



Telecom Regulatory Authority of India



**Inputs for Formulation of
National Telecom Policy - 2018**

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CHAPTER-I: INTRODUCTION

A. Background

1. The Department of Telecommunications, through its letter dated 21.08.2017 (**Annexure-I**), requested the Telecom Regulatory Authority of India (hereinafter, referred to as TRAI, or, the Authority) to suggest its policy inputs for formulation of National Telecom Policy - 2018.

B. Indian Telecom Sector

2. The Indian telecom sector is the second largest in the world by number of telephone subscribers with 1.2 billion subscribers as on 30.11.2017. India also has the world's second-largest internet subscriber base with 450 million internet subscribers as on 30.11.2017. It has one of the lowest tariffs for telecommunication services in the world.
3. The Indian telecom sector has undergone a high pace of market liberalization and growth since the 1990s and is, at present, one of the fastest growing telecom markets. It has played a significant role in the socio-economic development of India. As per industry estimates, the Indian telecom sector accounted for 6.5% of India's GDP while providing direct and indirect employment to four million people in 2015.
4. Department of Telecommunications (DoT), Ministry of Communications, is responsible for formulating Policy Frameworks aimed at accelerating growth of the telecommunication services. The main functions of DoT relating to policy formulation are listed below:
 - (i) Policy, Licensing, and Coordination matters relating to telegraphs, telephones, wireless, data, facsimile and Telematics services and other like forms of communications;
 - (ii) International cooperation in matters connected with telecommunications including matters relating to all international bodies dealing with telecommunications;
 - (iii) Promotion of standardization, research and development in telecommunications;

- (iv) Promotion of private investment in Telecommunications;
- (v) Financial assistance for the furtherance of research and study in telecommunications technology, and for building up adequately trained manpower for telecom programmes;
- (vi) Administration of laws with respect to any of the matters specified in the Acts, namely:
 - a. The Indian Telegraph Act, 1885 (13 of 1885),
 - b. The Indian Wireless Telegraphy Act, 1933 (17 of 1933); and
 - c. The Telecom Regulatory Authority of India Act, 1997 (24 of 1997).

C. Telecom Policies in India

5. Recognizing that provision of world class telecommunications infrastructure is the key to rapid socio-economic growth of the country, the Government has been announcing its telecom policy statements on a regular interval since the onset of market liberalization in the country in the early 1990s. In effect, post-liberalization the Indian telecom sector has been shaped by four policy statements viz. –

- (a) National Telecom Policy, 1994,
- (b) New Telecom Policy, 1999
- (c) Broadband Policy, 2004
- (d) National Telecom Policy, 2012

6. A brief description of the afore-mentioned policy statements is given below:

6.1. National Telecom Policy, 1994:

National Telecom Policy, 1994 (hereinafter referred to as the NTP-94) provided for opening up the telecom sector to competition in Basic Services as well as Value Added Services like Cellular Mobile Services, Radio Paging, VSAT Services etc. It also set targets for provision of telephone on demand and universal service (connecting all villages) by the year 1997, apart from opening up of long distance telephony.

6.2. New Telecom Policy, 1999:

With a view to remove some of the bottlenecks, and move the liberalization process forward, the Government of India, in 1999, announced New Telecom

Policy, 1999 (hereinafter referred to as the NTP-99). Provision of 'Universal Service' (including unconnected and rural areas, re-targeted for year 2002), and, provision of sophisticated telecom services capable of meeting needs of the country's economy were the main objectives of NTP-99. It had targets to provide 'Internet' access to all district-head-quarters (DHQs) by 2000 and to provide high speed data and multimedia capabilities to all towns of population of 2, 00,000 and above by 2002. Apart from a target for overall tele-density of 7% by year 2005 (and 15% by 2010), NTP-99 had a target for achieving rural 'tele-density' of 4% in the same period.

6.3. **Broadband Policy, 2004**

Recognizing the potential of ubiquitous Broadband service in growth of Gross Domestic Product (GDP) and enhancement in quality of life through societal applications including tele-education, tele-medicine, e-governance, entertainment as well as employment generation by way of high speed access to information and web-based communication, Government announced the Broadband Policy, 2004 to accelerate the growth of Broadband services. The Broadband Policy, 2004 visualized creation of infrastructure through various access technologies which could contribute to growth and could mutually coexist. It defined broadband connectivity as an 'always-on' data connection that is able to support interactive services, including Internet access and has the capability of the minimum download speed of 256 kbps to an individual subscriber. The Policy also estimated that, by 2010, Internet subscription and broadband subscription would rise to 40 million and 20 million respectively.

6.4. **National Telecom Policy, 2012**

With a vision to transform the country into an empowered and inclusive knowledge-based society, using telecommunications as a platform, the Government of India, in 2012, announced the National Telecom Policy, 2012 (hereinafter referred to as the NTP-2012). In the NTP-2012, the Government laid special emphasis on providing affordable and quality telecommunication services in rural and remote areas. It targeted - to increase the rural tele-density to 70 by 2017, and, to 100 by 2020; and to provide 'broadband-on-demand' by 2015. It also targeted to make India a global hub of domestic manufacturing and provided a roadmap to become a leader in cutting edge,

state of the art technologies through R&D, and creation and incorporation of Indian IPRs in global standards. On licensing and spectrum management front, the NTP-2012 aimed for simplification of licensing framework and for ensuring adequate availability of radio spectrum with a view to further extend converged high quality services across the nation, including rural and remote areas.

