



Telecom Regulatory Authority of India

Recommendations

on

Leveraging Artificial Intelligence and Big Data in Telecommunication Sector

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CHAPTER – 1

BACKGROUND

I. The Transformative Power of AI and Big Data

- 1.1 The emerging technologies of Artificial Intelligence (AI) and Big Data (BD) are transforming the world at an unprecedented pace. The future is likely to see large parts of our lives influenced by AI technology. With recent advances in AI, machines are gaining the ability to learn and make decisions in ways that will enable them to perform tasks which were previously thought to rely on human experience, creativity, and ingenuity. 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. These factors are primarily facilitated by massive investments in telecom network infrastructure and deployment of 4G, 5G and beyond technologies.
- 1.2 AI-based systems can be software-based which operate in the virtual world (e.g., image analysis software, search engines, speech and face recognition systems) or it can be embedded in hardware devices (e.g., advanced robots, autonomous cars, drones or Internet of Things applications). AI Systems are being used routinely by individuals in many applications such as while generating documents through translations in different languages, generating subtitles in videos or blocking email spam etc. 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.¹.
- 1.3 The rapid growth in AI can be attributed to advancements in the

¹ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2018%3A237%3AFIN>

internet technologies, exponential growth in data, increasing computing power and technologies such as cloud computing and edge computing. The market for AI is already large and growing rapidly with predictions of it reaching to \$500 billion by 2024², with a CAGR of 17.5%. The emerging technologies of AI/ML are changing the world, and their timely adoption is crucial for companies to stay competitive in today's digital age.

- 1.4 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. The European Union (EU) has taken a proactive stance towards AI governance. In 2018, the EU published a set of guidelines for ethical development of AI which prioritises transparency, fairness, and human oversight. In April 2021, the EU proposed world's first regulatory framework for AI which aims to ensure that AI systems are safe and trustworthy. The framework includes a risk-based approach for AI systems and mandatory transparency and accountability requirements.
- 1.5 The United States has recognized the importance of AI with the National AI Initiative Act signed into law in January 2021³. The act establishes a national strategy for AI research and development which includes increased investment in AI research, development of a workforce with AI skills and the promotion of AI adoption in various sectors. The Federal Communications Commission (FCC) is working on developing policies to ensure that the use of AI in telecom networks does not compromise the privacy and security of user data. Other countries such as Canada, Japan, and Singapore have also implemented AI strategies and policies to regulate and promote its use. Canada has launched a national AI strategy that focuses on research,

² <https://www.idc.com/getdoc.jsp?containerId=prUS47482321>

³

<https://www.ai.gov/#:-:text=The%20National%20AI%20Initiative%20Act,economic%20prosperity%20and%20national%20security>

talent development, and industry collaboration⁴. Japan's Society 5.0 initiative aims to integrate AI into all aspects of society to achieve a human-centred society⁵, while Singapore's AI Governance and Ethics initiatives prioritise ethical and responsible AI development.

- 1.6 ITU's focus groups on various subjects such as machine learning for future networks, AI for natural disaster management, and environmental efficiency for AI and other emerging technologies are vital in exploring the potential of AI and addressing the challenges related to its deployment. The G20 countries have adopted a human-centred approach to AI guided by the G20 AI Principles drawn from the OECD Recommendations on AI. The G20 aims to use AI to enhance livelihoods globally while addressing the challenges and risks posed by this technology. It is inspiring to see such a concerted effort by regulators and organisations worldwide to leverage AI while ensuring its responsible and ethical use.
- 1.7 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.

II. AI Proliferation in India: Government Initiatives

- 1.8 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 has published a National Strategy document on AI in 2018⁶. The strategy aims to guide the development of AI in India in a responsible and inclusive manner. It covers areas such as skilling and reskilling of the workforce, boosting R&D, creating centres of excellence, promoting

⁴ <https://www.canada.ca/en/innovation-science-economic-development/news/2022/06/government-of-canada-launches-second-phase-of-the-pan-canadian-artificial-intelligence-strategy.html>

⁵ https://www8.cao.go.jp/cstp/english/society5_0/index.html

⁶ <https://niti.gov.in/sites/default/files/2019-01/NationalStrategy-for-AI-Discussion-Paper.pdf>

data availability for AI training and building high computing infrastructure.

- 1.9 India has organized Responsible AI for Social Empowerment (RAISE) in 2020 to drive India's vision and roadmap for social transformation, inclusion and empowerment through responsible AI⁷. It was attended by 79,000+ stakeholders from academia, research, industry and government representatives from 147 participating countries. 320 distinguished speakers from 21 countries participated in the event.
- 1.10 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 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.

III. DoT's Reference

- 1.11 The National Digital Communications Policy (NDCP)- 2018 seeks unlocking of the transformative power of digital communications networks for achieving the goal of digital empowerment. NDCCP-2018 motivates towards harnessing the power of emerging digital technologies, including 5G, AI, Internet of Things (IoT), Cloud and BD to catalyse the fourth industrial revolution. In order to create a roadmap for AI, emerging technology and its use in the communication sector, vide letter dated 6th June 2019 (**Annexure-I**), Department of Telecommunication (DoT) sought recommendation of TRAI on the provision no. 2.2(g) of NDCCP-2018 i.e. "*Leveraging Artificial Intelligence*

⁷ <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1661345>

and Big Data in a synchronised and effective manner to enhance the overall quality of service, spectrum management, network security and reliability”.

- 1.12 AI being a developing technology, a virtual conference on “Leveraging Artificial Intelligence (AI), Machine Learning (ML) and Big Data (BD) in the Telecom Sector” was organised by the TRAI on 5th and 6th of August 2020. The conference served as a platform to engage with industry experts, telecom service providers, and leading solution providers to gain insights into AI/ML from a telecom perspective.
- 1.13 A workshop on "Metaverse" was conducted on 12th September 2022 by TRAI to understand the various dimensions of emerging technologies including AI. TRAI organized another workshop on "*Metaverse: Understanding and Regulatory Framework*" on 5th December 2022. The workshop aimed to explore the concept, challenges, and opportunities of the metaverse as well as the possible regulatory implications for the telecom sector. TRAI has sent many officers for training courses related to AI and 5G to have a better understanding of the new technologies.
- 1.14 The impact of AI is not limited to only telecom sector. AI has the potential to impact a wide range of sectors including healthcare, finance, transportation, education, agriculture and many others. Therefore, it is important to take a holistic approach for examining the impact of AI across all sectors rather than focusing only on telecom. In the Consultation Paper (CP) on "*Leveraging Artificial Intelligence and Big Data in telecommunication sector*", wide ranging issues covering all sectors were included. As the AI technology is still evolving, it took time to examine and bring out the multiple aspects of AI/ML in the telecommunication and other sectors by studying various international practices which are also in the nascent stage. TRAI issued Consultation Paper (CP) on "*Leveraging Artificial Intelligence and Big Data in telecommunication sector*" on 05th August 2022.

- 1.15 Written comments and counter comments on the consultation paper were invited from the stakeholders by 16th and 30th September 2022, respectively. The dates of submission of comments and counter comments were extended to 14th and 28th October 2022 respectively. In response, comments were received from 22 stakeholders and counter comment was received from 1 stakeholder. An Open House Discussion (OHD) was conducted on 17th February 2023 through online mode. Based on the written submissions of the stakeholders, discussions in the OHD and its own analysis, these recommendations have been finalised by the Authority.
- 1.16 **Chapter-1** of the recommendations is an introductory chapter, and it offers a concise overview of the subject. In **Chapter-2** various aspects of AI such as its definition, emerging risks from the use of AI, principles of ethical and trustworthy AI, need for the regulation of AI, international approaches and recommended regulatory approach for India have been included. Key constraints in the adoption of AI and need for a data governance framework have also been discussed in this Chapter. **In view of the impact of AI in all sectors, the framework which has to be suggested for telecom cannot be treated in isolation and hence a common framework covering all the sectors is being proposed.**
- 1.17 **Chapter- 3** discusses issues such as role of AI in Telecom, Broadcasting and other sectors, requirement of AI specific infrastructure and need of skill development. The importance of collaborations between industry and academia to address the talent gap in AI and various related issues have also been discussed. **Chapter- 4** gives the list of the Recommendations. AI/ML (Artificial Intelligence /Machine Learning) and Big Data (BD) are two related but distinct concepts. AI and ML are methods of creating systems that can perform tasks that normally require human intelligence. Big Data, on the other hand, refers to the large and complex datasets and can be used as an input and training for AI/ML systems. In this entire

document, phrase AI/ML has been used; however, it refers to both AI/ML as well as Big Data (BD) wherever applicable.

CHAPTER- 2

ADOPTION OF AI: OPPORTUNITIES AND CHALLENGES

I. Definition of AI

- 2.1 The definition of AI has been a topic of debate and discussion since the concept first emerged in the mid-20th century. In general, AI refers to the ability of machines to perform tasks that would normally require human intelligence such as learning, problem solving, and decision making. However, there are many different types of AI, each with its own capabilities and applications.
- 2.2 McCarthy, who is considered one of the founders of AI, coined the term "Artificial Intelligence" in 1955 and defined it as "*the science and engineering of making intelligent machines.*" This definition emphasises the idea that AI is not just about creating machines that can perform specific tasks but also about understanding and replicating the cognitive processes that underlie human intelligence.
- 2.3 Over the years, as AI has evolved and become more sophisticated, new definitions have emerged. Some definitions focus on the techniques and methods used to create intelligent machines such as machine learning, natural language processing, and computer vision. Other definitions focus on the applications of AI such as autonomous vehicles, virtual assistants and medical diagnosis. Further, to address the challenges related to trust, new terminologies such as Trustworthy AI, Responsible AI, and Explainable AI are being coined by various organisations and nations.
- 2.4 In view of the above, following issues were raised in the CP:
- Q1 a) *What may be the most appropriate definition of Artificial Intelligence (AI)?*
- Q4) *Do you think that a number of terminologies such as Trustworthy AI, Responsible AI, Explainable AI etc. have evolved to describe various aspects of AI but they overlap and do not have any*

standardised meanings? If yes, whether there is a need to define/harmonise these terms?

Comments of the Stakeholders

2.5 In response to the issue of defining AI, a large number of the stakeholders were of the view that the precise definition of AI is not required at this stage. Globally, solution providers and organizations categorize AI applications based on their capabilities and functionalities. Therefore, as per these stakeholders, it is probably the best at this point to leave this definition to the market forces. Some stakeholders were of the view that AI is still at its nascent stage and defining the same in a certain way may restrict the role of AI and its usefulness in various fields.

2.6 A few stakeholders submitted that, rather than trying to define AI, it is better to define the application or product that is sought to be addressed. This is because, in practice, AI systems are built not as “general purpose” systems but as “domain-specific” systems designed for specific tasks and are, therefore, not comparable. As per these stakeholders, there cannot be one definition of AI which can be termed appropriate.

Some stakeholders agreed with the NITI Aayog’s definition of AI i.e ‘*AI is a constellation of technologies that enables machines to act with higher levels of intelligence and emulate the human capabilities of sense, comprehend and act*’. A few stakeholders endorsed the definition of ISO/IEC 22989:2022 that defines an AI system as an “*engineered system that generates outputs such as content, forecasts, recommendations or decisions for a given set of human-defined objectives.*”

2.7 One stakeholder stated that a commonly considered definition of AI, which is included in the European Commission’s (draft) AI Act, is as follows: “*An ‘artificial intelligence system’ (AI system) means a system that is designed to operate with a certain level of autonomy and that,*

based on machine and/or human-provided data and inputs, infers how to achieve a given set of human-defined objectives using machine learning and/or logic and knowledge based approaches, and produces system-generated outputs such as content (generative AI systems), predictions, recommendations or decisions, influencing the environments with which the AI system interact.” Some stakeholders were of the opinion that definition can be useful to factually explain how an AI system functions, however, defining AI in terms of regulations is more challenging. For example, the definition may be too broad resulting in inclusion of a wider swath of technologies than intended to be regulated.

- 2.8 One stakeholder referred to explanation for AI provided by OECD which is *“An AI system is a machine-based system that is capable of influencing the environment by producing an output (predictions, recommendations or decisions) for a given set of objectives. It uses machine and/or human based data and inputs to (i) perceive real and/or virtual environments; (ii) abstract these perceptions into models through analysis in an automated manner (e.g., with machine learning), or manually; and (iii) use model inference to formulate options for outcomes. AI systems are designed to operate with varying levels of autonomy.”*
- 2.9 On the issue of need for defining or harmonising terms such as Trustworthy AI, Responsible AI, Explainable AI etc, some stakeholders submitted that standardisation of such terms may not lead to any beneficial output as these are largely academic definitions. Another submission was that defining or harmonising these terms may not add value. A few stakeholders submitted that the definitions of Trustworthy AI, Responsible AI, and Explainable AI overlap and that a standardised definition of AI would be useful.

