTO, 1999 did not prescribe any tariffs for national roaming services. These remained under forbearance along with tariffs for supplementary telecommunication services and other VAS. However, on observing that the charges for national roaming services were substantially high, the Authority, through the TTO (18th Amendment), 2002 brought the tariffs for national roaming services under regulation by prescribed ceiling tariffs. The approach of TRAI for regulating the tariff for national roaming service has been to prescribe a ceiling tariff below which the wireless service providers are allowed

to charge from their subscribers. These ceilings are arrived at by factoring in various cost-components for providing national roaming service.

The ceiling tariffs for national roaming services were revised by the Authority once again through the TTO (44th Amendment) dated 24th January, 2007 and later through the TTO (55th Amendment) dated 17th June 2013. The last review of tariffs for national roaming in 2013 was carried out in view of the decline in per unit incremental cost for national roaming and the objective of NTP, 2012 to work towards `One Nation - Free Roaming'.

In 2015, as per the latest TTO (60th Amendment), keeping in view the reduced cost of providing a roaming service, the ceiling tariff was revised and brought down to Rs.0.80 per minute for outgoing voice calls, Rs.1.15 per minute for outgoing distance calls and Rs.0.45 per minute for incoming calls.

Format for publication of tariffs
In 2003, the Authority issued guidelines on the publication of tariffs, under which service providers were required to publish their tariff plans in a prescribed format.
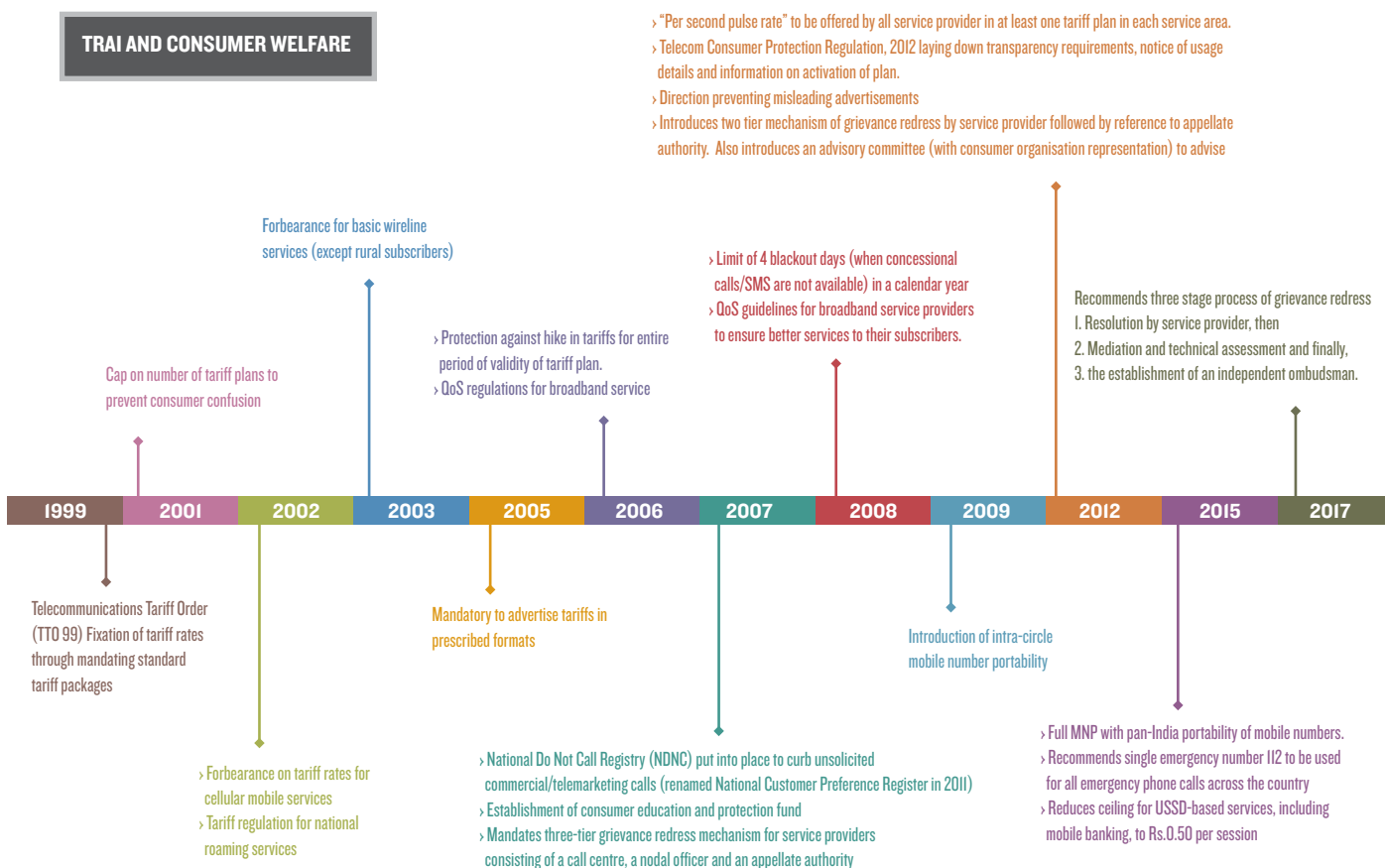
Hike in tariffs
In 2004, TRAI issued the 31st TTO amendment granting protection to subscribers against a hike in tariffs for a minimum period of six months from the date of enrolment of the subscriber to that tariff plan. Subsequently, vide the TTO 43rd amendment (21st March 2006), the six months period was extended to the entire period of validity offered to the customer. In the case of lifetime plans, the TSPs were prohibited to effect any adverse change to the disadvantage of the consumer at any point of time.

Mandatory per second pulse rate
TTO 51st Amendment, 2012 mandated the provision of a "per second pulse rate" by every service provider in at least one tariff plan in each service area.

FIGURE 5.1: TRAI AND CONSUMER WELFARE: KEY DEVELOPMENTS

TRAI AND CONSUMER WELFARE

› "Per second pulse rate" to be offered by all service provider in at least one tariff plan in each service area.
› Telecom Consumer Protection Regulation, 2012 laying down transparency requirements, notice of usage details and information on activation of plan.
› Direction preventing misleading advertisements
› Introduces two tier mechanism of grievance redress by service provider followed by reference to appellate authority. Also introduces an advisory committee (with consumer organisation representation) to advise

Forbearance for basic wireline services (except rural subscribers)

› Limit of 4 blackout days (when concessional calls/SMS are not available) in a calendar year
› QoS guidelines for broadband service providers to ensure better services to their subscribers.

Recommends three stage process of grievance redress
1. Resolution by service provider, then
2. Mediation and technical assessment and finally,
3. the establishment of an independent ombudsman.

› Protection against hike in tariffs for entire period of validity of tariff plan.
› QoS regulations for broadband service

Cap on number of tariff plans to prevent consumer confusion

| 1999 | 2001 | 2002 | 2003 | 2005 | 2006 | 2007 | 2008 | 2009 | 2012 | 2015 | 2017 |

Telecommunications Tariff Order (TTO 99) Fixation of tariff rates through mandating standard tariff packages

Mandatory to advertise tariffs in prescribed formats

Introduction of intra-circle mobile number portability

› Forbearance on tariff rates for cellular mobile services
› Tariff regulation for national roaming services

› National Do Not Call Registry (NDNC) put into place to curb unsolicited commercial/telemarketing calls (renamed National Customer Preference Register in 2011)
› Establishment of consumer education and protection fund
› Mandates three-tier grievance redress mechanism for service providers consisting of a call centre, a nodal officer and an appellate authority

› Full MNP with pan-India portability of mobile numbers.
› Recommends single emergency number 112 to be used for all emergency phone calls across the country
› Reduces ceiling for USSD-based services, including mobile banking, to Rs.0.50 per session

Interconnection

Interconnection means the commercial and technical arrangements under which telecom service providers connect their equipment, networks and services to enable their customers to have access to the customers, services and networks of other TSPs. Interconnection is extremely important from a consumer perspective. Telecom users cannot communicate with each other or connect with services they demand unless necessary interconnection arrangements are in place. A number of issues must be agreed upon by the TSPs or determined by the regulator in order to finalise these arrangements.

IUC can be regarded as the most important commercial issue for a successful interconnection arrangement. IUC has been one of the most contested issues in TRAI's regulatory mandate, given that it forms a significant part of both the expenses as well as revenues for service providers. Box 5.1 contains a brief description of the various components of IUC.

BOX 5.1: COMPONENTS OF INTERCONNECTION USAGE CHARGES

The following charges fall within the definition of IUC:

- Termination charges: Charges payable by an access provider, whose subscriber originates the call, to the access provider in whose network the call terminates. In a (CPP) regime, the calling party subscriber pays for the call to its access provider and the calling party's access provider usually pays termination charge to the called party's access provider to cover the interconnection/ network usage cost.

- International termination charges: International termination charges are the charges payable by an International Long Distance Operator (ILDO), which is carrying calls from outside the country, to the access provider in the country in whose network the call terminates.

- Transit charges: When two telecom networks are not directly connected, an intermediate network is used through which calls are transmitted to the terminating network. Such an intermediate network is known as a transit network and the charges to be paid to the transit network to cover the interconnection/ network usage cost are called transit charges.

- Carriage charges: Access providers in India can offer access services within the Licensed Service Areas (LSAs), also known as circles; the inter-circle traffic is required to be routed through a National Long Distance Operator (NLDO). The charges to be paid by an access provider to the NLDO to cover the cost of carrying the inter-circle calls are called carriage charges.

- Origination charges: The calling party's access provider collects call charges from the calling party (i.e. its subscriber) as per the applicable tariff. From the amount so collected from the subscriber, the access provider has to pay termination charges to the called party's access provider and carriage charges (in case of an inter-circle call) to the NLDO. The access provider retains the balance amount to cover the cost of originating the call. In India, origination charges have not been specified and are under forbearance.

- International settlement rates: International settlement rates are the charges exchanged between foreign service providers and Indian ILDOs for exchanging international traffic. The international settlement rate includes international carriage charge, national carriage charge (if any) and the termination charge applicable in the respective country.