D. Government's proposed telecom policy statement of 2018

7. DoT, on its web-site, has stated that the new telecom policy will be governed by the key guiding principle of alignment with the national vision. Its major themes will, *inter-alia*, be regulatory and licensing frameworks impacting the telecom sector, connectivity-for-all, quality of services, ease of doing business, and absorption of new technologies including 5G and IoT.
8. The Government, through the new telecom policy, seeks to spur the socio-economic development up to the bottom of the pyramid by ensuring voice, video and data connectivity for all. It seeks to provide reliable and secured connectivity with assured quality of service, facilitate development of infrastructure and services for new technologies including 5G and IoT, encourage innovation and manufacturing, and develop a large pool of digitally skilled man-power, by restructuring regulatory and licensing frameworks impacting the telecom sector. The overall aim is to aid digital transformation of the Government, enterprises and industry, infrastructure development including development of world-class cities through planned urbanization, and assume a leadership role in the world economy.

E. Consultation process by TRAI

9. Upon receiving the Government's request through its letter dated 21.08.2017 for providing inputs for formulating the proposed National Telecom Policy, 2018, TRAI prepared an initial draft consisting of a range of issues proposed to be addressed in NTP-2018 and shared the same with stakeholders for preliminary discussions. Subsequently, the Authority invited a wide range of stakeholders for brainstorming on the matter as to what objectives and strategies should form part of the new Policy. Stakeholders included telecom service providers, equipment manufacturers, consulting organizations,

industry associations, Information Technology (IT) companies, content providers, data center companies, broadcasting and cable services companies, etc. Based on the discussions with the stakeholders held on 23.11.2017 and 28.11.2017, and further analysis, the Authority formulated draft inputs for formulating the National Telecom Policy - 2018 and issued a Consultation Paper on 3rd January 2018 to seek views of stakeholders.

10. Written comments on the Consultation Paper were invited from the stakeholders by 19th January 2018. All the comments received were posted on TRAI's website. Subsequently, Open House Discussions were held at New Delhi on 17th January 2018 and at Bengaluru on 24th January 2018. In addition, discussions were held with eminent personalities from telecom sector, economic/policy research institutions and academicians on 17th January 2018 at New Delhi and on 24th January 2018 at Bengaluru seeking their valuable inputs.
11. During these discussions, many stakeholders were of the opinion that in this age of convergence, the proposed policy would affect the complete ICT sector, and accordingly it should be looked at with a much wider perspective. They further suggested that the policy be renamed National Information and Communication Technology (ICT) Policy. The Authority is also of the view that the proposed policy should be entitled the National Information and Communication Technology (ICT) Policy-2018 (National ICT Policy-2018).
12. The Authority, after carefully examining various issues emanating from the written submissions of the stakeholders, discussions during Open House Discussions and inputs received from eminent personalities, has finalized its inputs for formulation of the National Telecom Policy-2018.
13. Chapter-II of this paper provides the structure of Policy Framework for inputs to Government for formulation of the National Telecom Policy-2018 which includes Preamble, Vision, Mission, Objectives, Strategies, and End Notes.

CHAPTER-II: POLICY FRAMEWORK

A. Preamble

1. After pronouncement of NTP-2012, during the last few years, communication sector in India has seen massive transformation. While the mobile networks have got upgraded from 3G to 4G in large parts of the country, the availability of smart phones at affordable prices is driving mobile broadband subscriptions. Further, with the steep decline in tariffs of telecommunication services, the affordability has resulted in multifold increase in data consumption. Access to internet has empowered millions of Indians by giving them access to real-time information, Government services, marketplaces and social media which has a positive impact on quality of life.
2. While the objectives of NTP-2012 relating to subscription of telecommunication services have largely been met except for rural tele-density, the expected success in making India a global hub of domestic manufacturing, development of state of the art technologies through R&D, and creation and incorporation of Indian IPRs in global standards is yet to be achieved.
3. Growth of data communication services is helping in enhancing the economic conditions in rural and remote areas, and spurring new businesses by enabling access of markets to a large number of small and medium enterprises (SMEs). Above all, growth of digital communication networks is boosting competitiveness, enabling innovation, and improving productivity. Enhanced investments in telecom network infrastructure, which allow fast, reliable, and affordable internet connectivity, are leading to socio-economic growth and job creation in India.
4. The convergence of voice, video and data services has also become reality now. In the converged world, while the traditional telecommunication networks are being extensively used to deliver video services, after digitization, the cable TV networks are being increasingly used to provide fixed line broadband services. In order to meet the growing demand for the video, it would be necessary to encourage development of converged broadband and broadcast networks, development of cloud infrastructure for Video on Demand (VoD) services, and increase in high-speed broadband

subscriptions. While video distribution in broadcast mode can fulfil the need of masses, the video on demand can meet the specific requirements of the consumers. Convergence of the networks can ensure efficient utilization of the available resources. The convergence of information, communication, and broadcasting services is creating vast new capabilities that are benefiting individual, businesses, and society as a whole.