Analysis

- 2.10 A number of definitions of Artificial Intelligence (AI) have surfaced over time. Stakeholders have quoted the definitions used by various organisations such as European Commission in its (draft) AI Act, OECD and NITI Aayog. As mentioned earlier, NITI Aayog in its report²² on the National AI Strategy defines AI as *“AI is a constellation of technologies that enables machines to act with higher levels of intelligence and emulate the human capabilities of sense, comprehend and act”*.
- 2.11 ETSI defines AI as a computerised system that uses cognition to understand information and solve problems. ISO/IEC 2382-28⁸ defines AI as *“An interdisciplinary field, usually regarded as a branch of computer science, dealing with models and systems for the performance of functions generally associated with human intelligence, such as reasoning and learning”*. In a report on *“Emerging technology trends: Artificial intelligence and big data for development 4.0”*, ITU cited a report⁹ *“Toward an AI Strategy in Mexico”* and stated that *“Artificial intelligence (AI) refers to machines, and generally computer systems, that can simulate the processes of natural intelligence displayed by humans. These processes include learning, reasoning, and self-correction.”*
- 2.12 ITU¹⁰ in its report on ‘Artificial Intelligence for Good’, states that *“Artificial Intelligence (AI) comprises a set of widely different technologies, which can be broadly defined and grouped together as ‘self-learning, adaptive systems’. There are various approaches to defining AI:*
- *In terms of technologies, techniques and/or approaches (e.g., a*

⁸ <https://www.iso.org/obp/ui/#iso:std:iso-iec:2382:-28:ed-1:v1:en>

⁹ <https://www.oxfordinsights.com/mexico>

¹⁰ <https://www.itu.int/en/mediacentre/backgrounders/Pages/artificial-intelligence-for-good.aspx>

neural network approach to machine translation);

- *In terms of purpose (facial recognition, image recognition).*
- *In terms of functions (e.g., the ability to understand language, recognize pictures, solve problems, and learn, according to the Cambridge Dictionary).*
- *In terms of agents or machines or algorithms (e.g., robots, self-driving cars).*

AI comprises a rich set of methods and disciplines, including vision, perception, speech and dialogue, decisions and planning, problem-solving, robotics and other applications that enable self-learning. AI is best viewed as a set of technologies and techniques used to complement traditional human attributes, such as intelligence, analytical ability and other capabilities. AI, Machine Learning (ML) and modern data techniques have been greatly enabled by recent advances in computer processing, power and speed, and advances in AI depend in turn on advances in data techniques.”

- 2.13 As per a Report¹¹ on “Artificial Intelligence (AI) Policies in India- A Status Paper” of Telecommunications Engineering Centre (TEC), *“Artificial Intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and emulate human cognitive capabilities. The term AI may also be applied to any machine that exhibits traits associated with a human mind such as learning and problem solving.”*
- 2.14 AI is not a single technology. Instead, it is an umbrella term that includes any type of software or hardware component that supports machine learning, computer vision, natural language processing, robotics etc. Therefore, there is no globally accepted definition of AI.
- 2.15 The field of AI is constantly evolving and with it the terminology used to describe different aspects of AI has also evolved over time. There has been an evolution of terminologies such as Trustworthy AI, Responsible AI, Explainable AI, etc., to describe various aspects of AI. Instead of defining AI and clarifying different terms like Trustworthy

¹¹

<https://www.tec.gov.in/pdf/StudyPaper/AI%20Policies%20in%20India%20A%20status%20Paper%20final.pdf>

AI, Responsible AI, and Explainable AI, which are often used interchangeably in different context, focus should be to define underlying concepts to bring a unified approach to develop principles for responsible AI that balance ethical considerations with innovation.

- 2.16 In light of the above discussion, the Authority is of the view that the focus should be on establishing regulatory principles that promote the responsible use of AI, drive solutions to benefit society, and ensure legal certainty for businesses. Further, for the purpose of these recommendations, Artificial Intelligence may be understood as a set of widely different technologies aimed at approximating some aspect of human cognition and learning to mimic the problem-solving and decision-making capabilities of the human mind leveraging on Machine Learning (ML) and modern data techniques.

II. Emerging risks from the use of AI/ML

- 2.17 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** were some of the risks discussed in the CP. Such risks span the entire life of an AI solution from its conception to usages.
- 2.18 NITI Aayog in its approach paper¹² has mentioned that *“India has an extensive and robust system of sectoral regulators that oversee various activities, products and services. These regulators already have elaborate mechanisms to regulate and govern innovations in their domain, with some releasing rules and guidelines for AI applications....Extant regulation may continue to oversee AI-led innovations in domains under their purview for the time being.”*

¹² <https://www.niti.gov.in/sites/default/files/2021-08/Part2-Responsible-AI-12082021.pdf>

2.19 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. For this purpose, a body or an institution may be required to be established which can frame requisite guidelines, take necessary initiatives and oversee the compliance. This entity or group may also facilitate sharing of future telecom network capabilities and its role in achieving national objectives for the development and deployment of AI based solutions in other sectors.

2.20 With this background, the stakeholders were requested to give their responses on the following issues-

Q.8: (a) Whether risks and concerns such as privacy, security, bias, unethical use of AI etc. are restricting or likely to restrict the adoption of AI? (b) List out all such risks and concerns associated with the adoption of AI.

Q.9: (a) What measures are suggested to be taken to address the risks and concerns listed in response to Q.8? (b) Which are the areas where regulatory interventions may help to address these risks and concerns?

Q.10: (a) What measures do you suggest to instil trust and confidence regarding a robust and safe AI system among customers, TSPs and other related entities/stakeholders? (b) Whether adopting general principles such as Responsible AI and ethical principles at the time of designing and operationalising the AI models will help in developing ethical solutions and instilling trust and confidence in the users? (c) What may be such principles and who should formulate these and how compliance can be ensured?

Q.11: Whether there is a need of telecom/ICT sector specific or a common authority or a body or an institution to check and ensure compliance of national level and sector specific requirements for AI? If yes, what should be the composition, roles and responsibilities of such authority or body or institution?

Q.12: In response to Q.11, if yes, under which present legal framework or law such authority or body or institution can be constituted and what kind of amendments will be required in the said law? Or whether a new law to handle AI and related technologies is a better option?

Comments of the Stakeholders

- 2.21 Some stakeholders submitted that these risks are not specific to AI but these are applicable to any kind of data usage by any digital enterprise. However, since the risks and rewards of AI deployment are still at a nascent level, it is too early to deliberate or prescribe measures in this regard. As per these stakeholders, AI adoption should be left to the market, especially since a lot of such aspects are likely to get automatically addressed once India gets a data protection law. One of these stakeholders submitted that the regulator should only intervene when there is a demonstrable market failure that has an impact on the consumers clearly attributable to AI/BD biases. A few stakeholders suggested that instead of regulating the AI for now, the right thing to do might be to let the technology mature and drive ethics through outcome-based regulations/laws common to all digital enterprises.
- 2.22 A few stakeholders opined that the regulatory approach for development of a responsible AI environment in India should be driven by Principle of Safety, Reliability and Robustness, Non-Discrimination, Equality and Inclusivity, Privacy and Security etc. Such Principles should be developed by a non-statutory expert 'Multi-Stakeholders Body (MSB)', having varied representation, after due consultation with the industry stakeholders.
- 2.23 Some stakeholders suggested that as a general principle, regulatory obligations should be proportional to likely risk and harm. Only high-risk AI applications such as those that affect a person's life (e.g., access to food, water, healthcare, or credit) or pose a significant risk should be focused by regulations. One of these stakeholders submitted that it supports regulatory approaches that incentivize process-based accountability mechanisms like impact assessments for high-risk AI applications.

- 2.24 On the issue of requirement of a telecom/ICT sector specific or a common authority/body/ institution to ensure AI related compliances, a number of stakeholders were of the view that as AI is still evolving, it would be premature for regulatory intervention specifically in the telecom sector. Some of these stakeholders suggested that at a later stage, when an overarching national legislative framework encompassing all user sectors is developed and the principles and parameters of AI are finally defined, it may then be an appropriate time to review sector developments and assess whether a proportionate and appropriate intervention is required.
- 2.25 One stakeholder was of the view that there should be a standardized, sector-agnostic risk assessment framework to identify high risk applications. A few stakeholders submitted that TRAI should consider the need for specific AI regulations only in circumstances where there is a demonstrated gap in the existing framework.

Analysis

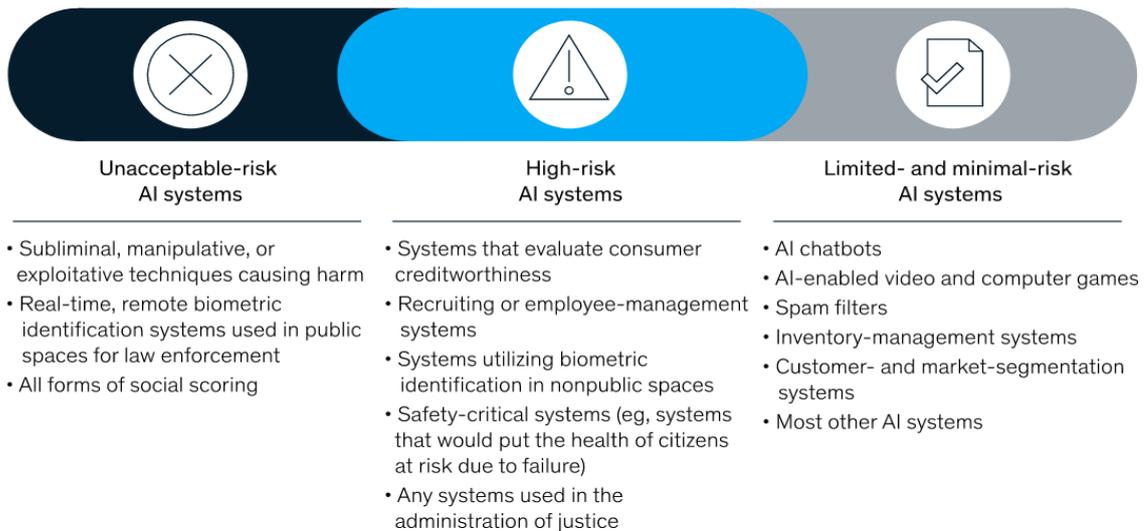
- 2.26 The issues raised by the stakeholders on requirement of the regulatory framework for AI are very pertinent. The debate over regulation has picked up pace in wake of recent launch of ChatGPT, an innovative chatbot designed by OpenAI which works as a text-generating tool that generates human-like text based on prompts or information.
- 2.27 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. These 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. Some of the important international regulations are discussed below:

A. International Experience

(i) EU AI Act

2.28 The European Commission made a proposal for an European Union (EU) regulatory framework on Artificial Intelligence (AI) in April 2021. The draft AI act is the first ever attempt to enact a horizontal regulation of AI¹³. The proposed regulations would apply to any AI system used within the European Union. Although the EU regulation is not yet in force, it provides clear insight into the future of AI regulation. The regulation divides AI systems into three categories: unacceptable-risk AI systems, high-risk AI systems, and limited- and minimal-risk AI systems as shown in Chart-I¹⁴.

Chart-I



Source- McKinsey

2.29 Unacceptable-risk AI systems include (1) subliminal, manipulative, or exploitative systems that cause harm, (2) real-time, remote biometric identification systems used in public spaces for law enforcement, and (3) all forms of social scoring such as AI or technology that evaluates

¹³ [https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/698792/EPRS_BRI\(2021\)698792_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/698792/EPRS_BRI(2021)698792_EN.pdf)

¹⁴ <https://www.mckinsey.com/capabilities/quantumblack/our-insights/what-the-draft-european-union-ai-regulations-mean-for-business>

an individual's trustworthiness based on social behavior or predicted personality traits. High-risk AI systems include those that evaluate consumer creditworthiness, provide assistance for recruiting or managing employees, or use biometric identifications. Under the proposed regulation, the European Union would review and potentially update the list of systems included in this category on an annual basis. Limited- and minimal-risk AI systems include many of the AI applications currently used throughout the business world such as AI chatbots and AI-powered inventory management.

- 2.30 If an AI system uses EU data but otherwise does not fall within one of these categories, it would not be subject to the draft AI regulation. It would, however, be subject to the General Data Protection Regulation (GDPR).
- 2.31 The oversight obligations imposed by the draft regulation on those building and selling high-risk systems in the marketplace or using them include "Conformity assessments," which are algorithmic impact assessments that analyze data sets, biases and the overall design and monitoring of system outputs. These obligations also include ensuring that these systems are explainable, oversee-able and perform consistently throughout their lifetime. Systems seen as posing minimal risk would have significantly fewer requirements, primarily in the form of specific transparency obligations such as making users aware that they are interacting with a machine.

(ii) United Kingdom¹⁵

- 2.32 In 2022, the United Kingdom (UK) government published a policy paper titled "A pro-innovation approach to AI regulation". The paper outlines the government's vision and principles for regulating Artificial

¹⁵ <https://www.gov.uk/government/publications/ai-regulation-a-pro-innovation-approach/white-paper>

Intelligence in a way that fosters innovation and public trust. This framework is supported by following set of principles:

- i. Context-specific: Rules or risk levels shall not be assigned to entire sectors or technologies. Instead, these will be regulated based on the outcomes AI is likely to generate in particular applications.
- ii. Pro-innovation and risk-based: Regulators should pay more attention to real threats rather minor ones related to AI.
- iii. Providing following cross-sectoral principles to guide the responsible development and use of AI in all sectors of the economy –
 - a. Safety, security and robustness
 - b. Appropriate transparency and explainability
 - c. Fairness
 - d. Accountability and governance
 - e. Contestability and redress
- iv. Proportionate and adaptable: These principles will be issued on a non-statutory basis and will be interpreted and implemented in practice by existing regulators such as Ofcom or the Competition and Markets Authority. This approach makes use of regulators’ domain-specific expertise to tailor the implementation of the principles to the specific context in which AI is used. Initially, regulators will take a lighter approach with options like voluntary actions or guidelines.

2.33 During the initial period of implementation, the Government will continue to collaborate with regulators to identify any barriers to the proportionate application of the principles and evaluate whether the non-statutory framework is having the desired effect.

