

**“Digital Transformation through 5G and Transformative Technologies Ecosystem”- Inputs from TRAI, INDIA**

**1. What are the challenges and opportunities faced by policy makers and regulators in embracing 5G for greater impact?**

**Challenges include-**

- Monetizing 5G poses challenges due to hefty investment needs, diverse use cases, and evolving regulations.
- For fully leveraging the capabilities of 5G and its use cases necessitates the further development of URLLC and mMTC technologies. Focus on areas such as multi-access edge computing, efficient protocols and improved AI and ML technologies, Network slicing, etc. is required.
- The multifaceted nature of 5G use cases spans various sectors and verticals within the industry, necessitating cross-sector collaboration.
- There are issues of increased vulnerabilities, Data privacy concerns. Striking a balance between fostering innovation and implementing necessary regulations to ensure security and consumer protection is challenging.
- Mitigating the environmental impact of increased infrastructure deployment, such as energy consumption and electronic waste.
- Developing and agreeing on global technical standards to ensure interoperability and maximize the benefits of 5G technology coupled with AI, ML, IOT, AR/VR/XR etc.

**Opportunities include-**

- 5G enables new business models and innovations across various sectors, such as autonomous vehicles, smart cities, and IoT (Internet of Things).
- The development and deployment of 5G infrastructure can hence create numerous jobs in engineering, construction, and technology sectors.
- 5G has the potential to provide high-speed internet access to underserved communities, promoting digital inclusion and equity. Improved connectivity can enhance access to education, healthcare, and other critical services, particularly in remote areas.
- 5G along with transformative technologies supports the development of smart cities with advanced infrastructure for traffic management, public safety, and efficient energy use.
- Advanced 5G technologies can lead to more efficient energy use in communications networks and other connected devices. Supporting applications that contribute to sustainability goals, such as smart grids and precision agriculture.

**2. What are the key regulatory measures and guiding principle to follow to foster positive and inclusive impact of 5G and emerging technologies?**

Government of India is taking several measures and establishing guiding principles to foster development of 5G and emerging technologies in India, such as-

- Support and Investment in Research and Development in 5G technologies and its use cases. The USOF funds are also to be used for R&D.

- Large scale structural and procedural reforms done to enhance liquidity and minimise financial stress within the telecom sector and enhance ease of doing business.
- Public-Private Partnerships are being formed to foster collaboration between governments, industry, and academia to pool resources and expertise.
- Educational and Training programs to train the workforce in new skills required for 5G-related jobs and technologies are proposed to be developed.
- Regulations that balance security, privacy, and innovation while ensuring consumer protection and fair competition are being implemented with wide consultation with all the stakeholders.

### **3. How to drive positive behaviours of market players? How to minimize risks while maximizing benefits?**

Driving positive behaviours requires a multifaceted approach that combines regulatory oversight, incentives, collaboration, and public awareness. Some measures include-

- Establishing clear, fair, and transparent regulations that promote healthy competition and protect consumer interests.
- Facilitate collaboration and idea-sharing between industries/sectors, Foster public-private partnerships
- Support joint research and development initiatives to drive innovation and shared technological advancements.
- Encourage or mandate open access to certain infrastructure elements (e.g., shared cell towers) to reduce barriers for new entrants and smaller players. India already has active and passive infrastructure sharing practices enabled.
- Investment in upskilling or targeted skill development programs focused on 5G use cases, including fellowships, training courses, & industry certifications.

Certain principles given below, lead to efficient minimization of risks while maximizing benefits.

- Encouraging integration of privacy-by-design principles in all 5G related technologies and services.
- Establishing robust cybersecurity protocols and frameworks to protect against potential threats and vulnerabilities.
- Enforcing strict data privacy regulations to ensure personal data is protected and only used with explicit consent. The DPDP Act 2023 regulates the processing of digital personal data and outlines various provisions to protect individuals' privacy in the digital age.
- Public private partnerships on regulatory sandbox for emerging technologies can help ascertain if existing regulations, standards, and policies are robust enough for such new products and services.