5. The digital transformation is emerging as a key driver of sweeping change in the world around us. The telecommunication industry is at the forefront of this transformation. The convergence of the digital and physical products through M2M and IoT services and applications is paving the way for Fourth Industrial Revolution (Industry 4.0). It represents a transition to a new set of systems that bring together digital, biological, and physical technologies in new and powerful combinations. Industry 4.0 is being built around the IoT/M2M infrastructure and services for which the availability of ubiquitous digital communication services; low-cost processing and high-density data storage; and an increasingly connected population of active users of digital technologies are pre-requisite. Therefore, just like physical form of connectivity like Roadways, Railways, Airlines, and Waterways, telecommunication networks i.e. I-ways are also becoming essential infrastructure for economic development in the country.
6. Machine to Machine (M2M) communications systems would connect billions of objects, sensors, and devices. Rollout of 5G networks will connect wearable computers, a vast array of sensors, and other devices, leading to better health, economic gains, and other advantages. 5G networks not only addresses Internet of Things (IoT) deployment on a massive scale, but also of applications previously not possible that depend on ultra-reliable and low-latency communications.
7. In addition to the reliable and low latency connectivity requirements, for success of Industry 4.0, the development of data centers and cloud services is equally essential. Other advances in science and technology such as big data, sensors networks, automation, Intelligent Transport Systems, machine learning, and artificial intelligence also depend extensively on cloud services. The convergence of networks and services is redefining the way the content

is hosted and delivered and this will also fuel the demand for cloud based services. To keep pace with these developments, it would be necessary to formulate policies that would encourage development of networks especially suited for IoT, data centers and associated services, data analytics, cloud computing, and homegrown digital platforms and applications. As these services can be delivered remotely, India can become a global hub for such systems and services.

8. With the introduction of 'Digital India' programme, India has set out on an arduous journey to catapult itself into an era where the Government to Citizen (G2C) and Government to Business (G2B) services are offered online in a most reliable, prompt, and cost-effective manner. The proliferation of mobile services, introduction of digital identity (Aadhaar), and launch of Prime Minister's Financial Inclusion Scheme - the Jan Dhan Yojna has created a JAM trinity foundation on which several layers of digital public goods services have been created by the innovators, commonly known as 'India Stack'. Various citizen centric services like eSign, Digital Locker, BHIM UPI protocol and payment app, eKYC, DBT, Authentication (Attendance, PDS, Aadhaar Pay, Jeevan Pramaan) have been launched on the India Stack. The new ICT policy has to create an enabling environment for JAM infrastructure and platform and build a foundation upon which other applications, processes, businesses and technologies could be developed. The digital communication has presented India an opportunity to overcome the impediments posed by deficiencies in its brick and mortar based physical infrastructure and opened doors to new paradigms in all sectors of economy whereby the common man at the bottom of the pyramid is served more efficiently and at a fraction of cost as compared to earlier days. For these reasons, this policy affects the outcomes of several sectors and should be looked at from a much wider perspective. Accordingly it is suggested that it be called "**the Information and Communication Technology Policy 2018**"
9. For achieving inclusive socio-economic growth in the country, it is essential that benefits of health, education, and digital services reach the population of urban as well as rural areas. Connectivity plays a vital role in extending such benefits. While the physical connectivity - Roadways, Railways,

Airlines, and Waterways - requirements are dealt with by respective policies, this policy is aimed to meet the digital connectivity requirements. The ubiquitous digital connectivity would help in delivering most social services to the bottom of pyramid in cost effective manner in rural and remote areas overcoming the deficit of physical infrastructure in the country. Access to secured data connectivity at affordable prices to every person, enterprise, and industry would transform the knowledge economy of the country.

10. In spite of development of telecommunication sector at a rapid pace during the last two decades, there are a number of challenges that need to be overcome. India is ranked much lower in international indices relating to ICT development and connectivity. Though the mobile wireless services coverage has now reached almost across the country, fiberisation of the networks – very much necessary for meeting the increasing data communication requirements – is very limited. The gains from increased connectivity have been inequitable, with the full benefits not reaching to those who need them most. As per report ‘the State of Broadband: Broadband Catalyzing Sustainable Development’, released in September 2017 by Broadband Commission, jointly established by ITU and UNESCO, 49.5% population of India is still unconnected. Further, the average speed of the internet in India is still much lower than the global average. We are highly dependent on imported equipments and devices as investments in research and development of indigenous systems is negligible. It is necessary to address these challenges and meet new requirements, which include reliable and low latency connectivity requirements, convergence of ICT and media, coordination with other sectors of the economy for successful adoption of IoT, and ensuring privacy and security of users, in a time bound manner. For addressing many of these challenges, large amounts of investments are required in the sector. Further, it is also necessary that the critical issues being faced by the industry are addressed through policy level interventions.
11. Most critical issues, identified on the basis of extensive consultation with stakeholders, which require attention to address challenges being faced by the industry and fuel next wave of growth are:
 - i. **Licensing framework:** With the latest developments taking place in the ICT sector, the nature of the entities rolling out infrastructure, networks,

services, and applications are also changing. While most entities specialize in a particular segment of the value chain, some integrated players are involved in all segments of value chain starting from rolling out infrastructure to offering services and applications for end consumers. Further, the geographic divisions in the form of Short Distance Charging Area (SDCA), Long Distance Charging Area (LDCA), and Licence Service Area (LSA) are also becoming redundant in many cases. Corresponding changes in the licensing/ registration/ permissions structure is necessary to ensure transparency, non-discrimination, and orderly growth of the sector. It has also to be ensured that the licensing framework provide sufficient space for experimentation and innovation.