In 1994, when mobile telephony was introduced in India, mobile subscribers were required to pay for receiving a call on their mobile connections. This is referred to as the Receiving Party Pays (RPP) regime, which continued for about a decade. It was, however, found that the growth of mobile telephony, in terms of metrics such as subscriber base, usage and revenues, remained below expectations during this period.

Introduction of IUC regime

In the year 2002, TRAI laid down a regulatory framework for interconnection through 'The Telecommunication Interconnection (Reference Interconnect Offer) Regulation, 2002'. The regulation required any service provider enjoying significant market power to submit its proposed Reference Interconnect Offer (RIO) to the Authority for approval and then publish the same. RIO refers to the document that describes the technical and commercial conditions for interconnection based on the model RIO contained in the Regulation. Subsequently, with a view to ensure effective interconnection between service providers, the Authority directed all TSPs to provide interconnection on the request of the interconnection seeker, within 90 days.

With a view to encourage usage of cellular mobile services and bring about an increase in the subscriber base, the Authority notified the Telecommunication Interconnection Usage Charges (IUC) Regulation, 2003. This regulation was responsible for introducing the CPP regime in India. It provided for the payment of origination charges, carriage charges and termination charges, based on the type of network in which the call originated or terminated and the distance

travelled in a TSP's network. In case of cellular networks, the charges were also based on whether the destination network was in a metro or a non-metro location.

On the basis of the feedback received from various stakeholders, the Authority revised its IUC framework through 'The Telecommunication IUC Regulation, 2003 (4 of 2003)', superseding the earlier Regulation. As per the revised Regulation, a uniform termination charge of 0.30 per minute was prescribed irrespective of distance for all types of calls, namely fixed-line, wireless in local loop and full mobility. The carriage charges remained distance-based.

BOX 5.2: ACCESS DEFICIT CHARGES

The ADC are charges to be paid by operators to reimburse those calls where the payment for access does not cover the cost of providing the service. The framework of the ADC regime was established by the Authority through its Regulation dated 24th January 2003. It aimed to facilitate the incumbent operators to transit from a monopoly to a competitive regime by giving adequate time for the rebalancing of tariffs. The estimated amount of ADC was significant and the contribution was mainly from calls involving fixed line subscribers either at one end or both ends. This meant that the ADC differed widely for calls from and to fixed and mobile networks. With ADC being levied only on fixed line calls, the mobile service providers had greater flexibility in offering lower tariffs in comparison to fixed lines especially when fixed lines were involved at both ends. This had an impact of the competitiveness of fixed line operators, particularly BSNL. In Jan 2003, the ADC were 30 percent of the total AGR of telecom sector, with 81 percent being contributed by BSNL and 19 percent from other telecom service providers. In the subsequent regulation in October 2003, the ADC amount was kept at about 10 percent of the total AGR of the sector, and BSNL's contribution was reduced to 47 percent.

The ADC regime was designed to deplete with time and any justification for financial subvention was to be passed on by 2008-09 to the USOF. Accordingly, in 2008, the Authority began to implement its decision to phase out ADC as stipulated.

TRAI also recommended that some form of assistance would still be required to support BSNL in sustaining their rural fixed asset through the USOF after the withdrawal of ADC. However, the administrator of the USOF did not accept this proposal on the ground that it was already supporting BSNL's rural wire line connections by offering subsidy support in order to enable deployment of wireline exchanges in rural areas.

The Authority conducted another review of IUC regime in 2005, which led to the Telecommunication IUC (Sixth Amendment) Regulation (1 of 2006). The ceiling on carriage charges was amended while other IUC components were kept at the same level as before. The change in the carriage charge regime effected through this amendment provided a strong basis for TSPs to reduce long-distance tariffs and to offer uniform STD tariffs across the country.

Subsequently, another IUC review was conducted in the year 2008-09. Based on a detailed consultation process, the Authority notified the Telecommunication IUC (Tenth Amendment) Regulations, 2009 (2 of 2009), which came into effect from 1st April, 2009. This amendment led to a downwards revision of termination charges for domestic calls to fixed and mobile networks (Rs. 0.20 per minute) and an upwards revision for international calls (Rs. 0.40 per minute).

Some TSPs challenged the 2009 amendment before the TDSAT on various grounds. TDSAT issued its decision on 29 September, 2010, directing TRAI to make a fresh determination of the IUC, based on its observations and directions. TRAI filed an appeal in the Hon'ble Supreme Court challenging the order of TDSAT on various technical and legal grounds including, the principally legal issue of whether the validity of the TRAI's regulation framed in exercise of powers conferred under Section 36 of the TRAI Act, can be challenged before the TDSAT under section 14 of the TRAI Act, 1997. On this issue, the Hon'ble Supreme Court vide its judgment dated 6th December 2013 ruled that TDSAT does not have the jurisdiction to entertain the challenge to the regulations framed by the Authority under section 36 of the TRAI Act.

After following a due consultation process, the Authority issued the Telecommunication IUC (Eleventh Amendment) Regulations, 2015 dated 23rd February, 2015, through which, the termination charges were prescribed as shown in Box 5.3:

While revising the regime for termination charges through the Eleventh Amendment in 2015, TRAI had indicated that the termination charges would be reviewed after two years of being in force. In this context, the Authority came out with a Consultation Paper on 5th August 2016 to review the IUC regime. The consultation paper, inter alia, raises questions about whether the existing model of cost-based termination charges or a "bill and keep" model may be deemed more suitable for prescribing domestic termination charges in India. The Authority is currently in the process of reviewing the inputs received in the course of this consultation process.

Besides laying down call termination charges, TRAI has also issued a separate set of regulations on SMS termination charges, which were previously under forbearance. The Short Message Services (SMS) Termination Charges Regulations, 2013 dated 24th May, 2013 have prescribed SMS termination charges at Rs. 0.02 per SMS.

Port charges
A 'port' means a place of termination on a switch/ distribution frame to provide a point of access or interconnection for ingress and egress of traffic between the two interconnecting networks. The bandwidth of the port is 2.048 Mbps. The 'port charges' are payable by the interconnection seeker to the interconnection provider for terminating the interconnection links on the network interface of the interconnection provider. The Authority, through 'The Telecommunication Interconnection (Port Charges) Regulation 2001' port charges payable by interconnection seeker to the interconnection provider. This regime was reviewed in the year 2011 and subsequently in 2012.

Intelligent networks

Intelligent Network (IN) is a network architecture that allows flexibility for the operation and provision of new services. It does so by separating the core intelligence and databases for controlling services from the switching elements.[50] IN was a response to the inability of competing telecom service providers to offer advanced services to their subscribers, due to dissimilar requirements of the various switching systems supplied by different vendors. The IN adoption allows for the optimisation of software, database and hardware architectures - permitting developers and telecom operators to implement value-added network and subscriber services, such as optimal routing, satellite-cellular roaming, voicemail, single number service, alternate billing, call forwarding, call barring and conference calling. These services translate into expanded network capacity and revenue while increasing subscriber-base and customer satisfaction. The independence of the bearer Network entities with the IN nodes lets the network providers utilise the same IN Infrastructure for a variety of networks, namely, fixed, WLL-F, WLL-M, cellular mobile and VoIP.

The Authority has noted that in other countries any subscriber of any access service provider was able to access the IN services provided by any other service provider from anywhere in the service provider's network. In contrast, in India, the subscribers were able to access the IN platform of their own access service provider only. TRAI, therefore, issued the Intelligent Network Services in Multi Operator and Multi Network Scenario Regulations of 2006. The main provisions included prohibition on denying subscribers access to the INs, providing for interconnection to all eligible service providers, network equipment standards and obligation to follow a numbering plan. This regulation envisaged quick implementation of Free Phone services and Virtual Calling Cards (VCC).

The proliferation of VCCs was not as hoped, as they were mainly operator specific and could not be accessed by all subscribers. In 2012, the Authority amended the regulations such that following the agreements between the service providers, the subscribers would be able to make STD and ISD calls using calling cards issued by all service providers.

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[50] Chen et al. Intelligent Networks, 1999.

As per the prevailing regime till 2014, a customer did not have the option to choose a long distance carrier. This lack of choice was potentially harmful to consumer welfare since telecom service providers would ordinarily charge high retail tariffs for long distance calls. The customer was thus locked-in to the service provider and deprived of the benefits of potentially lower prices that could accrue from competition in the long-distance services market. Since most telecom service providers themselves held NLD and ILD licenses, there was no competition for long-distance calls as far as subscribers are concerned. The Authority thought competition could be increased, and consumer welfare enhanced by providing a choice to subscribers to select their long distance carrier using calling cards.

In 2014, TRAI issued the 'International Calling Card Service (Access Charges) Regulations' prescribing access charges payable by ILD Operators to access service providers. Access Charges to be paid by ILD operators to service providers were specified as 40 paise per minute for wireless services and Rs.1.20 per minute for wireline services. The Regulation paved the way for introduction of competition in the Calling Card segment resulting in choice for customers of long distance operators and lower tariffs.

Mobile number portability

MNP is a facility that allows mobile telephone subscribers to retain the mobile telephone number when they opt to move from one access provider to another access provider in same/another licensed service area irrespective of the mobile technology and licensed service area or from one cellular mobile technology to another of the same access provider. MNP is essential for maintaining competition in the telecom sector. By making it easy for users to switch operators if they are dissatisfied or otherwise require a change, MNP ensures that users are not locked into a particular telecom service and thus imposes a competitive constraint on telecom operators.

With the issue of Telecommunication Mobile Number Portability Regulations, 2009, TRAI laid down the basic business process framework for implementation of intra-circle (within the service area) MNP in the country, in January 2011. Initially, when the MNP service was introduced, monthly rejections were as high as 39 percent in March 2011, which by way of continuous monitoring and sample testing has been reduced to the level of 9-10 percent, out of which wrongful rejections are around 2 percent. Imposition of financial disincentive was introduced by way of an amendment to MNP Regulations on 19th September 2012.