TRAI has taken up a consultation with the stakeholders regarding digital transformation through 5G ecosystem. Stakeholders have submitted their comments, which largely align with the above principles.

# Charting the course of transformative technology of AI for positive impact

## 1. What are the challenges and opportunities faced by policy makers and regulators in embracing transformative technologies for greater impact?

The emerging technologies of Artificial Intelligence (AI) and Big Data (BD) are transforming the world at an unprecedented pace. AI is revolutionising every sector including High Tech Automotive, Telecom, Retail, Healthcare, Education, Financial Services, Agriculture, and many more. This is enabled by the stupendous growth in computational power, data analytics and the widespread availability of telecommunication access worldwide. AI systems help us not only to ease our work and lives but also support in solving some of the bigger challenges such as treating chronic diseases, fighting climate change or anticipating cybersecurity threats etc.

The global policy landscape surrounding AI is rapidly evolving. It is critical that AI is developed and used ethically, transparently and with human oversight to ensure that its benefits are realised with inclusivity while minimising its risks. Countries around the world are recognizing the need to seize the opportunities that AI presents for growth of economy and also regulate its use to ensure that it aligns with social and ethical values.

India has recognized the strategic importance of AI in driving economic growth and development, and the government has taken several initiatives to promote its proliferation in the country. NITI Aayog (apex public policy think tank of the Government of India) has published a National Strategy document on AI in 2018<sup>1</sup>. The strategy document coined “AI for All” mantra, to be the governing benchmark for future AI design, development and deployment in India and aims to guide the development of AI in India in a safe, responsible and inclusive manner. It covers areas such as skilling and reskilling of the workforce, boosting R&D, creating centres of excellence, facilitating adoption of AI solutions, development of guidelines for ‘responsible AI’, promoting data availability for AI training and building high computing infrastructure. While underlining the role of private sector and collaboration, NITI Aayog has identified a few priority sectors such as healthcare, agriculture, education, smart cities and smart mobility to encourage AI deployment. Responsible AI for Social Empowerment (RAISE) was organised in 2020 to drive India’s vision and roadmap for social transformation, inclusion and empowerment through responsible AI.

India has joined the league of leading economies including USA, UK, EU, Australia, Canada, France, Germany, Italy, Japan, Mexico, New Zealand, Republic of Korea and Singapore as a founding member of the Global Partnership on Artificial Intelligence (GPAI). GPAI is an international and multi-stakeholder initiative to guide the

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<sup>1</sup> <https://niti.gov.in/sites/default/files/2019-01/NationalStrategy-for-AI-Discussion-Paper.pdf>

responsible development and use of AI grounded in human rights, inclusion, diversity, innovation and economic growth. Indian Government has launched 'National AI Portal' (<https://indiaai.gov.in/>) which is a repository of Artificial Intelligence (AI) based initiatives in the country at a single place.

New technologies such as AI/ML not only provide new opportunities but also bring certain risks. Low quality data, data biases, data security, data privacy, inaccurate or biased algorithm, and unethical use of AI to name a few. Such risks span the entire life of an AI solution from its conception to usages. It is widely believed that societal impacts of AI are uncertain and unpredictable and the challenges associated with AI have potential to impact a large number of citizens. AI is increasingly being used to make critical decisions about the lives of individuals and critical decisions that influence our societies. Therefore, it is important to ensure ethical and responsible use of AI through robust regulatory framework.