- ii. **License fee:** The present framework for calculation of license fee and spectrum usage charges requires review as it was devised approximately two decades back when the telecom networks and services were tightly coupled, convergence of networks, services, and devices were non-existent, and the telecom market was primarily a voice centric market. It has served its purpose and the sector has grown at rapid pace during the last two decades. With the developments of technology and markets during the last two decades, the nature of market has changed from voice to data centric, and service providers need to offer a package of services which may consist of many licensed, and some unlicensed services. In this context; it may be appropriate to review the concept of Gross Revenue and its underlining elements. A number of issues related to GR and AGR are being litigated at various forums and it is essential that these be resolved at the earliest. A review of GR and AGR would assist in enhancing clarity and removing ambiguities. Further, due to layering of service providers in the value chain i.e. infrastructure, networks, services, and applications, it is essential to review the positions to avoid cascading of levies. In addition to reviewing the license fee and spectrum usage charges structure, there is a need to review the rates of such levies keeping in view the fact that the access spectrum is now being assigned through auction process, and telecommunication networks have become underlying infrastructure for growth of digital economy. Boost to the digital economy would generate much more employment for citizens and revenue to the Government.

- iii. **Spectrum management:** Spectrum is the most critical resource for rollout of wireless networks and services. Further, it is an intangible asset which perishes with time if not put to any productive use. India's dependence on wireless networks is much more in comparison to other similar sized economies, as we have very low level of penetration of fixed line networks. It is necessary that the available spectrum is utilised fully, and transparently assigned in such a way that results in maximization of socio-economic gains to the country. Wherever it is possible to free up spectrum by utilising more efficient technologies or substitutable wireline systems, the same should be done. To create awareness about the value of spectrum assigned to various Government entities, nominal values should be assigned for such spectrum holdings. To encourage government departments for freeing underutilised/ substitutable spectrum, they should be incentivised and spared spectrum should be assigned for more productive use through auction process. Further, audit and accounting of the spectrum in use by various governments and private entities is also essential to ensure optimum usage of spectrum.
- iv. **Right of Way and Fiberisation:** As has been discussed before, the speedy rollout of communication infrastructure is vital for meeting the increasing demand of data, improving competitiveness, productivity and innovation, and enabling the Fourth Industrial Revolution in the country. The rollout of fibre networks is critical for backhauling the large amount of data, improving reliability, and reducing latency. For speedy rollout of infrastructure, it is necessary that Right of Way permissions, to be granted by the respective local authorities, are granted expeditiously at reasonable charges and in non-discriminatory manner to the service providers. Accordingly, there is need for coordinated efforts among the Central, State, and Local authorities so that a common online portal for granting all kind of Right of Way permissions in time bound manner is put in place swiftly. It will improve ease of doing business in the sector and in attracting required amount of investments.
- v. **Sharing of infrastructure and resources including spectrum:** Sharing of the infrastructure and resources plays a vital role in bringing down

prices and improving affordability of services. While on the one hand it helps in speedy rollout of services and applications, on the other hand it maximizes return on investments, and thereby attracts more investment and creates new jobs. Under the policy, it should be permitted to share the available infrastructure and resources, on voluntarily basis, with any service providers who possess the valid license or permission to offer services using such infrastructure and resources. Further, an online exchange for voluntarily trading and sharing of available infrastructure and resources including spectrum should be put in place to maximize their use, discover market linked prices, and improve efficiency.

- vi. **Development of data centres:** For meeting the new age ICT needs of the country including rollout of cloud services, IoT/ M2M services, content hosting and delivery, software defined networks, and network function virtualization, and in the process transform knowledge economy of India, it is essential that an integrated policy framework for development of data centres involving legal, cyber and data security, connectivity, building space, power, and human capital relating issues is framed early. These data centres can also be used to export ICT services and applications. It will also improve quality of experience for consumers.
- vii. **Research and Development:** Promotion of R&D, innovation, experiments, patent creation, testing, and standardization in the country is a mission critical for self reliance, security of the nation, and addressing the local challenges. We already have a large pool of trained manpower, however, the requisite test bed infrastructure and policy incentives are missing. We can create special technology zones, where a complete ecosystem for promoting such activities can be developed. In such zones, the rules can be further simplified, and required resources including spectrum should be made available on easier terms.

12. Therefore, **the proposed policy** can have twin goals viz. (i) facilitate development of communication infrastructure and services to achieve inclusive socio-economic growth in the country, and (ii) to propel India into becoming the front-runner in the Fourth Industrial Revolution. It should be in alignment with the already stated flagship programs of the Government

i.e. Digital India, Skill India, Start up India, and Make in India. This policy sets the vision, mission, and objectives to be accomplished by the end of calendar year 2022, when India will celebrate 75 years of independence. It also specifies the strategies to accomplish such objectives in particular, and accomplish the mission in general. All strategies have been divided under six heads for the sake of convenience. However each strategy would help in attaining more than one objective classified under different heads.

B. Vision:



VISION

To develop a competitive, sustainable, and investor-friendly Information and Communication Technologies (ICT) market for rollout of state-of-the-art ubiquitous digital communication infrastructure to provide resilient, reliable, affordable, and consumer friendly products and services to meet local as well as global needs; and in the process, transform India's knowledge economy, support inclusive development, foster innovation, and stimulate job creation.