In accordance with the provisions contained in the NTP, 2012 regarding "One Nation – Full Mobile Number Portability", an amendment to the Telecommunication Mobile Number Portability Regulations, 2009 was issued on 25th February 2015 to facilitate full MNP, allowing pan-India portability of mobile numbers. Accordingly, with the implementation of full MNP from 3rd July 2015 onwards, wireless telephone subscribers can retain their mobile numbers when they relocate from any place in the country to another. Till January 2017, approximately 261 million subscribers have used the MNP facility. This has resulted in infusion of more competition, with the overall effect of forcing operators to improve network reach and QoS.

Consumer protection

The protection of consumer interests lies at the heart of telecom regulation and almost all of the policy and regulatory initiatives in this space are grounded in the need to promote better outcomes for telecom users in terms of availability, affordability and QoS. Initiatives such as tariff regulation, regulating interconnection charges, monitoring QoS, ensuring transparency, etc., discussed in different sections of this chapter, all find their basis in the need to protect consumer interests and promote healthy competition in the sector. In addition to these, TRAI has also undertaken several other actions that have been aimed specifically at protecting consumer interests and ensuring that they have access to appropriate redress mechanisms.

Telecom consumer protection regulation, 2012

The Telecom Consumer Protection Regulation, 2012 lays down requirements relating to mode of disclosure (minimum font size for printed matter on physical vouchers), providing usage details to pre-paid subscribers after every call/data usage; information on activation of plan; and improved transparency in provision of premium rate services by providing prior information about charges.

The regulations initially provided for the classification of vouchers into three categories, namely, plan vouchers, top-ups and special tariff vouchers (STVs). In October, 2012 the regulations were amended to also include combo vouchers (that provide monetary value and tariff concessions through a single voucher) as an additional category.

Transparency

Transparency in tariff and the provision of other information to consumers has been a focus area for the Authority as a tool to promote consumer welfare. To enhance consumer awareness, the Authority has continually refined its transparency requirements through provisions of the TTO as well as other regulations, directions and guidelines issued to service providers. Some of the significant measures taken in this regard are as follows:

- *Cap on tariff plans on offer:* TRAI was of the view that too many tariff plans could confuse the consumer and make it difficult for consumers to make an informed choice. Accordingly, the 21st amendment to the TTO in 2001 capped the number of tariff plans that can be offered by an access provider in each licensed service area at any given point of time at 25.

- *Prescribed formats:* In 2005, the Authority issued a direction to all access providers making it mandatory to advertise tariff in prescribed formats. Directions were also issued for

streamlining the procedure of prescribing credit limit for post paid subscribers of cellular mobile services. Additionally, as a measure to bring standardisation and transparency in the procedures being followed by various operators, the Authority also issued a Regulation on Code of Practice for Metering and Billing Accuracy in March, 2006.

▸ *Publication of plans:* TRAI issued a direction on publication of tariff plans on 16th January 2012 requiring providers to publish all tariff plans in a service area for prepaid and postpaid subscribers in the given format in one regional and one English newspaper at an interval not more than six months.

▸ TRAI has also advised all service providers to provide printed material in English and vernacular language to customers at the time of enrolment giving full details of the tariff plan being offered. Full details of tariffs are also to be made available at customer care centre, point of sale, and website in the given format with a view to facilitate easy and transparent comparison.

▸ *Black out days and other measures:* Through a direction dated 1st September 2008 and the 48th Amendment to the TTO, the Authority mandated several transparency measures including: limit of 5 blackout days (customary/festival days on which free/concessional calls/SMS are not available) in a calendar year.

▸ *Misleading advertisements:* In March, 2012, TRAI issued a direction on preventing misleading advertisements so as to facilitate subscribers to choose a plan that best suits their requirements. It has been mandated that tariff advertisements must be transparent, unambiguous and not misleading; must disclose all material information in an unambiguous manner; and contain the website address and customer-care number of the service provider. Service providers have to maintain an advertisement register which must include a copy of every tariff related advertisements, and carry out internal audit to ensure that they are complying with all aspects of the direction.

Consumer protection fund

The Telecommunications Consumers Education and Protection Fund Regulations, 2007 established the Telecommunication Consumers Education and Protection Fund for consumers' awareness, education and protection of their interest. As per the regulation, any excess amount collected by the service providers from the subscribers is to be transferred to this fund. The custody, control and management of the fund has been vested with TRAI.

The fund has been set up for financing activities to be carried out in order to protect the interests of the consumers. These activities would include consumer awareness programmes, studies and market research projects, seminars & workshops conducted on the subject of consumer welfare and education in the field of telecommunication.

Numbering plan

In 2010, the Authority recommended that the existing 10-digit numbering scheme should be continued to avoid inconvenience to the customers that would accompany any move to shift to an 11-digit numbering scheme. In 2012, the government accepted this recommendation. TRAI had also recommended that India should migrate to an integrated numbering scheme for fixed and mobile services by 31st December, 2011 in which both fixed line and mobile phones would have a 10-digit number.

Do not disturb registry

With a view to regulate the unsolicited calls from telemarketers, the Authority issued the 'The Telecom Unsolicited Commercial Communications Regulations, 2007' whereby a National Do Not Call registry was put into place. This was setup to curb unsolicited commercial and telemarketing calls that a customer did not wish to receive.

With effect from February 2011, this was renamed as the National Customer Preference Register (NCPR). The NCPR is a national database containing a list of the telephone numbers of all subscribers who have registered their preferences regarding receipt of commercial communications. As per TRAI guidelines, companies are prohibited from making unsolicited commercial communication with subscribers who have registered themselves in the NCPR. In other words, 'promotional calls' cannot be made to customers who have registered themselves in the NCPR.

As per the Telecom Commercial Communications Customer Preference Regulations, 2010, a customer can use the NCPR database to register itself in the fully or partially blocked, the difference being that in the partial category, the customer may opt to receive commercial calls/SMSs from one of the opted preferences.

Redress of consumer complaints

Redress of complaints is an integral part of the consumer protection framework for the telecom sector. In May 2007, the Authority issued the Telecom Consumer Protection and Redressal Grievances Regulation to put in place a defined institutional framework to replace the then existing self regulatory mechanisms for redress operated by TSPs. It consisted of a three-tier mechanism consisting of a call centre, a nodal officer and an appellate authority. Subsequently, in 2010 the Authority conducted a detailed review of the measures to protect consumers in the telecom sector, which led to the repeal of the 2007 regulations and adoption of a new set of regulations on redress of telecom consumers' complaints in 2012. The new framework opted for a two-tier mechanism (instead of the three tier mechanism seen earlier) consisting of redress by the service provider followed by a reference to an appellate authority, also constituted by the service provider. It also saw the addition of a two-member advisory committee, consisting of one representative of a consumer organisation registered with TRAI and one member from the

service provider, that is responsible for rendering advice to the appellate authority.

While reviewing the outcomes and effectiveness of the current redress mechanisms, TRAI has also been concerned by the fact that unlike other sectors like banking and insurance, which have sectoral ombudsman schemes, at present we do not have an independent mechanism to provide redress to telecom consumers. The Authority had in 2004 made a recommendation to the Government on the establishment of a telecom ombudsman to handle and investigate all unresolved telecom complaints within a set time frame. The proposal was, however, not accepted at that point of time.

In July, 2016 TRAI once again mooted the idea of an external telecom sector ombudsman in its Consultation Paper on Complaints/ Grievance Redressal in the Telecom Sector. The need to reconsider redress mechanisms was felt in light of the fact that the Indian telecom sector has gone through phenomenal changes in the last 12 years. The number of telecom subscribers in India has increased greatly and with that, the number of complaints being made by consumers has also increased. For instance, in the Jan-March quarter of 2016 subscribers filed approximately 10.23 million complaints with their service providers on account of wrong billing, indifferent or poor QoS, non-provision of contracted services, etc.

Following a detailed consultation process, the Authority came out with its recommendations as recently as 10th March, 2017 recommending a three stage process for grievance redress: a) resolution by TSP; b) mediation and technical assessment; c) independent ombudsman.

TRAI has recommended that after the first stage of resolution of the complaint of the TSP, the next step should be to approach the Consumer Grievance Redressal Forum (CGRF) to be set up with the multiple objectives of bringing in technical expertise in resolution of complaints and also an element of mediation by facilitating settlement of the grievance, based on facts. CGRFs are proposed to be set up at the LSA /State level by leveraging existing field formations of DoT like Public Grievances (PG) Cells, Telecom Enforcement, Resource and Monitoring (TERM) Cells etc., that already have a reasonable presence across the country.

If the consumer is not satisfied with the process at the level of CGRF, s/he may choose to proceed to the third stage, for determination by an independent ombudsman that will have the power to award compensation to the consumer, award costs and issue directions to the TSP for the performance of specific obligations. It is proposed that the ombudsman would be supported by a technology driven solutions so as to provide convenient, speedy and affordable redress to telecom consumers.

Other key initiatives

Emergency response systems

TRAI sent its recommendation on 'Single Number based Integrated Emergency Communication and Response System to DoT on 7th April, 2015. In its recommendations, TRAI, inter-alia, recommended to have a single emergency number '112' which could be used for all emergency phone calls across the country, including for police, fire and ambulance. Accordingly, DoT while making amendment to the National Numbering Plan -2003 on 4th May, 2016 issued guidelines on implementation of 'Single Number based Integrated Emergency Communication & Response System' to all access service providers.

Further, TRAI has also made recommendations on the need to devise a system that can facilitate communications during emergencies and disaster situations, particularly amongst those responsible for response and recovery operations. In its recommendations dated 26th November, 2013, TRAI, inter-alia, recommended that a Priority Call Routing (PCR) scheme should be instituted for the calls of personnel responsible for 'response and recovery' during disasters. TRAI also recommended mandating all service providers to ensure that PCR services for priority users are supported through roaming arrangements. In response to this, the DoT issued necessary instructions to all access service licensees and made suitable amendments to the license conditions.