## **2. What are the key regulatory measures and guiding principle to follow to foster positive and inclusive impact of transformative technologies?**

As AI continues to evolve and become more integrated into our lives, more regulations and guidelines are being formulated around its use in some countries. Ethical implications of AI are under active consideration of regulators across the globe with the focus being on avoiding or mitigating the unintended negative consequences of AI while promoting good use of AI. They are framing the rules and guidelines that govern the development, deployment and safe, responsible use of AI. For policy makers and regulators, the approach to handle sector-agnostic risks or challenges associated with AI will require alignment in the policies and initiatives of sectoral ministries and agencies involved in taking decisions with regard to AI. Hence, many countries have called for the creation of an AI regulatory agency that would be responsible for overseeing the development and deployment of AI. Others have called for the creation of AI impact assessments similar to environmental impact assessments to evaluate the potential impact of AI on individuals and society.

In 2021, NITI Aayog released two-part approach paper on 'Principles of Responsible AI (RAI)'<sup>2</sup> in 2021, identifying principles for responsible design, development, and deployment of Artificial Intelligence (AI) in India and setting out enforcement mechanisms for the operationalisation of these principles. These principles are: (i) safety and reliability, (ii) inclusivity and non-discrimination, (iii) equality, (iv) privacy and security, (v) transparency, (vi) accountability and protection (vii) and reinforcement of positive human value. These RAI principles come in the background of a growing call for developing governance and regulatory frameworks to mitigate potential risks of AI while maximising its benefits for the largest number of people.

Niti Aayog paper further proposes the setting up of an independent, multi-disciplinary advisory body at the apex-level whose remit covers the entire digital sector. This proposed Council for Ethics and Technology (CET) will aide sectoral regulators in formulating appropriate AI policies and serve as a think-tank for

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<sup>2</sup> <https://www.niti.gov.in/sites/default/files/2021-08/Part2-Responsible-AI-12082021.pdf>

creating quality research products around issues related to AI. The CET will also be responsible for devising model guidelines or ethics review mechanisms that will evaluate the efficacy of AI systems.

Telecom Regulatory Authority of India (TRAI) released recommendations in July 2023 on “Leveraging Artificial Intelligence and Big Data in Telecommunication Sector”<sup>3</sup>. Here, TRAI recommended that for ensuring development of responsible Artificial Intelligence (AI) in India, there was an urgent need to adopt a regulatory framework by the Government that should be applicable across sectors and an independent statutory authority designated as “Artificial Intelligence and Data Authority of India” (AIDAI) should be established for ensuring development of responsible AI and regulation of use cases in India.

### **3. How to drive positive behaviours of market players? How to minimize risks while maximizing benefits?**

Many initiatives have already been taken by industry to self-regulate and ensure ethical use of AI. One such initiative was launched in 2016 by the Institute of Electrical and Electronics Engineers (IEEE), one of the world’s largest standard-setting and professional engineering societies. The initiative, “The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems”, is intended to ensure that every stakeholder involved in the design and development of autonomous and intelligent systems is educated, trained and empowered to prioritize ethical considerations so that these technologies are advanced for the benefit of humanity. Another such initiative is the “Partnership on AI”<sup>35</sup>, which is a non-profit community of academic, civil society, industry, and media organizations.

Self-regulation approach for regulating AI relies on the voluntary compliance of AI developers and users with ethical principles, professional guidelines, codes of conduct, best practices, standards, certification programmes etc. Therefore, Industry led self-regulations, though very important and to be encouraged, may lack accountability and enforcement mechanisms. The United Nations Educational, Scientific and Cultural Organization (UNESCO) recommendation on ‘the Ethics of Artificial Intelligence’ too emphasizes making a strong call to governments around the world to establish the necessary institutional and legal frameworks to govern these technologies and ensure they contribute to the public good. It clearly signals that the “self-regulatory model” that has prevailed prioritizing commercial and geopolitical objectives over people, though essential, is not good enough. Hence, the need for adoption of regulatory framework by governments and regulators to ensure development and deployment of ‘responsible and inclusive AI’ across sectors.