C. Mission:

1. To fulfil the information and communication needs of the individuals including persons with disabilities, governments, enterprises, and industries with high quality of experience at affordable prices on a sustainable basis;
2. To facilitate growth of state-of-the-art, secure, and energy-efficient digital communication infrastructure for delivering ubiquitous, resilient, reliable and ultra-high speed connectivity with extremely low latency for objects, machines, and devices;
3. To stimulate the environment for innovation and entrepreneurial opportunities making India a global centre for research and development, patent-creation, and standardization in Information and Communication Technologies and services;
4. To develop indigenous technologies, equipments, platforms, and applications ecosystem for providing digital services to local and global markets;
5. To establish India as a global hub for cloud computing, content hosting and delivery, and data communication systems and services in a net-neutral environment;
6. To protect consumers' interests by increasing awareness and putting in place an effective grievance redressal mechanism, improving quality of experience, ensuring network, communication and data security, encouraging adoption of environment and safety standards for ICT, and

- modernizing public safety and emergency communications networks;
7. To attract investments by enhancing ease of doing business through simplification of licensing and regulatory frameworks, rationalization of taxes, levies and related compliances, and facilitating availability of resources including spectrum.

D. Objectives:

1. To enable access at affordable prices for wireless broadband services, including through satellite to 90% population by 2022;
2. To ensure availability of bandwidth on demand through wireline, including cable TV and optical fibre networks to 30% households by 2020 and 50% households by 2022;
3. To provide at least 1 Gbps data connectivity to all Gram Panchayats to enable wireless broadband services to inhabitants by 2022;
4. To achieve 900 million broadband subscriptions supporting download speed of 2 Mbps, out of that at-least 150 million broadband subscriptions supporting download speed of 20 Mbps and 25 million at a download speed of 50 Mbps by 2022;
5. To achieve 'unique mobile subscriber density' of 55 by 2020 and 65 by 2022 by enhancing mobile network coverage to 95% of inhabitants by 2020 and 100% by 2022;
6. To deploy 2 million public WLAN including Wi-Fi hotspots in the country by 2020 and 5 million by 2022;
7. To leapfrog India into the top-50 nations in the ICT Development Index (IDI), released by ITU every year, by 2022;
8. To enable access for connecting to 1 billion IoT/ M2M sensors/ devices by 2020 and 5 billion by 2022;
9. To attract an investment equivalent to USD 60 billion in communication sector by 2020 and USD 100 billion by 2022;
10. To become net positive in international trade of communication systems and services by 2022;
11. To create 2 million additional jobs in ICT sector by 2022;
12. To put in place an ombudsman based consumer grievance redressal mechanism by end of 2018;
13. To establish online centralised platform for provision of Right of Way (RoW) permissions for single window clearance by 2019;

14. To achieve backhaul connectivity on optical fibre for at least 60% base stations by 2022;
15. To put in place an online platform for all Government to Business (G2B) activities including spectrum and license related information, applications, clearances, compliances, and payments by 2019;
16. To simplify licensing and regulatory frameworks, and rationalize taxes, levies and related compliances by 2019;
17. To put in place a flexible, robust data protection regime powered by a strong encryption policy by 2019;
18. To establish a policy framework for facilitating setting up of data centres by 2019.

E. Strategies:

i) Strategies for enhancing ease of doing business, establishment of an online platform for G2B activities, rationalise licensing and regulatory regime, attract investment equivalent to USD 100 billion in communication sector, and to leapfrog India into the top-50 nations in international rankings:

- (a) By recognizing communication systems and services as essential connectivity infrastructure at par with other connectivity infrastructure like Roadways, Railways, Waterways, Airlines etc. for development of India, and, in the process, enable low cost financing for development of communication infrastructure;
- (b) Keeping in view importance of communication infrastructure in socio-economic development, by reviewing the license fee, Universal Service obligation Fund (USOF) levy, Spectrum Usage Charges (SUC), definition of Gross Revenue (GR), and concept of pass through revenues in line with principle of input line credit;
- (c) By rationalizing taxes and levies on ICT equipment, infrastructure, and services;
- (d) By restructuring of legal, licensing and regulatory frameworks for reaping the benefits of convergence;
- (e) By working towards further simplification of One Nation – One License concept for services;
- (f) By exploring the possibilities of separation of licenses/permissions for infrastructure, network, services, and applications providers;

- (g) By enhancing the scope of Infrastructure Providers (IP) and promoting deployment of common sharable, passive as well as active, infrastructure;
- (h) Review of license and regulatory compliance requirements keeping in view best international practices;
- (i) By reviewing the penalty provisions in the licenses to ensure that these provisions are commensurate with level of violation or shortcoming;
- (j) By reviewing the objectives of spectrum management to maximise socio-economic gains;
- (k) By incentivising government departments for freeing underutilised/ substitutable spectrum, which could be assigned for more productive use through auction process;
- (l) By establishing an online exchange for voluntarily trading and sharing of available infrastructure and resources including spectrum;
- (m) By publishing annual spectrum utilization and availability roadmap for communication needs including those of aircraft and vessels;
- (n) By simplification of processes, rationalisation of the requirements, and easing grant of licenses/ permissions for spectrum, wireless apparatus, equipment imports, and SACFA clearance to improve efficiency, innovation, and research;
- (o) By putting in place an online platform for all Government to Business (G2B) services including spectrum and license related information, applications, clearances, compliances, and payments;
- (p) By allowing delivery of broadcast services using converged wireline and wireless networks;
- (q) Integrated regulation of ICT and broadcasting sector led by economic and social policy goals of the country;
- (r) Restructuring of TRAI as converged regulator for ICT and Broadcasting sector;
- (s) Review of SATCOM policy for communication services keeping in view the international developments, and social and economic needs of the country;
- (t) By engaging with the State Governments and Local Bodies for faster rollout of communication infrastructure;