(iii) Saudi Arabia

2.34 Saudi Data & AI Authority (SDAIA)¹⁶ was created in 2019 to set the National Data & AI agenda, orchestrate implementation of Data & AI agenda across the government, and oversee agenda execution across

¹⁶ <https://sdaia.gov.sa/en/default.aspx>

its subordinate entities – National Information Center (NIC), the National Data Management Office (NDMO), and the National Center for Artificial Intelligence (NCAI). Following are the strategic objectives of SDAIA-

- Continuously updating the national data and AI agenda.
- Implementing data and AI agenda at the national level.
- Providing the Authority's sub-entities with guidance on implementing data and AI agenda.
- Raising public awareness of the Kingdom's achievements in the field of data and AI.
- Maximizing data and AI's contribution to realizing the objectives of Vision 2030.
- Ensuring that all government entities make greater use of data and AI agenda.
- Supporting the achievement of strategic objectives in the Authority's sub-entities on legislation, operation, and innovation.
- Promoting the Kingdom's image as a global leader in the field of data and AI.

2.35 National Information Center (NIC)- NIC is the national data bank, hosting all government data.

2.36 National Data Management Office (NDMO) -NDMO manages national data as a digital asset and is responsible for the development of standards, policies and regulations as well as driving compliance. On policies and regulations, NDMO is developing a number of regulatory frameworks including topics such as data privacy and freedom of information.

2.37 National Center for Artificial Intelligence (NCAI)- The NCAI was established in August 2019, with its main mission to drive Saudi advancement in AI innovations through AI research and solutions development providing AI strategic advisory to the government, and

promoting AI education and awareness. NCAI aims to be a sustainable world-class center of excellence leveraging collaborations with academia, the public sector and private sector. NCAI aims to drive AI strategy execution, carry out AI research in the field of Data & AI, develop AI solutions and build AI expertise.

2.38 In October 2020, SDAIA announced the National Strategy for Data and AI (NSDAI)¹⁷. The key objectives of this strategy are:

- i. Ambition- Position Kingdom of Saudi Arabia (KSA) as the global hub where the best of Data & AI is made reality.
- ii. Skills-Transform KSA's workforce with a steady local supply of Data & AI -empowered talents.
- iii. Policies and Regulations-Enact the most welcoming legislation for Data & AI businesses and talents.
- iv. Investment-Attract efficient, stable funding for qualified Data & AI investment opportunities.
- v. Research and Innovation-Empower top Data & AI institutions to spearhead innovation and impact creation.
- vi. Ecosystem-Stimulate Data & AI adoption with the most collaborative and forward-thinking ecosystem.

(iv) Australia¹⁸

2.39 Australia's AI Ethics Framework was published in November 2019. AI Ethics Principles are designed to ensure that AI is safe, secure and reliable. They will help to (a) achieve safer, more reliable and fairer outcomes for all Australians, (b) reduce the risk of negative impact on those affected by AI applications and (c) businesses and governments to practice the highest ethical standards when designing, developing and implementing AI. Following are the Eight AI Ethics Principles-

- i. Human, societal and environmental wellbeing: AI systems should benefit individuals, society and the environment.
- ii. Human-centred values: AI systems should respect human rights, diversity, and the autonomy of individuals.

¹⁷ https://ai.sa/Brochure_NSDAI_Summit%20version_EN.pdf

¹⁸ <https://www.industry.gov.au/publications/australias-artificial-intelligence-ethics-framework>

- iii. Fairness: AI systems should be inclusive and accessible and should not involve or result in unfair discrimination against individuals, communities or groups.
- iv. Privacy protection and security: AI systems should respect and uphold privacy rights and data protection and ensure the security of data.
- v. Reliability and safety: AI systems should reliably operate in accordance with their intended purpose.
- vi. Transparency and explainability: There should be transparency and responsible disclosure so people can understand when they are being significantly impacted by AI and can find out when an AI system is engaging with them.
- vii. Contestability: When an AI system significantly impacts a person, community, group or environment, there should be a timely process to allow people to challenge the use or outcomes of the AI system.
- viii. Accountability: People responsible for the different phases of the AI system lifecycle should be identifiable and accountable for the outcomes of the AI systems and human oversight of AI systems should be enabled.

2.40 The principles are entirely voluntary. They are designed to prompt organisations to consider the impact of using AI enabled systems. If AI system under development or implementation be used to make decisions or in other ways have a significant impact (positive or negative) on people (including marginalised groups), the environment or society, or if the developer is unsure about how the AI system may impact its organisation or customers/clients, only then the AI Ethics Principles shall be applicable. If the AI use does not involve or affect human beings, all principles may not be required to be considered.

2.41 The AI Ethics Principles shall be applicable at each phase of the AI system lifecycle. The AI lifecycle includes (a) design, data and modelling (such as planning, data collection and model building), (b) development and validation (such as training and testing), (c) deployment, and (d) monitoring and refinement (including when fixing any problems that occur).

(v) OECD Principles on AI¹⁹

2.42 Adopted in May 2019 and endorsed by 42 countries, the Organisation for Economic Co-operation and Development's (OECD) AI Principles are aimed at promoting use of AI that is innovative and trustworthy and that respects human rights and democratic values. These include:

- (i) Inclusive growth, sustainable development and well-being-
Stakeholders should proactively engage in responsible stewardship of trustworthy AI in pursuit of beneficial outcomes for people and the planet such as augmenting human capabilities and enhancing creativity, advancing inclusion of underrepresented populations, reducing economic, social, gender and other inequalities, and protecting natural environments, thus invigorating inclusive growth, sustainable development and well-being.
- (ii) Human-centred values and Fairness-
 - a) AI actors should respect the rule of law, human rights and democratic values, throughout the AI system lifecycle. These include freedom, dignity and autonomy, privacy and data protection, non-discrimination and equality, diversity, fairness, social justice, and internationally recognised labour rights.
 - b) To this end, AI actors should implement mechanisms and safeguards such as capacity for human determination, that are appropriate to the context and consistent with the state of art.
- (iii) Transparency and Explainability- AI actors should commit to transparency and responsible disclosure regarding AI systems. To this end, they should provide meaningful information, appropriate to the context and consistent with the state of art:
 - a) to foster a general understanding of AI systems,

¹⁹ <https://oecd.ai/en/ai-principles>

- b) to make stakeholders aware of their interactions with AI systems including in the workplace,
 - c) to enable those affected by an AI system to understand the outcome, and
 - d) to enable those adversely affected by an AI system to challenge its outcome based on plain and easy-to-understand information on the factors and the logic that served as the basis for the prediction, recommendation or decision.
- (iv) Robustness, Security and Safety –
- a) AI systems should be robust, secure and safe throughout their entire lifecycle so that in conditions of normal use, foreseeable use or misuse, or other adverse conditions, they function appropriately and do not pose unreasonable safety risk.
 - b) To this end, AI actors should ensure traceability including in relation to datasets, processes and decisions made during the AI system lifecycle, to enable analysis of the AI system’s outcomes and responses to inquiry, appropriate to the context and consistent with the state of art.
 - c) AI actors should, based on their roles, the context, and their ability to act, apply a systematic risk management approach to each phase of the AI system lifecycle on a continuous basis to address risks related to AI systems including privacy, digital security, safety and bias.
- (v) Accountability - AI actors should be accountable for the proper functioning of AI systems and for the respect of the above principles based on their roles, the context, and consistent with the state of art.

2.43 OECD made following recommendations for national policies and international co-operation for trustworthy AI²⁰ with special attention to small and medium-sized enterprises (SMEs).

- (i) Investing in AI Research and Development- Governments should consider long-term public investment, and encourage private investment in research and development including interdisciplinary efforts, to spur innovation in trustworthy AI that focus on challenging technical issues and on AI-related social, legal and ethical implications and policy issues. Governments should also consider public investment and encourage private investment in open datasets that are representative and respect privacy and data protection to support an environment for AI research and development that is free of inappropriate bias and to improve interoperability and use of standards.
- (ii) Fostering a Digital Ecosystem for AI - Governments should foster the development of and access to a digital ecosystem for trustworthy AI. In this regard, governments should consider promoting mechanisms such as data trusts to support the safe, fair, legal and ethical sharing of data.
- (iii) Shaping an Enabling Policy Environment for AI - Governments should promote a policy environment that supports an agile transition from the research and development stage to the deployment and operation stage for trustworthy AI systems. To this effect, they should consider using experimentation to provide a controlled environment in which AI systems can be tested and scaled-up, as appropriate. Governments should review and adapt, as appropriate, their policy and regulatory frameworks and assessment mechanisms as they apply to AI systems to encourage innovation and competition for trustworthy AI.

²⁰ <https://legalinstruments.oecd.org/en/instruments/oecd-legal-0449>

- (iv) Building human capacity and preparing for labour market transformation- Governments should work closely with stakeholders to empower people to effectively use and interact with AI systems including by equipping them with the necessary skills. Governments should take steps, including through social dialogue to ensure a fair transition for workers as AI is deployed, such as through training programmes along the working life, support for those affected by displacement, and access to new opportunities in the labour market.
- (v) International co-operation for trustworthy AI- Governments, should actively co-operate to advance these principles and to progress on responsible stewardship of trustworthy AI. Governments should work together in the OECD and other global and regional fora to foster the sharing of AI knowledge, as appropriate. They should encourage international, cross-sectoral and open multi-stakeholder initiatives to garner long-term expertise on AI. Governments should promote the development of multi-stakeholder, consensus-driven global technical standards for interoperable and trustworthy AI.

(vi) Singapore²¹

2.44 The Personal Data Protection Act (PDPA)-2012 is the principal data protection legislation in Singapore governing the collection, use and disclosure of individuals' personal data by organisations. PDPA provides a baseline standard of protection for personal data in Singapore. It comprises various requirements governing the collection, use, disclosure and care of personal data in Singapore. The PDPA recognises both the need to protect individuals' personal data and the need of organisations to collect, use or disclose personal data for legitimate and reasonable purposes.

²¹<https://www.pdpc.gov.sg/help-and-resources/2020/01/model-ai-governance-framework>

- 2.45 Singapore has established a Personal Data Protection Commission (PDPC) in 2013 under the Personal Data Protection Act (PDPA)-2012. PDPC plays the main role in administering and enforcing the Personal Data Protection Act in Singapore. It is a part of Infocomm Media Development Authority (IMDA).
- 2.46 An Advisory Council on the Ethical Use of AI & Data was also established in 2018 in Singapore for the purpose of advising the Government on ethical, policy and governance issues arising from the use of data-driven technologies in the private sector and supporting the Government in providing general guidance to businesses to minimise ethical, governance and sustainability risks, and to mitigate adverse impact on consumers from the use of data-driven technologies. The members of the Advisory Council are appointed by the Minister for Communications and Information and supported by a Secretariat.
- 2.47 In January 2019, the PDPC released its first edition of the Model AI Governance Framework (Model Framework) for broader consultation, adoption and feedback. In January 2020, the PDPC released the second edition of the Model Framework²². The Model Framework provides detailed and readily implementable guidance to private sector organisations to address key ethical and governance issues when deploying AI solutions. It is a voluntary Model Framework as a general, ready-to-use tool to enable organisations that are deploying AI solutions at scale to do so in a responsible manner.
- 2.48 In May 2022, PDPC launched A.I. Verify - the AI Governance Testing Framework and Toolkit for companies that wish to demonstrate responsible AI in an objective and verifiable manner. A.I. Verify aims to promote transparency between companies and their stakeholders.

²² <https://www.pdpc.gov.sg/-/media/files/pdpc/pdf-files/resource-for-organisation/ai/sgmodelaigovframework2.pdf>

A.I. Developers and owners can verify the claimed performance of their AI systems against a set of principles through standardised tests. A.I. Verify packages a set of open-source testing solutions together including a set of process checks into a Toolkit for convenient self-assessment.

(vii) USA

2.49 In April 2020, the Federal Trade Commission (FTC) published²³ five principles that companies should follow when using AI and algorithms while adequately managing consumer-protection risks. According to these guidelines, companies should (1) be transparent with consumers about their interaction with AI tools; (2) clearly explain decisions that result from the AI; (3) ensure that decisions are fair; (4) ensure that the data and models being used are robust and empirically sound; and (5) hold themselves accountable for compliance, ethics, fairness and non-discrimination.

2.50 The Office of Science and Technology Policy (OSTP) in the White House has been working on AI Bill of Rights. In October 2022, OSTP published a blueprint for an AI Bill of Rights²⁴ that among other things shared a non-binding roadmap for the responsible use of AI. It spelt out five core principles to govern the development of AI systems. The broad tenets are.

- i. Safe and effective system -Protecting users from unsafe or ineffective systems.
- ii. Algorithmic discrimination protections- Users not having to face discrimination by algorithms.
- iii. Data privacy- Users are protected from abusive data practices via built in protections.

²³ [Using Artificial Intelligence and Algorithms | Federal Trade Commission \(ftc.gov\)](https://www.ftc.gov/ai-verify)

²⁴ <https://www.whitehouse.gov/wp-content/uploads/2022/10/Blueprint-for-an-AI-Bill-of-Rights.pdf>

- iv. Notice and explanation- Users should know that an automated system is being used and comprehend how and why it contributes such outcomes that impact them.
- v. Human Alternatives, Consideration and Fallback-Users can opt out and have access to a person who can quickly consider and remedy problems they encounter.

2.51 In April 2023, the US Department of Commerce sought the public opinions on how it could create rules and laws to ensure that the AI systems operate as advertised. The agency flagged the possibility of floating an auditing system to assess whether AI systems include harmful bias or distort communications to spread misinformation.