But a critical challenge in the AI regulation landscape is the pace of development of AI. The risks, benefits and trajectories of AI are all highly uncertain. And finally, it is not advisable to impede innovation in an emerging technology by strict regulations in an era of intense international competition. If all the AI systems are treated alike and same set of mandatory requirements are applied, this could restrict innovations

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<sup>3</sup> [https://www.trai.gov.in/sites/default/files/Recommendation\\_20072023.pdf](https://www.trai.gov.in/sites/default/files/Recommendation_20072023.pdf)

as not all firms/startups will be able to fulfil all the regulatory requirements. However, strict regulatory compliances are a must for AI systems those are involved in the outcome affecting the human beings like acceptance/denial of credit to any person, health care system, facial recognition system etc. Hence, the goal is regulating AI in a manner so that safety from the potential risks is ensured while also ensuring that regulation does not stifle growth in technology.

In this regard, it is essential to identify different use cases based on potential risks such as AI systems related to law enforcement, education, employment, credit, healthcare etc. and their likely impact on the people. Such AI systems can be categorised under the category of high risk. If it is a high-risk category AI system, we need to make sure it complies with mandatory compliance requirement before its deployment. Such systems cannot be allowed to be deployed without being fully sure that they are safe and ethical. Limited risk applications such as talking to a chatbot may be prescribed less stringent requirements such as transparency requirements, whereas for minimal or no risk applications, there may be very limited or no rules. In light of this, the TRAI recommendations hold the view that the AI regulatory framework should ensure that specific AI use cases are regulated on a risk-based framework where high risk use cases that directly impact humans are regulated through legally binding obligations.

To maximize the benefits of use of AI in all sectors, awareness and skill development is important so that new use cases are developed based on the needs of specific sectors and local requirements. TRAI has recommended a concerted effort by different ministries/ departments of the government to encourage and develop indigenous AI use cases for various sectors by funding from the respective Ministry/ Departmental Budgets.

# In-Building Access for Digital Connectivity

## 1. What are the challenges and opportunities faced by policy makers and regulators in embracing transformative technologies for greater impact?

Digital connectivity is vital to the way we live and work. The exponential growth in digitalization during last decade has revolutionized the world impacting everything, from economy, innovation, science and education, to health, sustainability, governance, and lifestyles. Digital technologies are fundamentally changing business models, institutions and society. The demand for digital connectivity has increased many folds in recent years and COVID-19 has further given impetus to surge in the demand across all segments of users, irrespective of their locations. With increasing reliance on digital connectivity, the importance of good digital connectivity adding to its value and utility for a meaningful connectivity gained a prime stage. However, provision of high-quality mobile data and voice services in the indoor setup (that is, inside the premises of buildings) have always faced disruptions due to appreciable losses in signal strength when it penetrates building walls. While all wireless services can suffer from poor in-building coverage, this problem is particularly pronounced for the high-data rate services. With the introduction of 5G, it is imperative to take all possible measures to improve the inbuilding coverage of 5G services so as to realise the maximum potential of the transformative technology of 5G. Many challenges are however faced in creating In-Building Digital Connectivity Infrastructure (DCI)<sup>1</sup>. Some of them being – 1) Telecom being a capital-intensive sector, significant upfront investments are needed to create inbuilding DCI, (2) Dependence on multiple entities managing the premises or a notified area, such as a state, city or local administration, and Property Manager when it comes to approval and access.

## 2. What are the key regulatory measures and guiding principle to follow to foster positive and inclusive impact of transformative technologies?

Recognising the need to improve in-building coverage and to offer better quality telecommunication services in the indoor settings, various policy initiatives have been undertaken by Telecom Regulatory Authority of India (TRAI) and the Government of India from early on to ensure digital connectivity and meet users' requirements of remote working and distance learning.