Adoption of Aadhaar based electronic Know Your Customer (e-KYC) services for mobile subscriber verification

In order to make the entire system of mobile subscriber verification more secure and robust, TRAI on 6th January 2016, recommended the acceptance and adoption of Aadhaar-based e-KYC service along with Aadhaar based e-Sign as a valid alternative process to the existing process for digitally signed, biometric based verification of new mobile subscribers. Aadhaar linked e-KYC service offers a robust mechanism which can be used to verify the identity of the person electronically and instantaneously from the Aadhaar database, based on the biometrics of the person. DoT accepted the recommendations and issued necessary guidelines on 16th August 2016. These instructions are applicable only for issue of new SIM cards, including swapping and replacement of SIM cards. It, however, excludes the existing mobile subscriber base from the ambit of e-KYC. Also, use of e-KYC process has not been permitted for outstation customers by DoT for the present.

In order to further strengthen the authentication process for SIM card registration, the Authority has, on 20th January, 2017, recommended that the Government; (i) work with the service providers, to evolve a framework to verify the existing mobile subscribers through Aadhaar based e-KYC services in a phased manner and within a defined timeframe, and (ii) permit Aadhaar based e-KYC for outstation customers also at any

place within the service area.

Internet access services

In parallel, TRAI has placed equal focus on ensuring that the Internet and broadband services being offered in the country should meet the acceptable QoS requirements and that the services are delivered within a reasonable, fair and transparent framework. In 2000, TRAI conducted an online survey to gauge customer perception of Internet service QoS. Based on the results, the TRAI initiated a process of prescribing benchmarks for leased line access services and dial-up Internet access.

BOX 5.5: DOMESTIC LEASED CIRCUIT

Domestic Leased Circuit (DLC) is the medium of carriage of data and voice services within the country. In a review carried out during 2005-06 the TRAI found that competition was not fully effective in the provision of DLCs despite increase in the number of players in the market. The Authority also found that a competitively priced DLC Service is fundamental to achieving a higher rate of penetration of broadband in the country, which provides the basis for fundamentally transforming the socio-economic opportunities, particularly in rural India. Accordingly, TRAI issued an amendment to TTO on 21st April, 2005 reducing the ceiling tariff on domestic bandwidth prices by 3 percent to 70 percent from the existing market levels.

Subsequently, TRAI issued a Regulation on DLCs on 14th September, 2007 with the intention of facilitating customer choice in selection of service providers of DLC/VPN without any artificial and anti-competitive constraints. Prior to this, the provision of DLCs was mandated through the TTO Thirty Sixth Amendment, 2005, which prescribed tariff ceilings for DLC based on the distance and the data rate. Tariff ceilings for local leads and ports were also prescribed. As the tariffs prescribed were in the nature of ceilings, service providers could offer discounts on a transparent and non-discriminatory basis. Mandation of provision of DLCs as contained in the said tariff order and its modalities were not covered by earlier regulations. This was achieved through the DLC regulations issued in 2007.

The Broadband Policy issued by the Government in October, 2004 provided for fixation of the QoS standards for broadband services. At the time of issue of the Broadband Policy, there were approximately 50,000 broadband connections in the country, which rose to over 1.7 million by August, 2006. It was found that along with an increase in the number of customers, the numbers of consumer complaints pertaining to broadband services were also increasing. An analysis of the complaints received by the Authority indicated that customers faced concerns relating to faulty repair, service provisioning and network and billing issues. To address these concerns and create conditions for better consumer satisfaction, TRAI noted a need to fix the QoS benchmarks for broadband services. Accordingly, TRAI issued its Regulations on QoS of Broadband Service on 6th October 2006. This regulation was later amended in December, 2012, to prescribe financial disincentives on the broadband service providers for failure to meet the prescribed QoS benchmarks. The regulation also provides for a deterrent against false and delayed reporting.

Subsequently, in 2008-09, the Authority issued a set of guidelines to all service providers providing Internet/ broadband to ensure better services to their subscribers. The following were some of the key aspects of the guidelines:

▸ Provide adequate information to subscribers regarding Internet/ broadband services being offered and marketed as a good business practice.

▸ Provide information regarding contention ratios adopted for different services by service providers in their tariff plans submitted to TRAI, manual of practice, call centres and on their websites.

▸ Ensure availability of minimum required bandwidth in their network according to maximum contention ratio suggested by TRAI for different services based on number of subscribers.

India had just 10.30 million broadband connections in the country at the end of September 2010 as against the target of 20 million broadband subscribers by 2010, set by the Broadband Policy 2004. In order to spur broadband growth in the country, TRAI forwarded its recommendations on NBP to the Government on 8th December 2010. It recommended the establishment of a fiber optic based, open access, National Broadband Network to connect all habitations with a population of 500 and above. It also recommended the provision of Fiber-to-the-Home (FTTH) in 63 cities covered under the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) and Fiber-to-the-Curb (FTTC) in all other cities and towns. The recommendations for optic fiber network in rural areas have since been accepted by the Government, as discussed earlier in the context of the BharatNet project.

Keeping in view the future growth of telecom in the country, the Authority recognised the need for creation of an effective infrastructure requiring significant investment. The Authority accordingly recommended a framework for efficient deployment of infrastructure, deployment of towers, sharing of active and passive infrastructure, promoting advanced in-building solutions and distributed antenna systems, RoW policy, Internet Exchange Points, migration to IPv6, mobile virtual network operator and framework for rural telecom.

TRAI has also issued separate regulations to govern QoS aspects of Internet-related services. The Mobile Banking (Quality of Service) Regulation issued on 17th April 2012 seeks to ensure faster and reliable communication for enabling banking through the mobile phones. TRAI also issued the Standards of Quality of Service for Wireless Data Services Regulations, 2012 laying down QoS benchmarks for data services covering data transmission download/ upload attempts, minimum download speed and average throughput for packet data covering all tariff plans and latency for data services. Benchmarks have also been prescribed for provision or activation of data services, PDP context activation success rate, and data drop rate. Service providers have been mandated to publish on their website, details of all data services offered, along with tariff, clearly indicating the cities and towns where such data services and tariff plans are applicable.

Through an amendment to this regulation issued in July 2014, the Authority mandated TSPs to indicate the minimum download speed available to customers in all data plans. TSPs have also been mandated to print details of the minimum download speed on the vouchers of the wireless data plans, publish it on their websites, at their complaint centres and sale outlets.

Broadcasting and cable services

Following the notification of 9 January 2004, the Authority immediately started addressing some of the pressing concerns facing the broadcasting and cable industries. The key actions taken by TRAI in this area are reflected in terms of its recommendations to the Government, which were discussed in the previous chapter, and the tariff orders and the regulations issued on various aspects of broadcasting. The general philosophy followed by TRAI while regulating this sector has been to create enabling conditions within which market forces will be able to act in order to generate competitive prices and QoS.

Tariff regulation

TRAI initiated its first tariff intervention in the market, by imposing a price cap on cable services. The Telecommunication (Broadcasting and Cable) Services Tariff Order 2004, issued on 15th January 2004, specified the ceiling rates for charges payable by cable subscribers to cable operators, by cable operators to MSOs/broadcasters and by MSOs to broadcasters in respect of both FTA and pay channels. Subsequent amendments to the tariff order provided for inflation linked adjustments in the tariff ceilings.

TRAI on 31st July 2006 issued an amendment to the tariff order for non-addressable systems, wherein the concept of genre and language of a new pay channel or a channel converting into pay channels from FTA was introduced for deciding similarity of channels for purpose of price fixation of new pay channels.

In October, 2007, TRAI further amended the tariff order for non-addressable systems, wherein specific ceilings at retail level based on the number of channels received and different types of habitations (i.e., cities, towns, semi-urban areas, etc) were prescribed. It also mandated the broadcasters to provide their channels on a-la-carte basis to the MSOs/cable operators as per their request. In addition, they could also provide channels on bouquet basis. In addition, TRAI also prescribed a relationship between a-la-carte rates and bouquet rates known as 'twin conditions at wholesale level' to address perverse pricing of bouquets vis-à-vis individual channels by broadcasters.

Following up on the Government's notification dated 31st July 2006, for implementing CAS in parts of three metros of Delhi, Mumbai and Kolkata, the Authority formulated the necessary regulatory framework consisting of QoS standards, inter-connection issues and tariff issues. The Telecommunication (Broadcasting & Cable) Services (Third) (CAS Areas) Tariff Order, 2006, accordingly, prescribed the rates of tariff for basic services consisting of a minimum of thirty FTA channels; Maximum Retail Price (MRP) that a MSO or cable operator cab charge for individual pay channels; and schemes for supply of STBs. Various amendments have been made to this tariff order from time to time.

In the year 2010, TRAI conducted a comprehensive review of the tariff structure of the television sector and implementation of DAS. This involved the issuance of separate consultation papers to TRAI to review the tariff framework for cable TV services in CAS notified areas and non-CAS areas. A significant outcome of this exercise was the issuance of a tariff order for addressable systems (DTH, HITS & IPTV excluding cable TV) mandating the provision of all pay channels on a-la-carte basis to the consumers. Wholesale rates of pay TV channels and bouquets for all addressable systems fixed at 42 percent of corresponding channels and bouquets in cable TV services in non-addressable systems.

In 2012, TRAI issued an amendment to the tariff order of 2010, and permitted forbearance at retail level tariffs for all addressable systems including cable TV. However, to prevent misuse of this forbearance and to ensure consumers choice, TRAI prescribed preventive measures in the form of twin conditions, both at wholesale level and retail level.

Various developments in the broadcasting sector related to use of different technologies, emergence of multiple distribution platforms, evolving business models, and enhanced addressability across platforms, once again prompted a need for a rethink of the regulatory framework to suit these requirements. This led TRAI to initiate a new consultation process in 2016 on tariff, interconnection and QoS related issued to move towards a consolidated technology neutral regulatory framework for DAS. Following from this, TRAI has issued the Telecommunication (Broadcasting and Cable) Services (Eighth) (Addressable Systems) Tariff Order, 2017, which is applicable to all broadcasting TV provided to subscribers through addressable systems. While framing this

tariff order, TRAI's emphasis was to ensure transparency, non-discrimination, consumer protection and create an enabling environment for orderly growth of the sector. The new framework attempts to address all the issues raised by broadcasters, distributors of television channels and subscribers.