B. Initiatives taken in India-

(i) NITI Aayog

2.52 In June 2018, NITI Aayog released the National Strategy on Artificial Intelligence (NSAI) discussion paper²⁵. The strategy document coined “AI for All” mantra, to be the governing benchmark for future AI design, development and deployment in India. A part of this strategy was to ensure the safe and responsible use of AI. Towards promoting development as well as adoption of AI, the NSAI made broad recommendations for supporting and nurturing an AI ecosystem in India under four heads, (a) promotion of research; (b) skilling and reskilling of the workforce; (c) facilitating the adoption of AI solutions; and (d) the development of guidelines for ‘responsible AI’. 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.

²⁵ <https://niti.gov.in/sites/default/files/2019-01/NationalStrategy-for-AI-Discussion-Paper.pdf>

2.53 In 2021, NITI Aayog released two-part approach paper on 'Principles of Responsible AI (RAI)', identifying principles for responsible design, development, and deployment of Artificial Intelligence (AI) in India and setting out enforcement mechanisms for the operationalisation of these principles²⁶. 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.

2.54 In the context of regulation, the paper recommends a risk-based mechanism for regulating AI in India. Regulation must be proportional to the likelihood of harm that can be occasioned by an AI system; greater the risk of harm, greater the regulatory scrutiny attracted by the relevant AI system. To determine the risk posed by AI systems, the paper proposes the adoption of specific policy interventions such as sandboxing and controlled deployments. Further, in instances where the perceived risk of harm is low, governments may prefer regulatory forbearance and allow market players to lead with self-regulation. Sectoral regulators may, however, continue to oversee AI-related developments in their field to avoid conflicting guidelines in the future.

2.55 Niti Aayog paper further proposes the setting up of an independent, multi-disciplinary advisory body at the apex-level whose remit covers

²⁶ <https://www.niti.gov.in/sites/default/files/2021-08/Part2-Responsible-AI-12082021.pdf>

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 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.

(ii) The upcoming Digital Personal Data Protection Bill 2022

2.56 Currently, India does not have a standalone law on data protection. The usage of personal data is regulated under the Information Technology (IT) Act, 2000. It has been observed that this framework is not adequate to ensure the protection of personal data. The upcoming Digital Personal Data Protection Bill 2022 (DPDPB 2022) will apply to AI developers who develop and facilitate AI technologies. This implies that AI developers will be required to comply with the key principles of privacy and data protection as enshrined in DPDPB 2022.

2.57 The Bill will apply to the processing of digital personal data where such data is: (i) collected online, or (ii) collected offline and is digitised. As per the draft bill, personal data may be processed only for a lawful purpose for which an individual has given consent. Consent may be deemed in certain cases. Data fiduciaries will be obligated to maintain the accuracy and security of data. The Bill grants certain rights to individuals including the right to obtain information, seek correction and erasure, and grievance redressal. The central government may exempt government agencies from the application of provisions of the Bill in the interest of specified grounds such as security of the state, public order and prevention of offences.

(iii) Other Initiatives

2.58 Currently, India does not have an overarching regulatory framework for the use of AI systems. There are certain sector specific frameworks that have been identified for development and use of AI.

- i. In finance, SEBI issued a circular in Jan 2019 to Stockbrokers, Depository Participants, Recognized Stock Exchanges and Depositories and in May 2019 to all Mutual Funds (MFs)/Asset Management Companies (AMCs)/Trustee Companies/Board of Trustees of Mutual Funds/Association of Mutual Funds in India (AMFI) on reporting requirements for Artificial Intelligence (AI) and Machine Learning (ML) applications and systems offered and used. The reporting is towards creating an inventory of AI systems in the market and guide future policies.^{27,28}
- ii. The Indian Council of Medical Research (ICMR) released "Ethical Guidelines for AI in Biomedical Research and Healthcare" in June 2023²⁹. The purpose of the Guideline is to provide an ethics framework which can assist in the development, deployment and adoption of AI-based solutions for biomedical research and healthcare delivery. The guidelines are intended to foster trust and collaboration among the stakeholders involved in the development and deployment of AI in biomedical research and healthcare. The Ethical Guidelines for AI in Healthcare outline ten principles specific to AI in the healthcare domain. These principles are as follows –
 - i. Autonomy
 - ii. Safety and Risk Minimization

²⁷ https://www.sebi.gov.in/legal/circulars/jan-2019/reporting-for-artificial-intelligence-ai-and-machine-learning-ml-applications-and-systems-offered-and-used-by-market-intermediaries_41546.html

²⁸ https://www.sebi.gov.in/legal/circulars/may-2019/reporting-for-artificial-intelligence-ai-and-machine-learning-ml-applications-and-systems-offered-and-used-by-mutual-funds_42932.html

²⁹

https://main.icmr.nic.in/sites/default/files/upload_documents/Ethical_Guidelines_AI_Healthcare_2023.pdf

- iii. Trustworthiness
- iv. Data Privacy
- v. Accountability and Liability
- vi. Optimization of Data Quality
- vii. Accessibility, Equity, and Inclusiveness
- viii. Collaboration
- ix. Non-Discrimination and Fairness Principles
- x. Validity

2.59 In June 2023, National Association of Software and Service Companies (NASSCOM)³⁰ published guidelines for the responsible implementation of Generative AI, aiming to ensure its responsible adoption. The guidelines primarily centre on the research, development, and utilization of Generative AI. The main objective of these guidelines is to encourage and support the responsible advancement and application of Generative AI solutions by various stakeholders.

C. Need to Regulate AI

2.60 The Artificial Intelligence (AI) continues to be a hot topic for regulators, scientists, researchers, business, and media throughout the world. Artificial Intelligence systems are everywhere in the modern world helping run smartphones, internet search engines, digital voice assistants and Netflix movie queues. AI is expanding rapidly due to ever-increasing amounts of data available, improving algorithms and advanced computing facilities. There are no signs of any slowdown in the pace of AI adoption soon. The adoption of AI in various domains has brought many benefits, but also many challenges.

2.61 Bias- One of the most pressing challenges is how to deal with bias in AI systems, which can have negative impacts on individuals and society. Bias in AI can arise from different sources such as the data used to train the models, the design of the model architecture or the

³⁰ <https://nasscom.in/ai/responsibleai/images/GenAI-Guidelines-June2023.pdf>

algorithms themselves. The data that AI systems use as input can have built-in biases. For example, data on creditworthiness can be influenced by factors such as race, gender, caste and income which can lead to unfair outcomes for some groups of people. It is essential to identify and mitigate bias in AI systems and to ensure that they are fair, transparent, and accountable. It may require a multidisciplinary approach that involves not only technical solutions but also social, ethical, and legal considerations.

2.62 Lack of Explainability and Accountability-AI poses a unique challenge because unlike in traditional engineering systems, designers cannot be sure how AI systems will behave. Also, AI systems change and evolve with more and more interaction. The increasing complexity of algorithms which are often proprietary, undermines efforts to evaluate algorithmic decision-making. As more sectors are subject to decisions taken by AI systems, including housing, education and health, this opacity in decision making undermines democratic rights to due process and equal protection.

2.63 AI Surveillance Around the World- New technologies are arming governments with unprecedented capabilities to monitor, track and surveil individual people. In states with track record of frequent human rights abuses, AI systems are likely to be used to increase human rights abuse. AI systems are capable of processing large amount of information about the citizens – including social media posts, text messages, emails and phone calls – more quickly and efficiently. The use of AI based surveillance tools can be used to identify social trends as well as specific people. Extensive built-in surveillance technology can be deployed in cities with high-definition internet-connected cameras that provide 24/7 intelligent security surveillance with data analytics. Without comprehensive regulation these tools will weaken freedom of speech and assembly as well as the right to privacy.

- 2.64 AI and Disinformation - In addition to providing surveillance capabilities, AI can help in manipulating available information and spread disinformation. AI also underpins the technology commonly called “deepfake” in which algorithms create realistic video and audio forgeries. AI could allow for the automated, mass dissemination of falsehoods and misleading information. Further, AI data piracy is a serious issue that affects the security, privacy and integrity of data sources and systems.
- 2.65 The late Professor Stephen Hawking was a major voice in the debate about how humanity can benefit from Artificial Intelligence. Hawking made no secret of his fears that thinking machines could one day take charge. He went as far as predicting that future developments in AI “*could spell the end of the human race.*”
- 2.66 In a panel discussion in Athens Democracy Forum -2020³¹, well Known Professor Yuval Noah Harari mentioned that “*...In the hands of the wrong people, AI could be the end of democracy. AI could also be the basis for the worst totalitarian regimes in human history because you know dictators always dreamed about following everybody and monitoring everybody all the time, but they could never do it.You can use the same technology to build completely different Societies. In the 20th century, some people used trains and radio and electricity to build totalitarian regimes and other people used exactly the same technology to build liberal democracies. It is same with AI and with the Technologies of the 21st century. We still have a choice about how to employ them. I think that AI is nowhere near its full potential yet..... .*”
- 2.67 In another interaction³², Professor Yuval Noah Harari said that “*...We should be very worried because what we need to understand about AI. It is the first tool that can make decisions by itself. All previous inventions in human history always empowered us, they always gave us more power because the decisions were always made by humans. If you invent a knife, the knife cannot decide whether to use it to cut salad or to murder somebody or to save their life in surgery. If you invent an atom bomb, similarly, the atom bomb cannot decide who to attack and when and where. AI is the first technology that can actually make decisions by itself. It can make decisions about its own usage and development. Nukes cannot make better nukes but AI can make better AI and also AI can make and does make decisions about us,*

³¹ <https://www.youtube.com/watch?v=JfyIW9wRvB4>

³² <https://www.youtube.com/watch?v=11uSfpOcWzo>

increasingly when you apply to a bank to get a loan, you apply to get a job, it is an AI making crucial decisions about your life and we haven't seen anything yet, AI is just making its first tiny baby steps....”

2.68 Pause on powerful AI development- In March 2023, thousands of signatories, including Elon Musk, Steve Wozniak, and Tristan Harris of the Center for Humane Technology, have signed an open letter³³ that was posted online that calls on “*all AI labs to immediately pause for at least 6 months the training of AI systems more powerful than GPT-4.*” The letter reads:

“...Contemporary AI systems are now becoming human-competitive at general tasks, and we must ask ourselves: Should we let machines flood our information channels with propaganda and untruth? Should we automate away all the jobs, including the fulfilling ones? Should we develop nonhuman minds that might eventually outnumber, outsmart, obsolete and replace us? Should we risk loss of control of our civilization? Such decisions must not be delegated to unelected tech leaders. Powerful AI systems should be developed only once we are confident that their effects will be positive and their risks will be manageable...”

2.69 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. Ethical implications of AI are under active consideration of regulators across the globe. They are framing the rules and guidelines that govern the development, deployment and use of AI. The role of regulation in ensuring ethical AI is critical. The focus should be on avoiding or mitigating the unintended negative consequences of AI while promoting good use of AI.

³³ <https://futureoflife.org/open-letter/pause-giant-ai-experiments/>

2.70 It is likely that regulation strategies will differ around the world with some countries taking a government led approach while others opt for a self-regulation by the industry. For instance, the European Union has proposed to bring a new AI Act that segregates AI as per use case scenario on the basis of degree of invasiveness and risk, whereas UK has adopted a light-touch approach. The UK government has set out cross-sectoral principles which will apply to all actors throughout the AI lifecycle. These principles will then be interpreted and implemented in practice by existing regulators.

2.71 India's digital transformation journey has left an indelible mark in all walks of life and is ensuring digital access, digital delivery of services and digital inclusion of all. As the technology is being extensively used to provide services to citizens at such a large scale, formulating frameworks to mitigate the risk posed by the technology becomes even more critical. Therefore, the Authority is of the view that the Government should take cognisance of the risks associated with AI and make a regulatory framework immediately to regulate AI in India.

D. Is Self-Regulation Enough?

2.72 Many initiatives have been taken by industry to self-regulate and ensure ethical use of AI. One such initiatives 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.³⁴

³⁴ <https://standards.ieee.org/industry-connections/ec/autonomous-systems/>

- 2.73 Another such initiative is the “Partnership on AI”³⁵, which is a non-profit community of academic, civil society, industry, and media organizations. This Partnership was originally started by the big players in the AI space such as Google, Microsoft, Meta, IBM, Apple and Amazon but has expanded to include a wide variety of companies, think tanks, academic AI organizations, professional societies, and charitable groups such as the American Civil Liberties Union (ACLU), Amnesty International, United Nations International Children’s Emergency Fund (UNICEF) and Human Rights Watch.
- 2.74 Self-regulation approach for regulating AI adopted by some countries, relies on the voluntary compliance of AI developers and users with ethical principles, professional guidelines, codes of conduct, best practices, standards, certification programmes etc. Industry led self-regulations are very important but it may lack accountability and enforcement mechanisms.
- 2.75 In a panel discussion in Athens Democracy Forum -2020³⁶, noted historian and Professor Yuval Noah Harari said that, “...*I think nobody is doing enough. Again, I would say that the main responsibilities are of the governments, not of the companies. Yes, I expect the companies to do more but ultimately this is the responsibility of governments....*” In the same panel discussion, Brad Smith, President of Microsoft mentioned that “...*I don't think in the history of business there has ever been an industry that has successfully regulated itself entirely. You know we live in a world where for good reason we look to companies to exercise responsibility and we look for governments to apply laws that ensure that even those who are not thinking broadly are frankly required to hit some kind of minimum standard, I do think that we are at a point where we need more laws we need more regulation we*

³⁵ <https://partnershiponai.org/>

³⁶ <https://www.youtube.com/watch?v=JfyIW9wRvB4>

need both we need high standards by companies and we need governments to move faster and start to catch up....”