- (u) By developing a network readiness index for States/ UTs to attract investments and address RoW challenges;
- (v) By increasing international cooperation;
- (w) By aligning the definitions and data collection of performance parameters with reporting requirements to ITU;
- (x) By improving the performance parameters data collection techniques in close coordination with National Sample Survey Office (NSSO);
- (y) By closely coordinating with Ministry of Human Resource and Development to improve enrolment in educational institutions using ICT;

ii) Strategies to achieve ‘unique mobile subscriber density’ and mobile network coverage targets, and to provide enhanced data connectivity to all the Gram Panchayats:

- (a) By redesigning USO Fund and broadening its objectives;
- (b) By further developing institutional capacity to improve focus on execution of Universal Service Obligation Fund (USOF) schemes for equitable development;
- (c) By promoting sharing of communication infrastructure among service providers;
- (d) By incentivizing the service providers for faster roll-out of services in remote and rural areas;
- (e) By facilitating sub-marine cable connectivity to the inhabited islands of Andaman and Nicobar Islands and Lakshadweep Islands;
- (f) By incentivising production of Li-ion batteries in India to meet out the demand of stable and clean power availability for the communication sector;
- (g) By promoting use of satellites to provide telephony and broadband services in remote and inaccessible areas through –
 - i) rationalization of satellite transponder and spectrum charges; and
 - ii) making available additional transponders, and new spectrum bands (such as Ka band) for satellite-based commercial communication services;
- (h) By encouraging penetration of Digital Infrastructure such as Data Centres to Rural locations;

- (i) By putting in place a mechanism for regular collection of performance data relating to 'unique mobile subscriber density', and 'mobile network coverage';

iii) Strategies to enable access for wireline and wireless broadband services at affordable prices; to develop public WLAN hotspots; to achieve broadband subscription targets; to facilitate RoW permissions; and to achieve backhaul connectivity targets on optical fibre:

- (a) By making requirement for telecom installations and the associated cabling and in-building solutions mandatory in in all commercial, residential and office spaces by amending National Building Code of India (NBC), through Bureau of Indian Standards (BIS);
- (b) By making provisions in the Indian Telegraph Right of Way Rules, 2016 for establishment of common service ducts, utility corridors in all new city and highway road projects, and related infrastructure elements for underground telecom infrastructure;
- (c) By facilitating development of Open Access Networks (OAN) to improve access and affordability of communication services;
- (d) By framing uniform guidelines for enabling installation of telecom towers in government premises;
- (e) By including telecommunication service assets in critical/emergency infrastructure category and ensuring availability of uninterrupted & affordable energy on priority;
- (f) By leveraging cable TV sector and power sector assets;
- (g) By upgradation of cable TV networks for delivery of converged broadcast and broadband services;
- (h) By facilitating development of content delivery networks for improved quality of experience;
- (i) By mapping telecom infrastructure assets like OFC cables, common service ducts and towers on NIC's National GIS Platform;
- (j) By implementation of corresponding infrastructure status benefits (such as availability of funds at concessional rates, allowing higher ECB limits, extension of VGF, etc.) to infrastructure providers;
- (k) By incentivizing fixed-line broadband services;
- (l) By devising enabling provisions for sustainable development of public WLAN hotspots, their interoperability and sharing;

- (m) By encouraging innovative approaches to infrastructure creation and access including through resale and Virtual Network Operators (VNO);
- (n) By working with State Governments for facilitation of massive deployment of Small Cells and optical fibre;
- (o) By allowing broadband connectivity services to moving platforms (such as aircraft, vessels, and trains) using state-of-the-art technological solutions including use of Earth Station In Motion (ESIM);
- (p) By monitoring efficient utilization of spectrum by conducting regular audit of the spectrum allocated to both commercial as well as government organizations;
- (q) By ensuring adequate availability of contiguous, broader and globally harmonised spectrum;
- (r) By encouraging efficient usage of spectrum through new technologies that support greater spectrum efficiency;
- (s) By exploring possibility of further liberalizing the spectrum sharing, leasing, and trading regime;
- (t) By revisiting maximum input power level restrictions at antenna and their measurement methodologies;
- (j) By facilitating effective competition amongst service providers;
- (u) By promoting efficiency in the operation of communication services;
- (v) By encouraging innovation in service delivery including bundling and pricing to expand reach and affordability;
- (w) By reviewing the policy of IP- PSTN connectivity;
- (x) By facilitating efforts to widen digital literacy of consumers;

iv) Strategies to enable access for IoT/ M2M sensors/ devices:

- (a) By closely coordinating with stakeholders relating to Agriculture, Smart Cities, Intelligent Transport Networks, Multimodal Logistics, Smart Electricity Meter, Consumer Durables etc. to develop market for IoT/ M2M connectivity services;
- (b) By creating appropriate institutions for coordinated development of 5G services, IoT/ M2M systems, and their security framework;
- (c) By closely working with sector specific Industry Councils for preparing roadmap for transformation of each sector to Industry 4.0;

- (d) By prescribing simplified and enabling licensing and regulatory framework for IoT/ M2M service providers;
- (e) By identifying and making available new Spectrum bands for Access and Backhaul segment for timely deployment and growth of 5G network.
- (f) By earmarking of suitable licensed and unlicensed spectrum for IoT/ M2M services;
- (g) By identifying the numbering resources for IoT and M2M communication devices and developing a unified numbering plan for fixed line and mobile services;

v) Strategies for setting up of data centres; developing ecosystem for indigenous digital platforms and services; establishing India as a global hub for research and development, innovation, cloud computing, content hosting and delivery, and data services; to become net positive in international trade of telecommunication systems and services; and job creation in ICT sector:

- (a) By prescribing an integrated policy framework consisting of cyber and data security, connectivity, building space, power, and human capital related issues;
- (b) By declaring data privacy, protection, and security laws;
- (c) By prescribing policy for cross-border data transfer;
- (d) By enacting net-neutrality laws;
- (e) By strengthening of cyber-security of communication systems and emergency response capabilities;
- (f) By incentivizing setting up of International Data Centres (IDCs) in India;
- (g) By facilitating establishment of interconnect exchanges for data services;
- (h) By facilitating augmentation of international bandwidth capacity to ensure easy access from outside India;
- (i) By prescribing a simple and enabling regulatory framework for deployment of cloud based systems;
- (j) By promoting collaborative approach (sharing/pooling of resources) between telecom service providers to maximize the benefits of cloud based systems;

- (k) By becoming a global hub for remote management of telecommunication networks;
- (l) By encouraging partnership between industry and academia for development of human capital for data analytics and product development;
- (m) By effectively utilising the training infrastructure available with telecom PSUs for skill development in ICT;
- (n) By effectively utilising the telecom centres of excellence for research;
- (o) By establishing NTIPRIT as an apex institute for policy practitioners, industry, researchers, academicians;
- (p) By earmarking 40% of incremental USOF for financing R&D, Innovation, and development of communication systems and services as per indigenous needs;
- (q) By providing financial incentives for the development of Standard Essential Patents (SEPs) in the field of telecommunication technologies;
- (r) By facilitating setting up of 'Special Technology Zones' (STZs) for experimental products to invite product and technology innovation and development in India;
- (s) By making TEC responsible for development and enforcement of standards for telecom products and services;
- (t) By developing own test labs and certification infrastructure;
- (u) By facilitating development of required infrastructure for research and development, incubation centres, standardization, testing, and certification of digital communication systems, products and services;
- (v) By establishing Telecom Research and Development Centre for identification, customization, and development of digital products and services in the country as per indigenous needs;
- (w) By prescribing a simple and enabling regulatory framework for Application Service Providers in order to promote innovation in Application Services;
- (x) By reducing entry barriers for Start-ups in the sector;
- (y) By formulating a simple and transparent method for expeditious allocation of frequency for experimental, demonstration, and research purpose;

- (z) By incentivising local manufacturing of network equipment and devices;
- (aa) By putting in place a mechanism for collecting performance data relating to investment, import, and export in respect of communication products and services;
- (bb) By reviewing the Other Service Provider regime;
- (cc) By coordinating with EXIM Bank and Telecom Export Promotion Council (TEPC) to facilitate international trade of telecommunication systems and services;
- (dd) By upgrading the manufacturing PSU under DoT to actively exploit their strategic and operational synergies;
- (ee) By facilitating proactive collaboration with the technology companies for trials and experimentation;

vi) Strategies for protecting interest of consumers, data protection regime, and modernizing public safety and emergency communications networks:

- (a) By strengthening consumer grievance redressal mechanisms through awareness and protection;
- (b) By establishing office of telecom ombudsman and centralized web based compliant redressal system;
- (c) By ensuring availability of mission critical communications infrastructure and service to every state and central public safety and disaster relief agency;
- (d) By providing necessary spectrum for other government services such as METRO and high-speed rails, Government radio networks, municipal services, forest and irrigation departments, flood control, etc.;
- (e) By reviewing/easing CMRTS license for all government and public-sector users;
- (f) By requiring all licensed telecom service providers to implement Next Generation 112 service availability in all areas and provide on line access to caller location and details to the authorized central and state agencies;
- (g) By creating a disaster management cell for early restoration of telecom services during disasters;

- (h) By facilitating establishment of a Pan India network for Public Protection and Disaster Relief(PPDR) on PPP mode;
- (i) By implementing Global and regional harmonized spectrum Plans for PPDR;
- (j) By making available necessary spectrum as needed for PPDR in accordance with regional and global standards;
- (k) To facilitate establishment of INSAT satellite based Mobile communication system including device eco-system on PPP mode for PPDR.
- (l) Strengthen network resilience by framing and enforcing standard operating procedures to be followed during disasters and natural calamities;
- (m) To put in place a flexible, future proof data protection regime powered by strong encryption policy;
- (n) To come out with specific policy for facilitating the access of Communication services for Persons with Disability (PwD).
- (o) By announcing a comprehensive policy for encouraging adoption of environment and safety standards for ICT;
- (p) By incentivizing adoption and use of energy efficient equipment and renewable energy sources including rationalization of taxes and levies on production and import of such equipment;

End Notes

- i) Strategies for enhancing ease of doing business, establishment of an online platform for G2B activities, rationalise licensing and regulatory regime, attract investment equivalent to USD 100 billion in communication sector, and to leapfrog India amongst top-50 nations in international rankings:**

In today's scenario, information and communication systems and services not only meet the needs of individuals and businesses, but have become the backbone for growth and development of knowledge and digital economies. The communication systems and services need to be recognised as essential connectivity infrastructure for development of India. To meet such requirements, a huge amount of private investment is required in the communication infrastructure and networks. Further, we have to unleash the power of entrepreneurship for investment, innovation, inclusive development. All the strategies suggested under this head are to improve ease of doing business and rationalise the applicable licensing and regulatory frameworks.