Some of the notable measures undertaken in India to improve the quality of in-building coverage of telecommunication services are –

- a) TRAI has conducted **studies** to assess the quality of service and to identify challenges in digital connectivity and suggest way forward using the findings of these studies. For example, a Monograph on “**Quest for a Good Quality Network inside Multi-Storey Residential Apartments: Reimagining ways to improve quality**” published by TRAI in September 2020.<sup>2</sup>

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<sup>1</sup> [https://www.trai.gov.in/sites/default/files/CP\\_25032022.pdf](https://www.trai.gov.in/sites/default/files/CP_25032022.pdf)

<sup>2</sup> [https://www.trai.gov.in/sites/default/files/Flipbook\\_Monograph\\_22092020.pdf](https://www.trai.gov.in/sites/default/files/Flipbook_Monograph_22092020.pdf)

- b) **TRAI released recommendations in 2017 titled “In-Building Access by Telecom Service Providers”**. Some of the key recommendations put forth here were –
- i) Telecom Service Providers (TSPs) and Infrastructure Providers (IPs) to be mandated to share the in-building infrastructure (IBS or In-Building Solutions, OFC and other cables, ducts etc) with other TSPs, in large public places like Airports, hotels, multiplexes, etc., commercial complexes and residential complexes.
  - ii) Service Providers to be prohibited from entering into any kind of agreement or contract, which results in exclusive access of DCI or lessening of competition.
  - iii) Access to building as well as Common Telecom Infrastructure (CTI) facilities inside the building should be available on a fair, transparent and non-discriminatory manner and minimum three TSPs/IPs should have presence in the building.
- c) **Sharing of both passive and active infrastructure** by Infrastructure Providers has been allowed by the Department of Telecom (DoT) to enable the cost-optimal and time-bound provision of DCI and TRAI has recommended Geographical Information System (GIS) mapping to facilitate the same.
- d) **National Building Code (NBC) of India and Model Building Bye-Laws** were amended to facilitate the provision of Common Telecom Infrastructure (CTI) housed inside the buildings for convenient provision of telecom services.

### 3. How to drive positive behaviours of market players? How to minimize risks while maximizing benefits?

In addition to the measures undertaken by TRAI and DoT which have already been discussed, many of TRAI recommendations have also been focussed on driving positive behaviours among market players, especially builders, to facilitate an ecosystem of effective deployment of In-Building Solutions (IBS) for DCI –

- a) TRAI recommendations released in 2017 titled **“In-Building Access by Telecom Service Providers”**<sup>3</sup> mandate that no building plan should be approved without having a plan for creation of CTI including the duct to reach to the telecom room inside the building and that completion certificate to a building is to be granted only after ensuring that the CTI as per the prescribed standards is in place.
- b) TRAI recommendations released in 2023 on **“Rating of Buildings or Areas for Digital Connectivity”**<sup>4</sup> however takes the route of positive incentivisation to drive positive behaviour of builders and property managers in this regard. This TRAI recommendation proposes development of a framework for “Rating of the buildings for digital connectivity” and mandating the rating for all existing as well as new buildings of public importance, like – airports, ports, railway/metro stations, industrial estates, large office and shopping complexes, multi-speciality hospitals, etc. Certification of a higher DCI (Digital Connectivity Infrastructure)

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<sup>3</sup> [https://www.trai.gov.in/sites/default/files/Recommendation\\_20\\_01\\_2017.pdf](https://www.trai.gov.in/sites/default/files/Recommendation_20_01_2017.pdf)

<sup>4</sup> [https://www.trai.gov.in/sites/default/files/Recommendation\\_20022023.pdf](https://www.trai.gov.in/sites/default/files/Recommendation_20022023.pdf)



Rating for a building or a real-estate property will add value to the property and in turn increase its worth in the market. Thus, this rating system is expected to drive positive behaviour of builders and property managers by providing them incentive to make DCI an intrinsic part of building development plan similar to other building services such as water, electricity or Fire Safety System. TRAI has also issued a consultation paper 'Regulation on Rating Framework for Digital Connectivity in Buildings or Areas' *inter-alia* seeking comments on draft regulations and rating criteria.