- 2.76 The United Nations Educational, Scientific and Cultural Organization (UNESCO) recommendation on ‘the Ethics of Artificial Intelligence’³⁷ 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 is not good enough.
- 2.77 Self-regulations are not directly enforceable by government and it is difficult to assess their actual compliance. These measures generally do not provide the same assurance to the public as traditional government regulation that the problems presented by a new technology are being adequately managed.
- 2.78 If the AI is to be regulated by the Government, should it be through different sector regulators or through a central body? AI offers some unique challenges. AI involves applications that are used across multiple industries, government agency jurisdictions and stakeholder groups. Many risks created by AI are not within any existing regulatory agency’s jurisdiction, including concerns such as human-machine relationships, biased algorithms and existential risks from future super-intelligence. AI raises a wide range of issues and concerns that go beyond a particular sector. Therefore, the adoption of horizontal regulation across sector could be a possible option.
- 2.79 In light of the above discussion, the Authority is of the view that for ensuring development of responsible Artificial Intelligence (AI) in India, there is an urgent need to adopt a regulatory framework by the Government that should be applicable across sectors. An independent

³⁷ <https://www.unesco.org/en/articles/recommendation-ethics-artificial-intelligence>

statutory authority should be established immediately for ensuring development of responsible AI and regulation of use cases in India. The authority should be designated as “Artificial Intelligence and Data Authority of India” (AIDAI).

2.80 TRAI, in its recommendations on ‘Regulatory Framework for Promoting Data Economy’ dated 18th November 2022, that were also sent to the Ministry of Electronics and Information Technology (MeitY), has inter-alia recommended the following-

“For steering the data digitization drive, the Authority recommends that a statutory body, Data Digitization and Monetization Council (DDMC), be established at the Centre by enactment of new law or by amendment of the present law. The proposed body should have suitable representation from DoT and MeitY, in addition to representatives from Central and State governments. The proposed body should be entrusted with the responsibility to review and prioritize the avenues which would require more concentrated efforts of data digitization and fix timeframes accordingly. DDMC should also assess the data digitization requirements and define the process framework for use of AI and related technology in data processing, data sharing and data monetization while ensuring the privacy and security of the data owner. The proposed body should also be entrusted with framing policies and incentivization schemes for data digitalization, data sharing, and data monetization. DDMC should be the apex body to oversee all issues related to data digitization, data sharing, and data monetization in the country. (Para 2.258)

The Authority further recommends that DDMC should also be entrusted with responsibility of putting in place an overarching framework for ethical use of data both by the Government as well as by the corporates in India. The framework should address the generic as well as vertical sector specific requirements. DDMC should also study the possible impact of upcoming technologies on data ethics and come out with relevant rules/guidelines on the subject.” (Para 5.44)

2.81 Since the Data Digitization and Monetization Council (DDMC) which was recommended to be established by TRAI through its aforementioned recommendation of 18th November 2022 was also envisaged to perform several functions related to use of AI and related technology as well as to study the impact of upcoming technologies on data ethics, the Authority is of the view that the DDMC should now be

renamed as “Artificial Intelligence and Data Authority of India (AIDAI). The Authority is also of the view that formation of too many statutory authorities/bodies creates confusion for the sector and therefore, in order to derive synergy, organically the work of AIDAI should be entrusted to TRAI with suitable modifications in the TRAI Act.

2.82 The functions of the DDMC (now proposed AIDAI) as recommended in the said recommendations are summarised below.

- (i) Assess the data digitization requirement in the country; review and prioritize the avenues requiring concentrated efforts for data digitization and fix timeframes accordingly.
- (ii) Be the apex body to oversee all issues related to data digitization, data sharing and data monetization in the country including framing policies and incentivization schemes for data digitalization, data sharing and data monetization.
- (iii) Define the process framework for use of AI and related technology in data processing, data sharing and data monetization while ensuring the privacy and security of the data owner.
- (iv) Putting in place an overarching framework for ethical use of data both by the Government as well as by the corporates in India. The framework should address the generic as well as vertical sector specific requirements.
- (v) Study the possible impact of upcoming technologies on data ethics and come out with relevant rules/guidelines on the subject.

E. Regulation of AI Technology or its Use Cases?

2.83 Another critical challenge 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. 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.

2.84 If all the AI systems are treated alike and same set of mandatory requirements are applied, this could restrict innovations 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.

2.85 **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.**

2.86 In light of the above, Authority is of the view that the 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.

F. Principles of Responsible AI

2.87 Responsible AI is an approach to designing, developing and deploying Artificial Intelligence systems that adhere to ethical and legal standards. Responsible AI aims to ensure that AI systems are fair, reliable, safe, inclusive, transparent and accountable. As discussed in

the section on International Practices, many countries are following certain fundamental principles for AI. OECD principles have been adopted by many countries. G20 AI Principles are also drawn from the OECD AI Principles. The list of these principles has been reproduced below-

- (i) Inclusive growth, sustainable development and well-being,
- (ii) Human-centred values and Fairness,
- (iii) Transparency and Explainability,
- (iv) Robustness, Security and Safety,
- (v) Accountability.

2.88 Adoption of principles of responsible AI for its development and use can foster trust, innovation and public good. These principles may evolve with time. Therefore, the Authority is of the view that the proposed authority AIDAI should define principles of responsible AI and their applicability on AI use cases based on risk assessment. A suggestive matrix for the same is given below:

Sl No	Principles of Responsible AI	High Risk Use Cases (such as system dealing with health of public)	Low Risk Use Cases (such as chatbot)
1	Inclusive growth, sustainable development and well-being	√	
2	Human-centred values and Fairness	√	
3	Transparency and Explainability	√	√
4	Robustness, Security and Safety	√	
5	Accountability	√	

The above matrix is only suggestive and AIDAI should evolve the framework based on its assessment, advice of proposed MSB, global best practices and public consultation.

2.89 The Authority is also of the view that these AI Ethics Principles should be applicable at each phase of the AI system lifecycle viz. design, development, validation, deployment, monitoring and refinement.

G. Multi Stakeholder Advisory Body

2.90 The AI ecosystem has multiple stakeholders- private sector, research, government, legal bodies, regulators, standard setting bodies, etc. The regulatory principles are expected to serve these stakeholders of the AI ecosystem. The AI technology is not confined to a sector. Moreover, the issues involve are wide and complex. It would require consultation with various stakeholders on various aspects of AI. Therefore, there should be a mechanism for an elaborate consultation with all the concerned stakeholders while formulating or updating AI regulations and guidelines.

2.91 In light of the above discussion, as suggested by many stakeholders, the Authority is of the view that a Multi Stakeholder Body (MSB) should be constituted by the Government to act as an advisory body to AIDAI drawing members from:

- i. Department of Telecommunication
- ii. Ministry of Information and Broadcasting
- iii. Ministry of Electronics and Information Technology (MeitY)
- iv. Department for Promotion of Industry and Internal Trade (DPIIT)
- v. Department of Science and Technology
- vi. Ministry of Home Affairs
- vii. Two members from academic and research institutes dealing with AI
- viii. Four members from industry
- ix. One legal expert in the field of AI
- x. One Cyber security expert
- xi. Any other suitable member (maximum two).

MSB may invite representatives of relevant Ministry/ Department of Centre/ State Government on need basis as special invitee.

- 2.92 As mentioned above, the proposed MSB shall function as an advisory body to AIDAI. Since the issues involved in AI are complex and need wider consultation, the Authority is of the view that while defining powers and functions of AIDAI, it should be ensured that the clauses related to exercising transparency through open consultation with stakeholders are made applicable to all regulatory decisions and recommendations of AIDAI.
- 2.93 Further, for synergy and coordination among different Central and State Ministries and local bodies and for orderly growth of AI and its use cases, the Ministry of Electronics and Information Technology (MeitY) should be designated as the administrative ministry for AI.

H. Global Collaboration for AI Regulation

- 2.94 Artificial Intelligence (AI) is a powerful technology that can have significant impact on society, economy, culture and environment. As AI becomes more pervasive and influential, there is a need for global collaboration and global regulations to ensure that it is used in a responsible and ethical manner. As brought out in the subsequent paras, there are many efforts made at global/regional levels to bring out a uniform regulatory framework for AI.
- 2.95 UNESCO's Recommendation on the Ethics of Artificial Intelligence- UNESCO published the first-ever global standard on AI ethics- 'Recommendation on the Ethics of Artificial Intelligence' in November 2021³⁸. This framework was adopted by all the Member States. The Recommendation establishes a set of values in line with the promotion and protection of human rights, human dignity and environmental

³⁸ <https://www.unesco.org/en/articles/recommendation-ethics-artificial-intelligence>

sustainability. It advances essential principles such as transparency, accountability and the rule of law. It also includes concrete policy chapters that call for better governance of data, gender equality, and important aspects of AI applications on education, culture, labour markets, the environment, communication and information, health and social well-being, and the economy.

2.96 The European Union proposed an AI legal framework- In addition to UNESCO's initiative, the European Union has also proposed an AI legal framework in 2021 which aims to create a single market for trustworthy and human-centric AI. The AI Act would establish rules and requirements for different types of AI systems based on their level of risk. The AI Act would also prohibit certain practices such as biometric surveillance, emotion recognition and predictive policing.

2.97 The Global Partnership on AI (GPAI)- The Global Partnership on AI (GPAI) is an international initiative that aims to promote the responsible and human-centric development and use of Artificial Intelligence (AI). GPAI brings together experts from various fields and sectors, such as government, industry, civil society and academia to collaborate on cutting-edge research and best practices on AI governance and ethics. GPAI also seeks to foster dialogue and cooperation among different stakeholders and regions, and to support the implementation of the OECD Principles on AI and other relevant frameworks. GPAI's vision is to ensure that AI benefits all people and respects human rights, dignity and diversity.

2.98 While these efforts are commendable, there are still challenges and gaps in achieving a global consensus over AI regulation. Different countries may have different priorities, values and interests when it comes to AI development and deployment. In June 2023, OpenAI CEO Sam Altman expressed his vision of a global collaboration on Artificial

Intelligence³⁹ drawing an analogy with the International Atomic Energy Agency (IAEA). "...Let's make sure we come together as a globe — and I hope this place can play a real role in this," Altman said. "We talk about the IAEA as a model where the world has said 'OK, very dangerous technology, let's all put some guard rails...'"

2.99 Artificial Intelligence (AI) is advancing rapidly in various domains. The deployment of 5G networks will enable faster adoption of AI applications. The use of AI products cannot be limited to geographical boundaries. Any framework for responsible AI cannot work in isolation and will require collaborations at global level. The ethical challenges can be effectively overcome only through international collaborations. It is important that an international body should be formed in collaboration with other nations for development, standardization and use of AI technology. Considering the sensitivity and far-reaching impact of AI across the nations which defies borders, the Authority is of the view that the Indian Government should collaborate with international agencies and governments of other countries for forming a global agency that will act as the primary international body for development, standardization and responsible use of AI.

I. India in Leadership Role

2.100 India has been making significant strides in the field of Artificial Intelligence (AI) in recent years. According to a report by NASSCOM⁴⁰, India ranked third in the world in terms of AI research publications and patents in 2019. India has emerged as a key player in the global AI landscape, with its unique strengths in talent, data and innovation. India has also taken several initiatives to promote AI research and development, as well as its adoption across various sectors and

³⁹ <https://www.communicationstoday.co.in/international-atomic-energy-agency-can-oversee-ai/>

⁴⁰ https://www.nasscom.in/system/files/publication/AI-Patent-driving-emergence-of-india-Report_0.pdf

domains. The government has also partnered with industry leaders, academic institutions, and international organizations to foster collaboration and knowledge sharing on AI. For example, the US-India Artificial Intelligence (USIAI) initiative was launched in 2021 to bring together key stakeholders from both countries to exchange ideas and experiences, identify new opportunities and support bilateral cooperation on AI. Similarly, the Responsible AI for Social Empowerment (RAISE) summit was organized in 2020 to showcase India's achievements and potential in AI as well as to discuss the challenges and opportunities for creating a positive social impact with AI. The National Strategy on Artificial Intelligence, released by NITI Aayog in 2018, outlines a vision to make India a global leader in AI by ensuring responsible and transformative AI for all.

2.101 India is poised to take a leadership role in AI through its G20 presidency. India's vision for AI is to leverage it for inclusive growth, social empowerment and digital transformation. India played a key role in shaping the G20 AI principles. India is committed to fostering international cooperation and dialogue on AI among diverse stakeholders including governments, industry, civil society and academia. India is also playing a leading role in the Global Partnership on Artificial Intelligence (GPAI). India has also assumed the Council Chair of GPAI for 2023. As part of this role, India will work with other member states to put in place a framework for exploiting the power of AI for the good of citizens across the globe with guardrails to prevent misuse and user harm.

2.102 In light of the above discussion, the Authority is of the view that India should play a leading role in shaping the global AI standards and governance structures.

III. Facilitating Availability of Data for AI

2.103 Data is essential for adoption of AI as data is the basis for training and validation of AI models. However, there is a lack of access to quality dataset. It may be necessary that attempts should be made to establish an institutional mechanism to make the data accessible. In this background, the stakeholders were requested to submit their responses to the following issues raised in the CP-

Q.16 What initiatives do you suggest to democratize data required to develop AI models in the telecom sector?

Q.17: Whether the authority or body or institution as suggested in response to Q.11 may also be entrusted with the task to manage and oversee collection, cataloguing and storage of data? Whether such authority or body or institution need to be entrusted to generate and make available synthetic data?