In addition to rationalisation of the applicable licensing and regulatory frameworks, to reap the benefit of convergence, we have to also restructure the governing and regulatory institutions. The roles of the State Governments and Local authorities are critical in rolling out of physical infrastructure for communication networks. The states having better network connectivity would be able to attract more investment in the sectors relating to digital economies in particular as well as other industries in general. Accordingly to create awareness and measure the progress at State level, a Network Readiness Index has been proposed. It would also help in addressing RoW challenges and creating competitive environment amongst the States.

- ii) Strategies to achieve 'unique mobile subscriber density' and mobile network coverage targets, and to provide enhanced data connectivity to all the Gram Panchayats:**

These strategies primarily focus on increasing the coverage and penetration of telecommunication services in rural and remote areas. Even after achieving almost 100% mobile tele-density, approximately 49.5% population is still remains unconnected. Approximately 30 % of India's population is below the age of 15 years and all of them may not require/ subscribe to independent

mobile connections. So the remaining 70% population may be considered as target population for communication services market. Many of the unconnected persons are either from rural and remote areas, where telecommunication infrastructure is lacking or they are still not able to afford these services. Therefore, in order to have a realistic assessment of access and affordability of telecommunication services, we need to shift focus from tele-density to 'Unique Mobile Subscriber Density', wherein each subscriber will be counted once, irrespective of multiple connections a subscriber has subscribed. Accordingly the target has been set for connecting approximately 90% of the target population by 2022.

To increase the coverage, affordability, and penetration of telecommunication services in rural and remote areas, efforts of the private and public sector companies may require support from USO Fund. To achieve the objectives and ensure equitable development, we need to further develop the institutional capacity of Universal Service Obligation Fund (USOF) administration and improve focus on execution of USOF supported schemes. In spite of significant developments in the satellite communication sector in India, we are not able to effectively utilise the same for providing communication services in rural and remote areas. There is a need to improve focus on this segment also.

iii) Strategies to enable access for wireline and wireless broadband services at affordable prices; to develop public WLAN hotspots; to achieve broadband subscription targets; to facilitate RoW permissions; and to achieve backhaul connectivity targets on optical fibre:

These strategies primarily focus on increasing the coverage and penetration of telecommunication networks for broadband services. In order to increase wireline broadband services, just like electricity services, there is a need to review National Building Code of India to mandate city developers and builders to have properly demarcated space for housing communication infrastructure in buildings. These areas should have provision for uninterrupted power supply for reliable, always-on services. Further, for fiberisation, establishment of common service ducts in the cities, utility corridors in all new cities and highway road projects, and rationalisation of RoW charges is required.

Spectrum management is to be revamped making it transparent, predictable, and efficient. To offload the cellular spectrum during stationary use and increase quality of wireless services, we need to increase the penetration of public WLAN including Wi-Fi hotspots. Further, the available infrastructure in the form of telecommunication and cable TV networks need to be efficiently used for achieving these objectives.

iv) Strategies to enable access for IoT/ M2M sensors/ devices:

IoT/ M2M services would fuel the Industry 4.0. In comparison to fixed to mobile market transition, it would be a much bigger transformation in the field of communication. It requires the development of market for these services as well as eco-system for supply of these services. It would require research, innovation, and coordination among multi sector stakeholders. Accordingly, a light touch, simplified licensing and regulatory framework for IoT/ M2M services need to be prescribed swiftly. Appropriate institutions for coordinated development of 5G services, IoT/ M2M systems, and their security framework needs to be created. New Spectrum bands for Access and Backhaul segment for timely deployment and growth of 5G networks has to be identified and made available.

v) Strategies for setting up of data centres; developing ecosystem for indigenous digital platforms and services; establishing India as a global hub for research and development, innovation, cloud computing, content hosting and delivery, and data services; to become net positive in international trade of telecommunication systems and services; and job creation in ICT sector:

The ICT markets are shifting from local to national and national to international. Many internet and data communication dependent services are now delivered from few regional hubs across the world. In order to make India a global hub for Data Centres and Internet dependent services, we need to put in place enabling policies for setting up of data centres. The communication networks are also moving towards cloud based and software controlled systems. A simple and enabling regulatory framework for deployment of cloud based services would propel their use. A clear policy for data ownership, protection,

security, and cross-border data transfer is must to achieve these objectives. For spurring the innovation and development of indigenous digital platforms, services and applications, ecosystem to be developed in 'Special Technology Zones (STZs)' can play a role of catalyst. In order to increase international trade of communication services, we need to improve focus on content hosting and delivery. India's commitment to net-neutrality principles and reliable international connectivity using submarine cables can help in attracting large investments in this area.

vi) Strategies for protecting interest of consumers, data protection regime, and modernizing public safety & emergency communications networks:

For orderly growth of the sector, it is essential that interests of the consumers are fully protected and their grievances are quickly redressed. This should be strengthened through awareness, establishing office of telecom ombudsman, and centralized web based compliant redressal system. In this era of data communication, we need to protect consumers from stealing of data and their communications need to be secured. This will increase the use of digital services and help in extending the services to rural and remote areas.

At the time of disasters the availability of mission critical communication services to public safety agencies is of critical importance. Establishment of a Pan India network for Public Protection and Disaster Relief (PPDR) would address this requirement. Specific policy for facilitating the access of communication services for Persons with Disability (PwD) would bring inclusivity in development.