Broadcasters have been given complete flexibility to declare MRP of their pay channels to subscribers with no restrictions as long as such channels are provided to consumers individually. However, any pay channel having MRP more than Rs. 19/- will not form part of the bouquet. This is to ensure protection of interests of consumers as bouquet deals are oblique to individual channel prices.

Distributors of television channels are permitted to charge a network capacity fee of maximum Rs. 130 (excluding taxes) per month from a subscriber for subscribing to a network capacity of 100 SD channels. This will ensure reasonable rate of return to the DPOs on investments in the existing distribution networks as well as incentivise them for additional investment to ensure better network quality for providing VAS and broadband to subscribers.

In order to provide choice to the subscribers and to curb skewed prices of a-la-carte channels as compared to bouquets, it has been mandated that a broadcaster can offer a maximum discount of 15 percent while offering its bouquet of pay channels over the sum of MRPs of all the of pay channels in that bouquet. The restriction of maximum discount of 15 percent on formation of bouquet is to reduce efforts to force non-driver channels to a subscriber without his willingness.

Consumer protection

In addition to the tariff related interventions discussed above, the Authority has taken several measures to protect the interests of consumers and ensure that the QoS being provided to the consumer in the broadcasting and cable television sector is in accordance with the prescribed norms.

The first QoS regulation was issued by TRAI in August, 2006 to prescribe the benchmarks for different parameters of QoS for cable services in CAS notified areas. Subsequently, to protect the interests of DTH subscribers, TRAI issued the DTH Broadcasting Services (Standards of Quality of Service and Redressal of Grievances) Regulations, 2007. These regulations contained provisions relating to the procedure for DTH service connection, disconnection or shifting, billing, grievance redressal mechanism and other measures for consumer protection. Similar regulations were issued for cable TV services in non-CAS areas in 2009, followed by QoS regulations for addressable cable TV service in May 2012.

In 2010, TRAI also issued the Consumers Complaint Redressal (Digital Addressable Cable TV Systems) Regulations, 2012. In addition to these, various consumer protection and quality related issues have also been addressed through tariff orders,

interconnection regulations and directions, issued from time to time.

As discussed above, in 2016, TRAI initiated a comprehensive review of the regulatory framework for TV broadcasting services so as to bring about greater consistency in the provisions applicable to multiple distribution platforms. This process included a review of the provisions relating to QoS for addressable systems, which have been revised and notified in the form of the Telecommunication (Broadcasting and Cable) Services Standards of Quality of Service and Consumer Protection (Addressable Systems) Regulations, 2017.

Interconnection

The significant disparities in the bargaining powers of different players in the broadcasting value chain led TRAI to enact the Telecommunication (Broadcasting and Cable Services) Interconnection Regulations 2004, which provided the basic structure on the matters of interconnection for broadcasting and cable services. The regulations were initially notified to regulate interconnection arrangements between service providers for distribution of TV channels in analog mode, in vogue at that point of time. From time to time, need arose to clarify, as well as to expand the scope of the Interconnection Regulations, 2004 to include addressable systems such as DTH, Head-end In the Sky (HITS), and IPTV. The regulations banned exclusive agreements for distribution of television channels and stipulated non-discriminatory provision of channels by broadcasters. This was done with the ultimate objective of promoting competition in the sector. The regulations also prescribed the notice period for disconnection of TV signals and the requirement for publishing of RIOs by broadcasters. TRAI had, through the Regulations on Register of Interconnect Agreements, 2004, also prescribed the modalities for the maintenance of the register of interconnect agreements entered between broadcasters and service providers.

Subsequently, with a view to ensuring timely implementation of CAS, the Authority amended its Interconnection Regulation in August, 2006 to provide for revenue share arrangements amongst service providers in the notified CAS areas. The regulation also provided for standard form agreements to be used in case service providers fail to enter into mutually acceptable interconnection agreements within a stipulated time. Further, it prohibited clauses that might require the payment of a minimum guaranteed amount as subscription fee in addressable systems.

In April, 2012, the Authority came out with the Telecommunication (Broadcasting and Cable Services) Interconnection (Digital Addressable Cable Television Systems) Regulations, 2012. These regulations were specifically applicable for cable services provided through DAS while the earlier Interconnection Regulations, 2004, continued for non-addressable cable TV systems and also for other addressable systems such as DTH, HITS and IPTV. The

DAS cable regulations of 2012 provided for the 'must carry' provision in the context of DAS; and required every MSO that levies a "carriage fee" to publish it in the RIO and apply it in a uniform, non-discriminatory and transparent manner. TRAI amended these regulations in 2016 to prescribe the formats of the model interconnection agreement and standard interconnection agreement to be signed between MSOs and LCOs for provisioning of cable TV services through DAS. TRAI has recently issued the Telecommunication (Broadcasting and cable) Services Interconnection (Addressable Systems) Regulations, 2017 to govern the commercial and technical arrangements among service providers for interconnection relating to TV broadcasting provided through all addressable systems.

Chapter 6 - Engagement with stakeholders

In the process of formulating its policies and recommendations, TRAI interacts with various stakeholders such as consumers, service providers, their organisations, consumer advocacy groups, civil society representatives and other experts in this field. It has developed a formal process which offers all stakeholders and the general public the opportunity to participate in policy formulation by offering their views on important decisions affecting the sector. This process involves inviting written comments in physical or digital form, holding open house meetings arranged in different parts of the country to discuss the issues posed in the consultation papers, and having interactive sessions with stakeholders and experts to obtain more specialised or detailed feedback.

Another way in which TRAI contributes to furthering transparency in its work is by ensuring that the regulations and orders issued by it are accompanied by an explanatory memorandum, which explains the rationale for the Authority's decisions. This allows the public and affected stakeholders to appreciate the intent of the rules and interpret them in the spirit of such intent. The participative and explanatory processes adopted by TRAI have gone a long way in creating an environment of open debate and discussions in this sector.

All key decisions of the Authority are published in its annual report that is placed before the Parliament. The annual report provides an overview of the general environment in the telecom and broadcasting sectors in terms of number of players, subscriber details, financial performance of the operators, etc. It also sets out a summary of the key initiative undertaken by the Authority during the year in terms of issuance of consultation papers on various subjects and recommendations, orders and regulations issued pursuant to the consultations carried out by the Authority.

Consultative process

The general approach followed by TRAI for undertaking consultation process prior to issuing any recommendations, regulations or orders is as follows:

▸ *Consultation paper phase:* A comprehensive consultation paper is prepared, addressing and analysing the current position, relevant issues, and posing questing for initiating a public debate.

▸ *Written comments phase:* The consultation paper is then released on the Authority's website for distribution to technical experts, consumer organisations, service providers, industrial groups, concerned government organisations, academic institutions and the public in general. Written comments are invited on the issues and questions posed in the consultation paper.

▸ *Open-house discussion phase:* Based on the comments,

the set of issues and questions are fine-tuned and flagged for further discussion in "open-house meetings". Such open public meetings are organised by TRAI at different places where a number of experts and citizens are invited to exchange their views. Efforts are made to disperse these meetings to various parts of the country. Adequate public notices through advertisements in the local press, information on the TRAI website as well as letters and emails to respective stakeholders are sent out to facilitate maximum participation.

▸ *Resolution of contradictory views phase:* Where there are a large number of issues involved and in case a need arises, TRAI may even issue a second or a third consultation paper in sequence after inviting further written comments followed by open house discussions. Contradictory views are taken into account and a detailed discussion is resorted to before a final conclusion is arrived at.

Interaction with consumers and their organisations

The Authority has a system of registering consumer organisations and Non-government Organisations (NGOs) that represent the interests of users of telecom services. In 2001, TRAI notified the regulations on registration of consumer organisations/NGOs and laid down the process for their interaction with TRAI.

A subsequent review of this system showed that more than eleven States in the country were not represented in the registered group of consumer organisations. The regulations were amended in 2007 in order to address this situation and enable the representation of more organisations.

TRAI has now registered 56 consumer organisations from all over the country and is constantly adopting measures for strengthening the role and capacity of consumer organisations. One of the ways in which it does this is by organising seminars and workshops with the participation of domestic and international experts on various technical issues and inviting stakeholders, consumer organisations and other research institutes to attend these seminars.

TRAI also organises consumer outreach programmes which take place in different parts of the country. Through these programmes, the Authority aims to educate telecom consumers as well as receive feedback from them. Such programmes bring together state representatives, telecom service providers, consumer advocacy groups as well as consumers. TRAI on its website also lists details of consumer education workshops hosted by various service providers.

Releases and publications

In addition to having elaborate consultation processes and taking various initiatives to increase consumer awareness,

TRAI also makes publicly available, important information on the sector in the form of audit reports, survey reports as well as QoS reports. Following are some of the key publications released by the Authority.

- **Consumer handbook:** In February, 2015, TRAI published a "Consumers' Handbook on Telecommunications". The handbook is a simple, consumer-friendly guide for informing consumers about their rights and privileges and the processes for dealing with service providers. It is intended for free distribution at the regional consumer education workshops organised by TRAI, to registered consumer organisations, and to consumers through other means and at other outreach programmes.

- **QoS data and reports:** TRAI also releases audit and performance indicator reports on QoS by various service providers. This is usually published on a state by state basis. One of the portals that TRAI provides on its website is the TRAI analytics portal, which facilitates users and service providers to explore as well as resolve various issues in different telecom services. It has three portals for different QoS parameters.

- **TRAI MySpeed portal:** The TRAI-MySpeed Portal allows users to explore the mobile data experience of consumers across India. It collects data on a crowd-sourced model through the App which can test Down-link and Up-link speed and latency tests of the wireless network. Users can submit data by downloading the app and testing their data speeds. See Figure 6.1 below.

- **TRAI drive test portal:** It is a portal to explore the results of independent drive tests done TRAI.

- **TRAI QoS analysis portal:** It facilitates users to explore the call drop rate of various TSPs. Through this portal the

QoS performance of service providers can be identified for any specific location in India. Users can also navigate and view performance metrics from service area to district to city and finally to the Base Tranceiver Station (BTS) level.

- **Financial data reports:** These are published by TRAI on their website on a quarterly basis. This data pertains to Gross Revenue, AGR, License Fee and Spectrum Charges in respect of all the Telecom Service Providers.