Q.18: Whether the legal framework as envisaged in Para 3.5.3⁴¹ and Q.12 should also enable and provide for digitalisation, sharing and monetization for effective use of the data in AI without affecting privacy and security of the data?

Comments of the Stakeholders

2.104 Many stakeholders submitted that a comprehensive PDP Bill must be passed before creating a data sharing framework for AI. According to these stakeholders, the Data Protection Bill will regulate data use, restrict the use of personal data without consent, regulate cross-border data transfer and fix the accountability of data fiduciaries. A few stakeholders submitted that the proposed Data Protection Bill by the Indian government should provide the necessary legal framework

⁴¹ Para 3.5.3- “For this purpose, an authority or a body or an institution may be required to be established which can frame requisite guidelines, take necessary initiatives and oversee the compliance. This authority or a body or an institution may also facilitate sharing of future telecom network capabilities and its role in achieving national objectives for the development and deployment of AI based solutions in other sectors. Also, there will be a need to examine the legal framework under which such authority or a body or an institution can be constituted. Evidently, on the basis of best practices in different jurisdictions as discussed in previous chapter it seems there will be need of a new law to handle AI and related technologies.”

and clarity for AI adoption as the absence of guidelines creates a blind spot for the industry and poses a significant challenge to AI adoption in India. One stakeholder submitted that a data protection regulator may be operationalized by Data Protection Law. It further submitted that open government data policies should be adopted to share public sector data with the ecosystem.

- 2.105 Some stakeholders were of the view that there is no need for any regulatory intervention or sector-specific compliance at this stage. One of these stakeholders submitted that at a later stage, at National level only, a cross sectoral multi-stakeholder body should be set-up to refine the guidelines/ principles for adoption of AI in India. A few stakeholders submitted that an executive body with a role of gatekeeping proposed data spaces can be formed under MSB (Multi Stakeholder Body) or under the Data Protection Authority ('DPA') as envisaged in the erstwhile PDP Bill. One suggestion given was that a MSB should be constituted after PDP Bill that should work towards development of standards for data handling, interoperability and design, development and deployment of AI systems.
- 2.106 Some stakeholders agreed with the suggestion that the authority or body or institution as suggested in response to Q.11 may also be entrusted with the task to manage and oversee collection, cataloguing and storage of data. Some stakeholders submitted that issues related to this question relate to a much wider aspect of Data Protection and Privacy which the proposed DP Act/Bill will try to address, and no overlapping institutions/mechanisms should be created lest they add avoidable costs and complexities.
- 2.107 One stakeholder proposed that rather than a regulatory body, a coordination mechanism should be established. As per the stakeholder, the tasks for the envisaged body are the same for an Indian Data Management Office proposed by the MeitY in its draft National Data Governance Framework Policy, which proposed to

harness non-personal data available with the government by start-ups of the country. One stakeholder submitted that Government Community Cloud (GCC) as envisaged by MeitY can act as a repository of open-source datasets with the respective CoEs as the custodian of their datasets.

2.108 A few stakeholders submitted that Government of India has been very pro-active in setting up the data portal <https://www.india.gov.in/> that can be opened further to get citizen data with the right governance. One stakeholder was of the opinion that common data sharing framework regulation has to be available so that participating entities can share data sets across industry domains and benefit from related or inter-related AI models.

2.109 One suggestion put forth by a stakeholder was that the Authority or body need not be restricted to the telecom sector and all sectors should have a common body. Another stakeholder believed identifying industry barriers and creating an AI-friendly policy should be the priorities at this point. Therefore, according to the stakeholder, the Government can create a group/institution to set guidelines and take necessary steps to produce/provide the necessary data set for research, sharing and monetization of data for effective use, data privacy and security, and AI system development. One stakeholder submitted that interoperability of data and AI models across different platforms is still a challenge that needs to be addressed in the future. The stakeholder suggested for creating a common legally authorised Nodal Entity to facilitate interoperability and compatibility among all sectors/users.

Analysis

Draft Digital Personal Data Protection Bill 2022 (DPDPB-2022)

2.110 Most stakeholders pointed out that enactment of PDP Act is an essential enabler for AI adoption in the country. The Authority agrees

with the view of the stakeholders that enactment of Data Protection Act is essential to regulate data use, restrict the use of personal data without consent, regulate cross-border data transfer, and other related issues. This would enable mechanism for data sharing and adoption of open data strategies. Countries have adopted different approaches in making public data available ranging from limited data releases to open data by default. The large amount of data availability to public, private, academic and research actors would provide key economic benefits, increased citizens engagement, attractive environment for investors and accelerating innovation.

2.111 In July 2018, TRAI had released its Recommendations on “*Privacy, Security and Ownership of the Data in the Telecom Sector*’. The Recommendations addressed the multiple aspects of the data protection in the telecommunications sector. These recommendations were forwarded to the Ministry of Electronics and Information Technology (MeitY) by DoT on 23.09.2020 for appropriate consideration of the relevant suggestions in the ‘Personal Data Protection Bill’. The Authority is of the view that any framework for Responsible AI will not be effective if the privacy, security and ownership of data aspects are not comprehensively addressed.

2.112 In light of the above discussion, the Authority reiterates its recommendations on ‘Privacy, Security and Ownership of the Data in the Telecom Sector’ of July 2018. The Authority is also of the view that all such provisions of the aforesaid recommendations which are in the domain of DoT should be implemented immediately.

Data Governance, a global perspective

2.113 In the European Union (EU), the European Data Portal (EDP) provides access to data from various sources across Europe. This is one of the initiatives of the EU to foster open data and innovation. The EDP is a platform that collects and harmonises data from various sources across Europe, such as national, regional and local portals. The EDP

provides access to datasets covering topics such as agriculture, environment, health, education, and transport. The EDP aims to improve the availability, quality, and usability of data in Europe, and to support data users and providers with tools, training, and guidance.

- 2.114 The United States Federal Government has launched the Open Data Initiative, a new program that aims to make government data more accessible and usable for the public⁴². The initiative is based on the principles of transparency, participation and collaboration, and seeks to foster innovation, accountability, and economic growth. The Open Data Initiative aims to provide a common platform for federal agencies to publish their data in standardized formats and metadata as well as tools and guidance for data users and developers. The initiative will also support the development of data communities and partnerships across sectors and domains such as health, education, energy and environment. The Open Data Initiative is part of the broader digital government strategy of the United States which strives to deliver better services to the American people through technology.

Draft National Data Governance Framework Policy

- 2.115 In India, a vast amount of data is available with the Government. However, it is scattered across different Government entities. With the digitization of various Government records and delivery of services using digital platforms, the data available with the Government in digital form is increasing. Further, data is available with the Union Government, State Governments, local bodies, public sector undertakings, autonomous bodies or private entities. However, the Digital Government data is currently managed, stored and accessed in

⁴² On January 14, 2019, the [Foundations for Evidence-Based Policymaking Act](#) ("Evidence Act"), which includes the OPEN Government Data Act, was signed into law. The Evidence Act requires the Office of Management and Budget, the Office of Government Information Services, and the General Services Administration to develop and maintain an online repository ([Resources.data.gov](#)) of tools, best practices, and schema standards to facilitate the adoption of open data practices across the Federal Government.

non-uniform ways across different government entities thus attenuating the efficacy of data-driven governance and preventing an innovative ecosystem of data science and AI from emerging to its full potential. The power of this data must be harnessed for more effective digital governance, public good and innovation.

2.116 In India, the National Data Sharing and Accessibility Policy-2012 (NDSAP-2012) was designed to promote data sharing and enable access to government-owned data for national planning and development. The Open Government Data (OGD) Platform India - <https://data.gov.in/> was set up by the MeitY through the National Informatics Centre (NIC) to provide open access by proactive release of the data available with various ministries, departments and organizations of the Government of India. However, the NDSAP-2012 does not have a clear legal mandate or enforcement mechanism to ensure compliance by data holding organizations. The policy relies on voluntary participation of the data providers, which may result in incomplete data sharing. The NDSAP-2012 does not specify the standards or formats for data sharing and accessibility which may affect the interoperability and usability of the data. The open data platform does not include data from State Governments, local bodies, public sector undertakings, autonomous bodies or private entities which may have valuable data for public use.

2.117 The Government wants to bring a National Data Governance Framework Policy and transform Governments data collection and management processes. On 26th May 2022, the draft National Data Governance Framework Policy was released by MeitY for public consultation. Currently the draft policy is under finalization. The Draft National Data Governance Framework Policy aims to ensure that non-personal data and anonymized data from both Government and Private entities are safely accessible by Research and Innovation ecosystem. The policy aims to provide an institutional framework,

standards, guidelines and protocols for sharing of non-personal data sets while ensuring privacy, security and trust.

- 2.118 MeitY has proposed setting up of an Indian Data Management Office (IDMO). The IDMO shall coordinate closely with line Ministries and State Governments to standardize data management by building up capacity and capabilities in each Ministry. Further it will accelerate inclusion of non-personal datasets housed within ministries and private companies into the India Datasets Program.
- 2.119 The Authority is of the view that the aims and objectives of the policy can be more effectively achieved if the work that has been proposed to be handled by IDMO in the draft policy is entrusted to an independent statutory body. The reasons of this view are elaborated below.
- 2.120 AI and other 5G based technologies require big data. Also, for developing indigenous AI use cases and applications, the digitalization and sharing of data available with various governments at various levels, government agencies and private sector is critical. Therefore, to achieve the objectives of the National Data Governance Policy, apart from the data available with Central Government, onboarding data that is under the control of State Governments, local bodies and other agencies is also important. Private entities should also be brought on-board for adoption of Data Governance Policy to enable them to share their data with governments and other public and private entities/agencies. There will be a need to bring these different data owners on a single platform and devise common rules for data sharing without violating privacy. In India, this work requires huge efforts and planning. Data sharing and monetization should be an important aspect of the proposed National Data Governance Policy. It can incentivise various entities to digitise and share their data with other entities. Only an independent authority can achieve this humungous task.

- 2.121 The proposed Artificial Intelligence and Data Authority of India (AIDAI) should ensure that the entire data pool is available not only for the Government's own use, but the same can be made available to Industry, educational institutes, R&D centers, start-ups etc. as per all applicable laws.
- 2.122 In light of the above discussion, the Authority is of the view that the scope of AIDAI should also include making recommendations to create a national level mechanism to bring the State Governments, Local Bodies and other agencies onboard to adopt the national policy on data governance. AIDAI should also recommend a uniform framework to on-board private entities for adoption of national policy on data governance and to enable them and public sector entities to digitalize, monetize and share their data within the privacy and other applicable laws and policies.
- 2.123 Further, AIDAI's scope of work should also include recommending to the Government a uniform framework for sharing of data available with Government and its entities with industry, educational institutes, R&D Centres, Startups etc. within the privacy and other applicable laws and policies.

Recommendations

- 2.124 **The Authority recommends that for ensuring development of responsible Artificial Intelligence (AI) in India, there is an urgent need to adopt a regulatory framework by the Government that should be applicable across sectors. The 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.**
- 2.125 **The Authority recommends that the broad tenets of the suggested regulatory framework should comprise of-**

- a. **An independent statutory authority.**
- b. **A Multi Stakeholder Body (MSB) that will act as an advisory body to the proposed statutory authority.**
- c. **Categorizations of the AI use cases based on their risk and regulating them according to broad principles of Responsible AI.**

2.126 **The Authority recommends that an independent statutory authority should be established immediately for ensuring development of responsible AI and regulation of use cases in India. The authority should be designated as “Artificial Intelligence and Data Authority of India” (AIDAI).**

2.127 **The Authority in its recommendations on “Regulatory Framework for Promoting Data Economy” dated 18th November 2022 has recommended the following: -**

“For steering the data digitization drive, the Authority recommends that a statutory body, Data Digitization and Monetization Council (DDMC), be established at the Centre by enactment of new law or by amendment of the present law. The proposed body should have suitable representation from DoT and MeitY, in addition to representatives from Central and State governments. The proposed body should be entrusted with the responsibility to review and prioritize the avenues which would require more concentrated efforts of data digitization and fix timeframes accordingly. DDMC should also assess the data digitization requirements and define the process framework for use of AI and related technology in data processing, data sharing and data monetization while ensuring the privacy and security of the data owner. The proposed body should also be entrusted with framing policies and incentivization schemes for data digitalization, data sharing, and data monetization. DDMC should be the apex body to oversee all issues related to data digitization, data sharing, and data monetization in the country. (Para 2.258)

The Authority further recommends that DDMC should also be entrusted with responsibility of putting in place an overarching framework for ethical use of data both by the Government as well as by the corporates in India. The framework should address the generic as well as vertical sector specific requirements. DDMC should also study the possible impact of upcoming technologies on data ethics and come out with relevant rules/guidelines on the subject.”

(Para 5.44)

Since the Data Digitization and Monetization Council (DDMC) which was recommended to be established by TRAI through its aforementioned recommendation was also envisaged to perform several functions related to use of Artificial Intelligence and related technology as well as to study the impact of upcoming technologies on data ethics, the Authority further recommends that the DDMC should now be renamed as “Artificial Intelligence and Data Authority of India” (AIDAI). The Authority recommends that formation of too many statutory authorities/ bodies creates confusion for the sector and therefore, in order to derive synergy, organically the work of AIDAI should be entrusted to TRAI with suitable modifications in the TRAI Act.

2.128 **The functions of the DDMC (now proposed AIDAI) as recommended in the said recommendations are summarised below -**

- i. Assess the data digitization requirement in the country; review and prioritize the avenues requiring concentrated efforts for data digitization and fix timeframes accordingly.*
- ii. Be the apex body to oversee all issues related to data digitization, data sharing and data monetization in the country including framing policies and incentivization schemes for data digitalization, data sharing and data monetization.*

- iii. *Define the process framework for use of AI and related technology in data processing, data sharing and data monetization while ensuring the privacy and security of the data owner.*
- iv. *Putting in place an overarching framework for ethical use of data both by the Government as well as by the corporates in India. The framework should address the generic as well as vertical sector specific requirements.*
- v. *Study the possible impact of upcoming technologies on data ethics and come out with relevant rules/guidelines on the subject.*

2.129 **The Authority recommends that AIDAI should be assigned the following functions, which includes the functions of DDMC summarised above-**

I. Regulation Making Functions

- i) **Framing regulations on various aspects of AI including its responsible use.**
- ii) **Defining principles of responsible AI and their applicability on AI use cases based on risk assessment. A suggestive matrix for the same is given below:**

Sl No	Principles of Responsible AI	High Risk Use Cases (such as system dealing with health of public)	Low Risk Use Cases (such as chatbot)
1	Inclusive growth, sustainable development and well-being	√	
2	Human-centred values and Fairness	√	
3	Transparency and Explainability	√	√
4	Robustness, Security and Safety	√	
5	Accountability	√	

The above matrix is only suggestive and AIDAI should evolve the framework based on its assessment, advice of proposed MSB, global best practices, and public consultation.

- iii) Ensuring that principles of responsible AI are made applicable at each phase of AI framework lifecycle viz. design, development, validation, deployment, monitoring and refinement.**
- iv) Developing model AI Governance Framework to guide organizations on deploying AI in a responsible manner.**
- v) Developing model Ethical Codes for adoption by public and private entities in different sectors.**
- vi) Any other aspect of regulation of AI for orderly growth of the AI sector and protection of the consumers.**

II. Recommendatory Functions

- i) Facilitating adoption of future technologies and innovative architectures related to AI models.**
- ii) Monitoring and making recommendations on the enforcement framework on AI applications and its use cases.**
- iii) Coordinating with technical standard setting bodies of government like Telecom Engineering Centre (TEC) for accreditation of various labs for testing and accreditation of AI products and solutions and giving recommendations thereof.**
- iv) Capacity building and infrastructure requirements related to AI- evaluation and giving recommendations to the Government.**
- v) Assess the data digitization requirement in the country; review and prioritize the avenues requiring concentrated efforts for data digitization and fix timeframes accordingly.**
- vi) Be the apex body to oversee all issues related to data digitization, data sharing and data monetization in the country including framing policies and incentivization schemes for data digitalization, data sharing and data monetization.**

- vii) **Define the process framework for use of AI and related technology in data processing, data sharing and data monetization while ensuring the privacy and security of the data owner.**
- viii) **Putting in place an overarching framework for ethical use of data both by the Government as well as by the corporates in India. The framework should address the generic as well as vertical sector specific requirements.**
- ix) **Study the possible impact of upcoming technologies on data ethics and come out with relevant rules/guidelines on the subject.**
- x) **Creation of a national level mechanism to bring the State Governments, Local Bodies and other agencies onboard to adopt the national policy on data governance.**
- xi) **Creation of a uniform framework to on-board private entities for adoption of national policy on data governance and to enable them and public sector entities to digitalize, monetize and share their data within the privacy and other applicable laws and policies.**
- xii) **Creation of a uniform framework for sharing of data available with Government and its entities with industry, educational institutes, R&D Centres, Startups etc. within the privacy and other applicable laws and policies.**

III. Other Functions-Considering the nature of functions, AIDAI may take up following activities also -

- i) **Setting up regulatory sandboxes for testing AI based solutions.**
- ii) **Collaborating with standard setting bodies of various sectors for establishing generic and interoperable standards for AI based products and solutions.**
- iii) **Collaborating with sectoral regulators and vertical ministries in Central and State Governments as well as with local and other authorities on various issues related to AI.**
- iv) **Collaborating with international regulators and organizations for AI related issues.**

- v) **Providing a platform for industry and academia collaboration for ensuring responsible use of AI and capacity building.**
- vi) **Creating public/institutional awareness for responsible use of AI.**
- vii) **Compiling and sharing of best practices deployed across sectors for use of responsible AI.**

2.130 **The Authority recommends that a Multi Stakeholder Body (MSB) should be constituted by the Government to act as an advisory body to AIDAI drawing members from:**

- i. **Department of Telecommunications**
 - ii. **Ministry of Information and Broadcasting**
 - iii. **Ministry of Electronics and Information Technology (MeitY)**
 - iv. **Department for Promotion of Industry and Internal Trade (DPIIT)**
 - v. **Department of Science and Technology**
 - vi. **Ministry of Home Affairs**
 - vii. **Two members from Academic and research institutes dealing with AI**
 - viii. **Four members from Industry**
 - ix. **One Legal expert in the field of AI**
 - x. **One Cyber security expert**
 - xi. **Any other suitable member (maximum two)**
- MSB may invite representatives of relevant Ministry/ Department of Centre/ State Government on need basis as special invitee.**

2.131 **The Authority recommends that for synergy and coordination among different Central and State Ministries and Local Bodies and for orderly growth of AI and its use cases, the Ministry of Electronics and Information Technology (MeitY) should be designated as the administrative ministry for AI.**

2.132 **The Authority recommends that while defining powers and functions of AIDAI, it should be ensured that the clauses related to exercising transparency through open consultation with stakeholders are made applicable to all regulatory decisions and recommendations of AIDAI.**

2.133 **Considering the sensitivity and far-reaching impact of AI across the nations which defies borders, the Authority recommends that the Indian Government should collaborate with international agencies and governments of other countries for forming a global agency that will act as the primary international body for development, standardization and responsible use of AI. India should play a leading role in shaping the Global AI standards and governance structures.**

2.134 **In July 2018, TRAI has released its Recommendations on ‘Privacy, Security and Ownership of the Data in the Telecom Sector’. The Recommendations addresses multiple aspects of the data protection in the telecommunications sector. The Authority reiterates its recommendations on ‘Privacy, Security and Ownership of the Data in the Telecom Sector’ of July 2018.**

The Authority also recommends that all such provisions of the aforesaid recommendations which are in the domain of DoT, should be implemented immediately.

2.135 **The Authority recommends that the scope of AIDAI should also include making recommendations to create a national level mechanism to bring the State Governments, Local Bodies and other agencies onboard to adopt the national policy on data governance.**

AIDAI should also recommend a uniform framework to on-board private entities for adoption of national policy on data governance and to enable them and public sector entities to digitalize,

monetize and share their data within the privacy and other applicable laws and policies.

2.136 **The Authority recommends that AIDAI's scope of work should also include recommending to the Government a uniform framework for sharing of data available with Government and its entities with industry, educational institutes, R&D Centres, Startups etc. within the privacy and other applicable laws and policies.**

CHAPTER-3

ENABLERS FOR ADOPTION OF AI

I. Opportunities and Constraints in the adoption of AI in Telecom Sector

- 3.1 The AI and 5G will be the key components that fuel the future innovations. The deployment of 5G and beyond technologies is expected to enhance network speed, capacity and latency which can lead to increased adoption of AI applications across various sectors. AI has the potential to improve efficiency, productivity and automation across industries by analysing vast amounts of data and providing actionable insights. The deployment of 5G can be a key enabler for the adoption of AI and vice versa.
- 3.2 AI has been transforming the telecommunications industry by offering intelligent automated systems in designing, deployment, maintenance and managing network complexities including proactively securing the network. However, the impact of AI is not limited to only telecom sector; it is being adopted by other sectors also. The huge quantum of data which is available or might be available with the Telecom Service Providers (TSPs) may be quite useful to provide insights to others to carry out their forecasts, planning, designs, operations and maintenance. These data sets can be utilised for various analytical services and representations.
- 3.3 Identifying the opportunities and the associated challenges is essential to ensure that the Telecom Service Providers (TSPs) can fully leverage the benefits of AI. Overcoming these challenges will require collaboration between industry stakeholders, policymakers, and regulators, and a deep understanding of the technical and ethical issues involved in the deployment of AI in the telecom industry.

3.4 In view of the above, the stakeholders were asked to offer comments on the following questions?

Q.1: (b) What are the broad requirements to develop and deploy “AI” models in a telecom sector? c) Whether any major challenges are faced by the telecom service providers in adopting “AI”?

Q2: Whether the big data in the telecom sector may be utilized for developing AI models? For efficient and effective handling of big data, whether there is a need for adoption of special programming models or software frameworks?

Q.3 Whether deployment of 5G and beyond technologies will help to accelerate adoption of AI in all the sectors and vice versa?

Q5. Which are the applications of AI and BD being used by the TSPs in their networks to improve Quality of Service, Traffic Management, Spectrum Management and for Security purposes?

Q.6: (a) What are the major challenges faced by the telecom industry, including policy & regulatory, in developing, deploying, and scaling applications of AI listed in response to Q.5? (b) How can such challenges be overcome?

Q7. In which areas of other sectors including broadcasting, existing and future capabilities of the telecom networks can be used to leverage AI and BD?

Comments of the Stakeholders

3.5 Many stakeholders submitted that Telecom Service Providers (TSPs) are using AI/ML to monitor and analyse network traffic in real-time, optimise network traffic by predicting peak usage times, manage spectrum resources and improve network security by analysing network traffic and identifying potential threats. The use of AI/ML in the telecom industry is helping TSPs to improve network performance, optimise network utilisation and deliver better services to their customers.

3.6 One stakeholder submitted that TSPs are using applications of AI & BD for two major purposes: (1) at the customer level, to understand the behaviour of customers and improve their user experience such as by developing customised pricing plans; (2) at the network level, to improve

network performance, such as by identifying gaps like high interference, poor coverage, low throughput, and take the right actions.

- 3.7 A few stakeholders submitted that AI with advanced analytics already plays significant role globally in reducing network capex, MTTR (Mean Time to Restore) and poor Quality of Experience (QoE) for Voice over Long-Term Evolution (VoLTE) subscribers. The adoption of AI has improved network reliability and customer experience, optimized cost of operations, and much more. One of them further suggested that AI can also be used in the telecom industry for churn prediction, spam detection, and fraud prevention, improving QoS, spectrum management, security, customer services, and broadcasting.
- 3.8 Some stakeholders were of the view that AI and Big Data have numerous applications in the telecom industry, including improving customer experience and network performance, and automating processes. Telecom companies use AI for internal efficiency and optimization. One stakeholder submitted that the deployment of AI/ML is still in its early stages, but it is expected to drive growth in the telecom industry, with applications in various sectors such as autonomous vehicles, smart cities, and remote medical procedures.
- 3.9 On the issue of use of AI in other sectors, many stakeholders submitted that AI is being used to improve services and enhance customer experience in the media and entertainment industry, including metadata tagging, content personalization, reporting automation, and subtitle generation. A few stakeholders were of the view that AI can play a vital role in other sectors like healthcare, agriculture, education, smart cities and infrastructure, smart mobility. transportation etc.
- 3.10 A few stakeholders suggested that AI will revolutionise various sectors such as hospitality, service, finance and healthcare. It is being used to predict desired products for consumers, provide smooth virtual experiences, assist doctors in making diagnoses, and engage customers more effectively. One stakeholder commented that Telecom network

data can provide insights to other sectors to carry out their forecasts, planning, design, operations and maintenance.

- 3.11 On the likely impact of 5G on AI and vice-versa, many stakeholders were of the view that the impact of 5G on different industries is yet to be seen but it has the potential to enable the development of IoT services and generate large amounts of data for AI training and modelling. Some stakeholders suggested that AI advancement will work towards improving 5G systems performance. Further, 5G will generate massive amounts of data from multitude of new services, and billions of IoT devices which will enhance AI learning and model training.
- 3.12 A few stakeholders suggested that the deployment of 5G and beyond technologies is expected to accelerate digitalization, create massive connections by machine type communications and generate huge amount of data. These developments can facilitate the adoption of AI in various sectors. Some stakeholders commented that the combination of 5G and AI is expected to create new revenue streams and transform industries such as manufacturing, healthcare, education, and agriculture with limitless use cases including virtual reality education, autonomous vehicles, remote-control surgery and improved energy efficiency.
- 3.13 Some stakeholders were of the view that there are several policy and regulatory challenges due to absence of a Data Protection Bill in India. Some stakeholders submitted that data privacy and security regulations hinder use case rollout as TSPs cannot share personal data for AI/ML under Unified License. TSPs are also facing challenges related to data governance, regulatory compliance, talent acquisition and creating an AI framework.
- 3.14 A few stakeholders were of the view that limited AI expertise and knowledge, access to quality data and AI specific infrastructure are some of the challenges faced by TSPs. Other stakeholder suggested that to promote innovation and adoption of AI, TRAI should consider:

- a) Ensuring free movement of data across borders;
- b) Making non-sensitive government data assets freely available and usable for the public; and
- c) Promoting voluntary data sharing mechanisms.

Some stakeholders suggested that the telecom industry's adoption of AI/ML technologies is constrained by data accessibility, privacy and regulatory obligations.

- 3.15 Some stakeholders suggested that big tech companies have made their infrastructure available to entrepreneurs, start-ups and large enterprises, and the market should be allowed to evolve on its own without specific measures. As per these stakeholders, industry or academic bodies should define those standards rather than regulatory interventions. Some stakeholders suggested that AI is an evolving field, therefore, its benefits for telecom/network service providers are still being investigated. However, algorithms, data, and computation & storage infra are needed to develop and deploy AI.