- **Performance indicator reports:** TRAI also published a quarterly telecom services performance indicator report. This includes data on subscribers, revenue and usage, financial data of TSPs, QoS related data performance of cable and broadcasting sector.

- **Study papers:** TRAI also releases a number of study papers on various topics in the industry from time to time. In 2016, a paper on the shareholding pattern, finance pattern and capital structure of Private service access providers in India was released. In 2014, TRAI released a study paper on the effects of electromagnetic field radiation from mobile towers and handsets.

- **Monthly subscribers report:** TRAI releases monthly report on the subscriber trends across the country.

- **Other publications:** TRAI publishes a technology bulletin called 'Technology Digest', which focuses on one technology aspect in every issue. The objective of this bulletin is to identify and share new technology trends with the industry. TRAI also releases a bilingual magazine called 'TRAI Darpan', which is published half yearly.

- **FAQs on broadcasting and cable TV Sesvices:** In July 2015 TRAI published a handbook titled FAQs on Broadcasting and Cable TV Services in a simple and consumer friendly

Figure 6.1 - TRAI MySpeed Portal
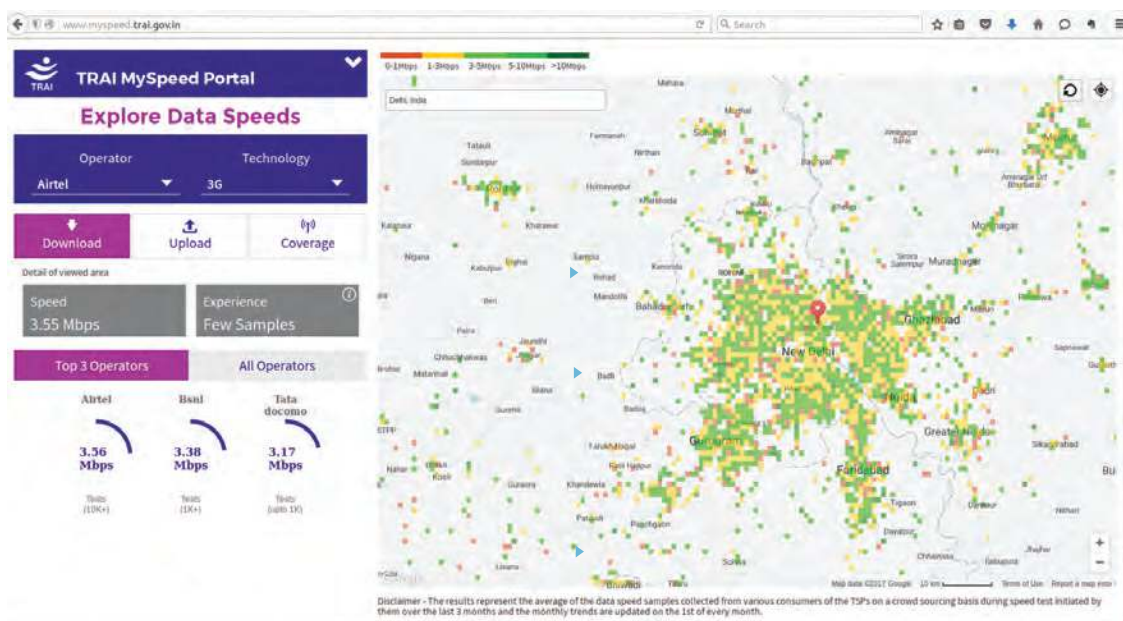
language to enable easy understanding by all. It provides the consumer with a gist of the relevant regulations and orders pertaining to broadcasting and cable TV services. Salient aspects that are covered in this handbook include procedures for connection, disconnection, transfer, shifting, complaint registration and billing.

Keeping pace with global developments

TRAI also has in place a system of in-house training and workshops, through which distinguished national and international experts are invited for interaction with its officers on latest developments in the telecom sector.

In order to keep pace with developments taking place globally, the Authority often deputes members of its staff to various international events, meetings and symposia. This helps in gathering valuable feedback and inputs for its own policy formulation as well in keeping abreast with the latest development in the fields of technology.

The growth of the telecom sector in the last twenty years has brought with it a tremendous increase in the welfare of telecom users as well as efficiency and innovation in many other allied sectors of the economy. As discussed in this report, policy makers and regulators have aided this process by playing a critical role in encouraging growth and limiting any potential harm to consumers, or the sector as a whole. While technology is dynamic and changing constantly, regulation is often slower to develop, and implement. This contrast makes the task of policy making in the communications sphere a delicate one. Dynamic approaches to regulation thus need to be considered. There is a risk that excessive regulatory intervention, or in some cases, non-intervention, could result in stifling innovation or distorting market decisions.

Awareness of some of the main challenges faced by the sector and regulatory framework of today, ranging from convergence to the persisting issue of the digital divide, is therefore necessary to be better equipped to handle these challenges in future.

Convergence

The convergence of telecom, media broadcasting and Internet services is widely recognised to be a landmark development in technology and service innovation. At the same time, it has given rise to many policy challenges with countries across the globe still mulling over the optimum strategy to adapt. Convergence refers to the trend of delivering the same communications services – voice, video and data – over multiple communications platforms. With the adoption of IP based next generation networks, the proliferation of converged services is only growing and at a cost much lower than traditional legacy networks. These networks hold promise for the delivery of varied services spanning from media to communications, computing and financial technologies.

FIGURE 7.1: CONVERGENCE

CONVERGENCE

For consumers, this spells good news, with benefits of better compression technologies, peer to peer tools, the ability to seamlessly store data and content over multiple platforms, and more intelligent user interfaces. This also requires a shift in how networks are conceptualised, moving away from merely intelligence at the ends of the network to technologies such as Software-Defined Networking (SDN) which allows intelligence to reside in the network itself.[51]

From a regulatory standpoint, convergence raises important issues of its implications on competition and the nature of regulation in future. In fact, one of TRAI's objectives is "Preparing the grounds for smooth transition to an era of convergence of services and technologies". NTP, 2012 also put an increased focus on convergence. This included a focus on reviewing and harmonising the legal, regulatory and licensing framework in a time bound manner to enable seamless delivery of converged services in technology and service neutral environment, and promote:

- Convergence of services i.e. convergence of voice, data, video, Internet telephony (VoIP), VAS and broadcasting services.

- Convergence of networks i.e. convergence of access network, carriage network (NLD/ ILD) and broadcast network.

- Convergence of devices i.e. telephone, personal computer, television, radio, STBs and other connected devices.

In March 2006, TRAI released its Recommendations on issues relating to Convergence and Competition in Broadcasting & Telecommunications. Key challenges identified by the Authority include:

- **Bottlenecks:** A regulatory regime that discriminates between service providers on account of technology used or services offered will hamper growth. For example, telecom companies in the USA were unable to roll out their IPTV services on account of the fact that provision of cable TV services requires approval/ license/ franchise at municipal level. Thus even though their high speed broadband infrastructure is in place, the telecom companies were unable to launch IPTV services.

- **Imperfect competition:** Different regulatory standards for different modes of service delivery may lead to concerns of a level playing field, and consequently imperfect competition. As an example of this, absence of any obligations/ regulations which are imposed on the circuit switched telephone service providers, the per-minute call charges being offered by the VoIP service providers are significantly less than those being charged by the circuit switched telephone networks. Thus, possibilities of regulatory arbitrage should be minimised. Further, different FDI limits for different technologies providing the same end service create similar competitive concerns.

The Communications Convergence Bill, 2000, which has since lapsed, was an attempt towards creating a single regulatory authority for the communications sector. In fact, it was in recognition of this trend towards convergence that the TRAI

Act was amended in 2000 to allow the Central Government to bring broadcasting services within the ambit of TRAI's regulation.

As noted above, the Authority itself, in 2006, recommended the need for a converged regulatory approach for facilitating more competition. Since then, TRAI has been analysing the need and implementation of a converged framework, and has in this regard undertaken initiatives such as commissioning a study paper on 'Convergence and its Regulatory Impact' in March, 2010, which examined the technologies, trends and regulatory impact of convergence. Leaps in modern technology are rapidly closing the gap between different categories of communication services. Issues of convergence will therefore continue to become even more relevant in the coming years.

Different licensing requirements for different entities providing the same or similar services has been a particularly contentious challenge thrown up by convergence. Given that several Over-the-top (OTT) content players provide communication services akin to voice services, telecom service providers argue that there is a need to regulate the two entities similarly. In the above context, TRAI also released a consultation paper on the regulatory framework for OTT services in April, 2015, inviting public opinion on the subject matter. TRAI has also issued related consultation papers on 'net-neutrality' and 'Internet telephony' in recent years. Some of the important issues highlighted in these papers are as follows -

- Policy and regulatory environment and need for regulation
- Security concerns of OTT players providing communication services
- Issues relating to security, safety and privacy of the consumer
- Issues arising because of net-neutrality
- Network discrimination and traffic management practices.

Coordination with other agencies

The convergence of technologies and services and increasing interconnectedness between telecom and other sectors, also prompts the need to rethink the inter-relationship between the different agencies that regulate these sectors. At present, the DoT is responsible for licensing, spectrum management, investment promotion, standardisation, and research and development efforts in telecom. TRAI is responsible for regulation of QoS, tariff and consumer protection related issues pertaining to telecom and broadcasting. Content regulation for broadcasting is looked into by MIB, which is also responsible for the allocation of spectrum for broadcasting purposes. Apart from this, the Ministry of Electronics and Information Technology (MeitY) is responsible for administering the Information Technology Act, 2000 that relates to electronic transactions and matters of Internet governance. MeitY is also responsible for overseeing the development of government IT infrastructure and promoting the growth of ICT services in India.

The move towards digital services, particularly digital financial services, has also created the need for more cooperation

[51] OfCom report, Communications: The next decade, 30 April, 2010.

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between the Authority and other sectoral regulators. TRAI's open consultation process is one such avenue for ensuring effective area of cooperation with other agencies. For example, recognising the potential for delivery of digital financial services, TRAI has released several consultation papers, to which the Reserve Bank of India has provided its inputs. Going forward, this works in the alignment of regulatory approaches of various sectoral regulators will gain even more significance.

On certain counts, express legislative provisions that facilitate cooperation between regulators open the window for TRAI and DoT to seek comments from other sectoral regulators prior to enacting a regulation. For example, on matters of competition enforcement, while the TRAI Act provides for the TRAI to ensure on an ex ante basis the promotion of competitive conditions in the industry, the Competition Act, 2002 empowers the Competition Commission of India (CCI) to look into matters of ex post intervention and enforcement. Accordingly, the Competition Act provides for statutory references from other government agencies, including TRAI, which enable cooperation on matters of competition enforcement and regulation in the telecom sector. These issues also gain prominence in the context of convergence, which often blurs the boundaries between traditionally distinct markets.

Bridging the digital divide

The telecom sector during the recent years has seen improvements in various operating parameters like rising increasing teledensity and usage, double-digit growth in Internet subscribers and increasing data-consumption levels. The Government on its part has also supported the sector with lots of positive initiatives such as the, NOFN project, launching of payments banks, new spectrum trading rules, Digital India and Make in India programs, which are helping in tapping the unexplored areas of the sector.

As highlighted earlier, India has been on a steady growth path when it comes to teledensity in both the urban and rural areas. Telecom service operators are expanding their reach every quarter and their renewed focus in rural areas is proven by the rise in rural telecom density which stood at 48.83 percent as on January 31, 2016, showing a year on year growth of 8.14 percent. However, lack of adequate telecom infrastructure in semi-rural and rural areas could be one of the major hindrances in tapping the potential rural telecom market, as service providers have to incur a significant amount of capital expenditure in order to set up their presence in rural areas. Moreover, these untapped areas not only lack basic infrastructure such as roads and power but also face scarcity of trained personnel, which further creates obstacles in deployment of services in these areas. The new RoW rules adopted by the Government and the push towards green technologies that can help address the power shortage issues are part of the solution.

There are also a number of barriers at the access level. Although underserved communities in India are gaining access to computers and the Internet their benefits are limited because of factors such as infrastructural barriers, economic barriers, literacy and skill barriers, content as well as language barriers. An important step towards reducing the digital divide is to give priority to the development of communication infrastructure as well as make available, affordable access to information to individuals in all geographical areas of the country.

The following are some of the recent initiatives that have been taken by TRAI with an aim towards bridging the digital divide:

▸ ***Broadband proliferation:*** A cornerstone of the Government's Digital India initiative is broadband connectivity. This will depend on leveraging cable TV infrastructure, satellite bandwidth and executing BharatNet through the BOOT model. Digital India is the most transformative project of the current government with a vision to change India into a knowledge economy. TRAI had suggested to the government that the BOOT model be adopted for its BharatNet strategy with active participation from entrepreneurs to operate, use and market the network, besides utilising cable TV infrastructure for speedier broadband penetration.

▸ ***Proliferation of broadband through public Wi-Fi networks:*** In its recommendations issued on this subject in March 2017, TRAI has proposed certain measures for addressing the regulatory/license issues as well as operational issues on the both the supply and demand side. While the recommendations touch upon subjects like infrastructure sharing, additional spectrum, seamless authentication in networks, its key suggestion is on the introduction of a concept of PDOs and PDOAs (PDO Aggregators). TRAI has recommended that PDOAs be allowed to provide Wi-Fi with only some specific registration requirements and without the need of a license. These aggregators will get into agreements with PDOs who will act as the venue providing the Wi-Fi service. If the Government chooses to adopt these recommendations it could potentially trigger the next wave of changes in digital inclusion.

▸ ***Free data in rural India:*** In December 2016, TRAI issued its recommendations on encouraging data usage in rural areas through provisioning of free data. This is in line with the Government's mission towards transforming the country into a digitally empowered one. The USOF may be used as the source to implement such a schemes to provide a reasonable amount of free data to rural subscribers.

Independent grievance redress

Despite the many leaps that have been made in ensuring better conditions for telecom users, the Indian telecom sector still has some way to go in terms of mechanisms for addressing consumer complaints. This forms one of the core principles of consumer protection, but is an area that needs some more focus. The TDSAT was set up under the TRAI Act to resolve and adjudicate disputes between a group of consumers and telecom service providers. It however does not look into individual complaints.

With the objective of addressing the above TRAI has issued regulations specifying the grievance redress mechanisms to be put in place by service providers. In addition to this, it has made specific recommendations for the setting up of a sector-specific independent ombudsman, first in 2004 and now again in 2017. Setting up of such an establishment will go a long way in tackling consumer redress at an individual level and increasing confidence among users. Hence, it is an essential requirement for a key sector such as telecom, especially given the fact that telecommunication services offer the underlying framework for the provision of so many other products and services in the economy.

Towards more innovation

The NTP, 2012 declares promoting innovation and indigenous R&D to be a key objective for the government. Research and development on issues such as interoperability standards, next-generation networks, cyber-security and new technologies like IoT can be encouraged through research universities, innovative ecosystems and investment in these areas. In particular, there may be a need to create enabling test environments and innovation labs in the country. In 2015, the Department of Electronics & IT, ERNET India and NASSCOM launched a Centre of Excellence for Internet-of-things in Hyderabad- an initiative expected to promote research and skill development in the IoT space.

The impact of policy choices on future innovation is difficult to gauge in advance. For this reason, the Authority is keen to engage in detailed consultations on creating a culture of innovation in the country and promoting innovation and networks of the future. This will enable it to identify potential regulatory hurdles and implement a forward-looking policy agenda.

References

All India Radio, Growth and development. available online at http://allindiaradio.gov.in/Profile/Growth%20and%20 Development/Pages/default.aspx.

Bhunia, Amalendu. 2011. An impact of ICT on the growth of capital market - Empirical evidence from Indian stock exchange, Information and Knowledge Management, 1(2). available online at http://www.iiste.org/Journals/index.php/IKM/article/ viewFile/745/3899

Central Statistics Office, 2016. Press note on estimates of GDP for the second quarter of 2016-17, 30 November 2016. available online at http://mospi.nic.in/sites/default/files/press_release/nad_PR_30nov16.pdf

Reserve Bank of India, 2016. Bulletin, 10 Feb 2016. available online at https://www.rbi.org.in/Scripts/BS_ViewBulletin. aspx?Id=16102

Chen et al., 1999. Intelligent networks. available online at http://www.tml.tkk.fi/Studies/Tik-110.300/1998/Essays/in_2.html

Confederation of Indian Industry (CII), 2016. e-Commerce in India - A game changer for the economy. available online at https://www2.deloitte.com/content/dam/Deloitte/in/Documents/technology-media-telecommunications/in-tmt-e-commerce-in-india-noexp.pdf.

Czernich, Nina et al., 2009. Broadband infrastructure and economic growth, CESifo Working Paper Series No. 2861. available online at http://papers.ssrn.com/abstract=1516232.

Deloitte, GSMA and Cisco, 2012. What is the impact of mobile telephony on economic growth? available online at http://www. gsma.com/publicpolicy/wp-content/uploads/2012/11/gsma-deloitte-impact-mobile-telephony-economic-growth.pdf.

Deloitte, 2014. Value of connectivity: Economic and social benefits of expanding Internet access. available online at https:// www2.deloitte.com/content/dam/Deloitte/br/Documents/technology-media-telecommunications/ValorConectividade.pdf

Department of Economic Affairs, Government of India, 2016. Press Release, 8 November, 2016. available online at http:// finmin.nic.in/press_room/2016/press_cancellation_high_denomination_notes.pdf.

Esmail, 2015. A handy guide to frequency bands used for telecommunication in India, Telecom Talk. (22 March 22, 2015). available online at https://telecomtalk.info/frequency-bands-used-india-telecommunication/132738/

European Commission, IMF, OECD, UN and World Bank, 2008. System of National Accounts. available online at https:// unstats.un.org/unsd/nationalaccount/docs/SNA2008.pdf.

EY-FICCI, 2015. Speeding ahead on the telecom and digital economy highway. available online at http://www.ey.com/ Publication/vwLUAssets/EY_-_Speeding_ahead_on_the_telecom_and_digital_economy_highway/$FILE/ey-speeding-ahead-on-the-telecom-and-digital-economy-highway-chapter-1.pdf.

EY, 2014. Inside telecommunications in India. available online at http://www.ey.com/Publication/vwLUAssets/EY_-_Inside_ Telecommunications_-_Issue_12/$FILE/EY-inside-telecommunications-issue-12.pdf.

Frontier Economics, 2011. Contribution of the digital communications sector to economic growth and productivity in the UK, Report prepared for Department for Culture, Media and Sport (UK). available online at https://www.gov.uk/government/ uploads/system/uploads/attachment_data/file/77464/FE-Full-Report_digitalcomms_economicgrowth.pdf.

Gandhi, Rikin et al., 2009. Digital green: Participatory video and mediated instruction for agricultural extension. available online at http://itidjournal.org/itid/article/view/322.

GSMA, 2015. Connected women: Bridging the gender gap: Mobile access and usage in low and middle-income countries. available online at http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2016/02/Connected-Women-Gender-Gap.pdf.

GSMA, 2016. The mobile economy. available online at https://www.gsmaintelligence.com/research/?file=97928efe09cdba2864c dcf1ad1a2f58c&download.

IBEF, Education sector in India, Last updated March 2017. available online at http://www.ibef.org/industry/education-sector-india.aspx.

India: The Impact of mobile phones, Policy Paper Series (9), 2009, available online at http://www.icrier.org/pdf/public_policy19jan09.pdf.

Indian Papers/ Submissions in WTO - Negotiating group on basic telecommunications services, 26 October 1995, Ministry of Commerce, Government of India, available online at http://commerce.nic.in/trade/international_trade_negotiating_groupon_bts_4.asp.

ITU, 2016. Measuring the information society report. available online at http://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2016/MISR2016-w4.pdf.

ITU, 2012. The impact of broadband on the economy. available online at https://www.itu.int/dms_pub/itu-d/opb/pref/D-PREF-BB.RPT2-2012-PDF-E.pdf.

Kathuria et al., 2015. An inquiry into the impact of India's app economy. available online at http://icrier.org/pdf/appreport.pdf.

Kathuria et al., 2016. Kathuria et al., Quantifying the value of an open Internet for India. available online at http://icrier.org/pdf/open_Internet.pdf.

Kathuria et al., 2009. Kathuria et al., An econometric analysis of the impact of mobile. The Policy Paper Series, Number 9, Vodafone. available online at http://www.icrier.org/pdf/public_policy19jan09.pdf.

Tim, Kelly, Tim and Carlo Maria Rossotto, eds. 2012. Broadband Strategies Handbook, World Bank. available online at https://openknowledge.worldbank.org/handle/10986/6009.

KPMG-FICCI, 2017. Media for masses: The promise unfolds, Indian media and entertainment. industry report. available online at https://assets.kpmg.com/content/dam/kpmg/in/pdf/2017/03/FICCIFrames2017.pdf.

KPMG, 2016. The future: Now streaming. available online at https://assets.kpmg.com/content/dam/kpmg/in/pdf/2016/08/The-Future-now-streaming.pdf.

McKinsey Global Institute, 2014. India's technology opportunity: Transforming work, empowering people. available online at http://www.mckinsey.com/industries/high-tech/our-insights/indias-tech-opportunity-transforming-work-empowering-people.

Minges, Michael, 2016. Exploring the relationship between broadband and economic growth,, World Development Report. available online at http://pubdocs.worldbank.org/en/391452529895999/WDR16-BP-Exploring-the-Relationship-between-Broadband-and-Economic-Growth-Minges.pdf.

Ministry of Statistics, Government of India, 2015. Press Note, 30 January 2015., available online at http://pib.nic.in/archieve/others/2015/jan/d2015013005.pdf

Notification on appointment of a National Task Force on Information Technology and Software Development, Prime Minister's Office, 22 May 1998, available online at http://it-taskforce.nic.in/appnot.htm.

OfCom UK, 2010. Communications: The next decade, 30 April 2010. available online at https://www.ofcom.org.uk/research-and-data/multi-sector-research/comms-next-decade.

Ovum, 2015. Telecoms, media & entertainment outlook, 2015. available online at http://info.ovum.com/uploads/files/Ovum_Telecoms_Media_and_Entertainment_Outlook_2015.pdf.

PTI, 2013. Economic survey 2013: FDI in telecom sector plunges by 96% to $70.46 million., 2013 available online at http://economictimes.indiatimes.com/industry/telecom/economic-survey-2013-fdi-in-telecom-sector-plunges-by-96-to-70-46-million/articleshow/18709945.cms.

Qiang, Christine Zhen Wei, Carlo Rossotto, and Kaoru Kimura, 2009. Economic impacts of broadband, in Information and Communications for Development, World Bank. available online at http://siteresources.worldbank.org/EXTIC4D/Resources/IC4D_Broadband_35_50.pdf.

Ravi, Shamika Ravi and Darrell M. West, 2015. Spectrum policy in India. (August). available online at https://www.brookings.edu/wp-content/uploads/2016/06/Spectrum-Policy-in-India8515.pdf.

Reserve Bank of India, 2016. Bulletin, 10 Feb 2016. available online at https://www.rbi.org.in/Scripts/BS_ViewBulletin.aspx?Id=16102.

Gandhi, Rikin et al., 2009. Digital green: Participatory video and mediated instruction for agricultural extension. available online at http://itidjournal.org/itid/article/view/322.

Scott, Colin, 2012. Does broadband Internet access actually spur economic growth? available online at http://www.eecs.berkeley.edu/~rcs/ classes/ictd.pdf.

Ravi, Shamika Ravi and Darrell M. West, 2015. Spectrum policy in India. , (August). available online at https://www.brookings.edu/wp-content/uploads/2016/06/Spectrum-Policy-in-India8515.pdf.

Somesh Jha, 2013. Major sectors saw decline in FDI inflows in FY '13 despite reforms. available online at http://www.business-standard.com/article/economy-policy/major-sectors-saw-decline-in-fdi-inflows-in-fy-13-despite-reforms-113062300285_1.html.

Tim, Kelly, Tim and Carlo Maria Rossotto, eds. 2012. Broadband Strategies Handbook, World Bank. available online at https://openknowledge.worldbank.org/handle/10986/6009.

The Earth Institute Columbia University & Ericsson, ICTs and SDGs, 2016. available online at https://www.ericsson.com/res/docs/2016/ict-sdg.pdf.

TRAI, 2016. Consultation paper on issues related to radio audience measurement and ratings in India,, (15 March 2016). available online at http://www.trai.gov.in/sites/default/files/Consultation_Paper_RAM.pdf.

TRAI, 2007. Telecommunication consumers education and protection fund regulations. (6 of 2007). available online at http://trai.gov.in/sites/default/files/201209030250489400257regulation15jun07[1].pdf.

USOF presentation, USOF roles and responsibilities, January 2016, available online at http://usof.gov.in/usof-cms/miscellaneous/USOF_brief.pdf.

Wolcott, Peter, 2005. The provision of Internet services in India. available online at http://mosaic.unomaha.edu/India_2005.pdf.

World Bank Data, 2005. Hospital beds per thousand people, 1970-2005. available online at http://data.worldbank.org/indicator/SH.MED.BEDS.ZS.

World Bank Group, 2016. World development report 2016: Digital dividends. available online at http://www.worldbank.org/en/publication/wdr2016.

World Bank, 2011. ICT in agriculture, e-Sourcebook, 2011. available online at indiagovernance.gov.in/files/ict_in_agriculture.pdf.

Acknowledgements

Abbreviations

3G	Third Generation
4G	Fourth Generation
ADC	Access Deficit Charge
AGR	Adjusted Gross Revenue
AIR	All India Radio
ARPU	Average Revenue Per User
BBNL	Bharat Broadband Network Limited
BOOT	Build-Own-Operate-Transfer
BSNL	Bharat Sanchar Nigam Limited
BSO	Basic Service Operator
BTS	Base Transceiver Service
BWA	Broadband Wireless Access
CAGR	Compounded Annual Growth Rate
CAS	Conditional Access Systems
CCI	Competition Commission of India
CDMA	Code Division Multiple Access
CGRF	Consumer Grievance Redressal Forum
CMIE	Centre for Monitoring Indian Economy
CMTS	Cellular Mobile Telephone Services
CoD	Cash on Delivery
CPP	Calling Party Pays
CRFC	Community Radio Facilitation Centre
CRS	Community Radio Station
DAS	Digital Addressable Cable Television Systems
DD	Doordarshan
DLC	Domestic Leased Circuit
DoT	Department of Telecommunications
DSL	Digital Subscriber Line
DTH	Direct to Home
DTT	Digital Terrestrial Television
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization
e-KYC	electronic Know Your Customer
FDI	Foreign Direct Investment
FM	Frequency Modulation
FTA	Free-to-air
FTTC	Fiber-to-the-Curb
FTTH	Fiber-to-the-Home
GDP	Gross Domestic Product
GOPA	Grant of Permission Agreement
GSM	Global System for Mobile communications
GSMA	Groupe Speciale Mobile Association
GVA	Gross Value Added
HHI	Herfindahl-Hirschman Index
HITS	Headend-In-The-Sky
ICRIER	Indian Council for Research on International Economic Relations
ICT	Information and Communication Technology
ILD	International Long Distance
ILDO	International Long Distance Operator
IN	Intelligent Network
IoT	Internet of Things
IPTV	Internet Protocol Television
IP-I	Infrastructure Providers-I
ISD	International Subscriber Dialling
ISDN	Integrated Services Digital Network

ISP	Internet Service Provider
ITU	International Telecommunication Union
IUC	Interconnection Usage Charge
IVR	Interactive Voice Response
JAM	Jan Dhan-Aadhar-Mobile
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
Kbps	Kilobits per second
LCO	Local Cable Operator
LSA	Local Service Area
M2M	Machine-2-Machine
Mbps	Megabits per second
MeitY	Ministry of Electronics and Information Technology
MIB	Ministry of Information and Broadcasting
MNP	Mobile number portability
MRP	Maximum retail price
MSO	Multi Service Operators
MTNL	Mahanagar Telephone Nigam Limited
NBP	National Broadband Plan
NCPR	National Customer Preference Register
NEFT	National Electronic Funds Transfer
NeGP	National e-Governance Plan
NGOs	Non government Organisations
NIC	National Informatics Centre
NIXI	National internet Exchange of India
NLD	National Long Distance
NLDO	National Long Distance Operator
NOFN	National Optical Fibre Network
NTP, 1994	National Telecom Policy, 1994
NTP, 1999	New Telecom Policy, 1999
NTP, 2012	National Telecom Policy, 2012
OECD	Organisation for Economic Co-operation and Development
Opex	Operating expenditure
OTT	Over-the-top
PCO	Public Call Office
PCR	Priority call routing
PDO	Public Data Office
PDOA	Public Data Office Aggregators
PG	Public Grievances
PPP	Public-Private Partnership
QoS	Quality of Services
RIO	Reference Interconnect Offer
RoW	Right of Way
RPP	Recieving Party Pays
RTGS	Real Time Gross Settlement
RTI	Right to Information
SDN	Software-Defined Networking
SIM	Subscriber Identification Module
SMP	Significant Market Power
SMS	Short Message Service
STB	Set top box
STD	Subscriber Trunk Dialling
STK	SIM Tool Kit
STV	Special Tariff Voucher
TDSAT	Telecom Disputes Settlement and Appellate Tribunal
TERM	Telecom Enforcement, Resource and Monitoring

TFP	Total Factor Productivity
TRAI	Telecom Regulatory Authority of India
TTO	Telecommunication Tariff Order
UAS	Unified Access Services
UPI	Unified Payment Interface
USO	Universal Service Obligation
USOF	Universal Service Obligation Fund
USSD	Unstructured Supplementary Service Data
VCC	Virtual Calling Cards
VHF	Very High Frequency
VNO	Virtual Network Operator
VSNL	Videsh Sanchar Nigam Ltd.
WAP	Wireless Access Protocol
WPC	Wireless Planning & Co-ordination Commission

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