Analysis

- 3.16 As pointed out by the stakeholders, telecom networks generate massive amounts of data from user interactions, network traffic and device telemetry. This data can be used to train machine learning algorithms to optimise network performance, improve customer experience and prevent security threats. AI/ML have several applications in the telecom network to improve the quality of service, traffic management, spectrum management and security purposes.
- 3.17 DoT in collaboration with the Service Providers and other Agencies like Centre for Development of Telematics (CDoT), Centre for Development of Advanced Computing (CDAC), Indian Computer Emergency Response Team (CERT-IN) have used AI in verification of customer data base for duplicate SIMs on fake IDs, prevention of unauthorised usage

of handset/devices in the mobile network and network security monitoring etc. The Authority while appreciating the efforts made by DoT in implementing AI based solutions, is of the view that there are still many areas in the telecom sector and other sectors also, where use of AI/ML can make performance of existing processes more efficient. Some specific areas in the telecom sector are discussed below.

3.18 KYC Verifications -In order to cope up with the challenge for preventing cyber-crimes through duplicate SIMs, DoT implemented an innovative and indigenous AI and Facial Recognition powered Solution for Telecom SIMs Subscriber Verifications (ASTRA) that helps in detecting and weeding out fake/forged SIMs. Analysis of data is done in offline mode based on subscriber data submitted by the service providers to DoT on monthly basis in respective LSAs. However, there is no online mechanism to analyse data on real-time basis to verify the customer and limit the number of connections that can be issued to a customer within the prescribed limit set by DoT (across Access Service Providers and across LSAs) resulting in large number of SIMs being acquired by fraudsters to send spam SMSs and voice calls to deceive citizens. Therefore, the Authority is of the view that DoT should collaborate with Access Service Providers for enhancing the capability of currently deployed systems through use of AI/ML and other new technologies, in order to analyse the data on real-time basis for verification of the total number of mobile connections (across Access Service Providers and across LSAs) against the limit set by DoT.

3.19 Network Security: DoT with support from CDoT has established a Telecom Security Operations Centre (TSOC) for identifying the cyber-attacks on telecommunications network and the machines which are initiating such attacks. It is also the main source for providing inputs to Telecom Computer Security Incident Response Team (Telecom-CSIRT), a framework established by DoT to protect the national telecom infrastructure. TSOC coordinates with Computer Emergency Response Team India (CERT-IN), which is the nodal agency to deal with cyber

security. With complexity of the networks getting converged for carriage of not only telecom traffic but various other services such as broadcasting, OTT etc., it is essential to enhance the capabilities of the current systems using AI/ML based tools for centralised monitoring and taking proactive actions to prevent possible threats. Therefore, the Authority is of the view that DoT's Telecom Security Operation Centre (TSOC) should deploy AI/ML and other new technologies-based tools for generating alerts to minimize network security threats.

3.20 Effective Monitoring of Grievance Redressal System- Current framework of Public Grievance Redressal System with two tier arrangements both operated by the service providers, does not provide full satisfaction to the customers. Large number of customers do not prefer the route of Consumer Forum to get their grievances addressed due to difficulty in accessibility and small grievances involved in telecom. It is therefore essential to use technology to enable service providers to take action as per consumers' feedback/complaints and also to monitor complaint redressal outcome on dynamic basis.

3.21 The Authority in its recommendation on "Complaints/Grievance Redressal in the Telecom Sector" dated 10th March 2017 had recommended establishment of office of telecom ombudsman for resolution of grievances of telecom consumers. As part of these recommendations, the Authority had recommended a technology driven solution to provide redress remotely to consumers. The Authority in para 50 of these recommendations has said that "*The centralized web-based system will allow flow of information from each level of the grievance redressal mechanism to the Ombudsman, thereby obviating the need for the same information to be provided again at various stages.*" The Authority, therefore, is of the view that for effective redressal of grievances of telecom customers, AI/ML and other new technologies should be used on data that should flow from networks and redressal systems of Access Service Providers to dash boards of DoT Public Grievance Unit.

- 3.22 Spectrum Management- AI can help to optimise the use of available spectrum by dynamically allocating resources to different users and services. This can help to reduce interference and improve network efficiency. Dynamic Spectrum Management (DSM) can address the spectrum scarcity and enable new applications and services in the wireless domain. However, DSM also poses significant challenges such as how to sense, classify and access the spectrum concurrently and in most efficient manner. AI/ ML can provide powerful solutions to these challenges by enabling data-driven decision making for DSM. However, the instant recommendations will not handle the issue of use of AI/ML in spectrum management as TRAI has already initiated a separate consultation process on “Infrastructure Sharing, Spectrum Sharing and Spectrum Leasing” which is considering this issue.
- 3.23 Use of AI/ML in Curbing Spams and Phishing Messaging - Spams and phishing are a global challenge. The spammers and scammers have become faster and smarter- continuously evolving new patterns and Call to Actions (CTAs) making it difficult to contain the menace by acting on a reactive basis. Currently, all ecosystem players operate in silos lacking active collaboration to effectively combat smishing together. AI/ML based anti-phishing solutions act proactively on real-time basis for identification and prevention of phishing attempts to protect end-customers. These solutions can also provide a single platform to connect all critical stakeholders to deliver an effective mechanism to counter such scammers.
- 3.24 The AI/ML based solutions for Unsolicited Commercial Communication (UCC) Detection require machine-based identification of P2P messages sent in bulk on continuous monitoring basis for automatic pattern recognition, anomaly detection, traffic analysis, reputation analysis, signature identification, etc. to recognize a communication (SMS) to be UCC having malicious contents or otherwise. The current frameworks available through Indian Telegraph Act and Indian Telegraph Rules on

real time monitoring require certain tweaking to allow machine-based learning of UCC and presence of malicious URLs/social media links.

- 3.25 The Authority is of the view that for effective use of AI/ML for UCC Detection and pro-active actions thereof in order to protect customers from phishing, spam and scam, suitable amendments in Indian Telegraph Act, Indian Telegraph Rules and License Conditions related to Unified Licence (UL) with Authorization for Access Services should be made to empower TRAI to direct licensees to enable continuous machine-based identification and monitoring of P2P messages sent in bulk for automatic pattern recognition, anomaly detection, traffic analysis, reputation analysis, signature identification, etc. .
- 3.26 Improving Quality of Service- AI can help in the analysis of data from various sources such as traffic patterns, network conditions etc., to optimize its network capacity and coverage. It can monitor network performance, detect anomalies and diagnose faults, thus, reducing human errors and downtime. AI can provide round-the-clock support and virtual assistance to customers through chatbots.
- 3.27 RF Optimisation-Artificial Intelligence (AI) can enhance the performance and efficiency of radio frequency (RF) optimisation in telecom networks. RF optimisation tools are software applications that help network engineers and operators to monitor, analyse and optimise the RF performance of their networks. AI can be used in RF optimisation tools to automate some of the tasks such as identifying network issues, recommending solutions and implementing changes. AI can also provide insights and predictions based on data analysis and machine learning which can help network engineers and operators to make better decisions and plan for future scenarios. AI can thus improve the accuracy, speed and scalability of RF optimisation in telecom networks.
- 3.28 Reduction in carbon emissions- AI can be used in green telecom to optimize network performance, improve energy efficiency and, thus, reduce carbon emissions. AI can monitor and control the power

consumption of telecom equipment such as base stations, routers, and switches. It can help telecom operators measure and report their carbon footprint, as well as identify and implement strategies to reduce it.

- 3.29 Beam Forming and Beam Tracing- Artificial Intelligence can be used for enhancing the performance and efficiency of 5G networks. AI can be applied to various aspects of 5G, such as beamforming and beam tracing. Beamforming is the technique of directing radio signals to specific users or areas, which improves the signal quality and reduces interference. Beam tracing is the process of predicting the optimal beam direction based on the user's location and environment.
- 3.30 Network Slicing: This is the process of creating customized virtual networks for different types of users and applications, such as IoT, gaming, or healthcare. AI can help allocate network resources dynamically and efficiently, based on the demand and quality of service requirements of each slice.
- 3.31 Edge computing and Federated Learning: One use case of AI in telecom is to leverage edge computing and federated learning to optimize network performance and security. Edge computing allows data processing and analysis to happen closer to the source reducing latency and bandwidth consumption. Federated learning enables distributed AI models to learn from local data without compromising privacy or data sovereignty. Together, these technologies can help telecom operators enhance customer experience and network efficiency.
- 3.32 Federated learning can help optimize network performance and resource allocation in a telecom by leveraging data from different network nodes and devices without compromising user privacy or network security. Another example of federated learning and edge computing is to detect traffic anomalies and accidents in video camera networks. Each camera can run a local model to identify unusual events and send only the relevant information to a central server.

3.33 In broadcasting sector also, AI can help making better decisions using the AI's analytics and the insights provided by the data. Some of the use cases in broadcasting industry are given below:

- (i) Analysis of viewer engagement and optimization of content selection and scheduling- Broadcasters can use AI to gain insights into levels of viewer engagement and make informed decisions about what content should be aired and when it should be aired. AI can help broadcasters analyze large amounts of data from various sources, such as social media, ratings, surveys and feedback to understand the preferences and behaviors of their audiences. This has the potential to result in increased ratings as well as increased revenue for the broadcaster.
- (ii) Speech recognition and synthesis: AI can transcribe audio into text and vice versa, enabling subtitles, captions, dubbing and voiceovers for different languages and audiences.
- (iii) Automated video processing- Computer vision algorithms can also be used to recognize items in videos or photographs and deliver extra information about them in real-time. This could include providing detailed descriptions of people or objects seen on camera during a live broadcast and while making commentaries of sports events.
- (iv) Content analysis and moderation: AI can detect and flag inappropriate or harmful content such as violence, nudity, hate speech or misinformation, and take appropriate actions such as removal, warning or rating.

3.34 The deployment of 5G is expected to accelerate digitalization, create massive connections by machine type communications and generate huge amount of data. These developments can facilitate the adoption of AI in various sectors. As suggested by some stakeholders, the combination of 5G and AI is expected to create limitless use cases in manufacturing, healthcare, education, agriculture and other sectors such as virtual reality education, autonomous vehicles, remote-control surgery etc.

3.35 In light of the above discussion. the Authority is of the view that considering the potential use cases of AI in various aspects of telecommunication and broadcasting, and its benefits, DoT, in collaboration with various stakeholders should encourage the development of AI in various fields of Communications and Broadcasting such as

- i. RF optimisation,
 - ii. carbon emission reduction,
 - iii. beam forming & beam tracing,
 - iv. network slicing,
 - v. edge computing,
 - vi. federated learning, etc and
 - vii. analysis of viewer engagement and optimization of content selection and scheduling
 - viii. speech recognition and synthesis,
 - ix. automated video processing,
 - x. content analysis and moderation etc
- } Telecom
- } Broadcasting and Cable TV

through indigenous technologies and may appropriately consider funding through Telecom Technology Development Fund (TTDF) or any other scheme of DoT/Government.

3.36 The Authority is also of the view that DoT should in collaboration with organizations such as IISc Bangalore, IIT Madras, IIT Kanpur and other research institutes launch research in telecommunications in order to develop indigenous AI use cases.

3.37 The Authority, in its recommendations on ‘Auction of Spectrum in frequency bands identified for IMT/5G’ dated 11th April 2022, has dealt with collaborative approach and focused development of 5G use cases

which also includes the aspects of AI use cases also. Therefore, the Authority would like to reiterate its following recommendations-

“6.72 The Authority recommends that:

- a. 5G-dedicated Inter-Ministerial Working Group (IMWG), under the Chairmanship of Member (Technology), DoT should be formed comprising Ministry of Electronics and Information Technology, Department for Promotion of Industry and Internal Trade, Ministry of Information and Broadcasting, Department of Space, Ministry of Finance, Ministry of Education, Department of Science & Technology, Ministry of Micro, Small and Medium Enterprises (MSME) and Niti Ayog as members, which should be represented by JS Level officers.*
- b. The IMWG may co-opt officers from other concerned Ministry(ies) / Department(s) as per requirement.*
- c. The concerned Ministries/Departments shall establish a special dedicated Digital Cell, headed by the JS Level officer nominated as member in IMWG, with dedicated technical manpower to formulate the use of digital technologies like 5G, IoT, M2M, AI etc. and development of relevant and affordable use cases involving start-up companies, entrepreneurs, application providers etc. The scope of the Digital Cell shall include, but not limited to, involving the relevant stakeholders in discussions, framing and monitoring short-term (annual), medium-term (5-year), and long-term (10-year) plans with quantitative targets in respect of sector specific 5G use cases, providing platform and promoting 5G use cases. The Digital Cell may also need to focus on issues relating to digital literacy, connectivity and affordable user devices for their sector.*
- d. The Ministries/Departments should take up short-term (annual), medium-term (5-year), and long-term (10-year) plans with quantitative targets in respect of sector specific 5G use cases and the same can be considered by IMWG for consistent and coordinated development of use cases and start-up ecosystems to align issues such as connectivity, privacy, data security etc. in the country.*
- e. The participating members of IMWG should be responsible for outlining strategies, defining targets, and budgetary provisions for achieving defined targets for their respective Ministries / Departments.*

- f. *The IMWG should conduct periodic meetings and discussions, at least once in 3 months, in which progress achieved will be reviewed and outline path for achieving planned objectives will be framed.*
- g. *The IMWG should present consolidated status/proposals to the Department of Telecommunications (DoT) being nodal Ministry, on a regular basis.*
- h. *The progress of digital transformation and implementation of 5G use cases in various verticals should also be monitored and documented by IMWG and be submitted to DoT for perusal and appropriate decision.*

[Para 5.77]

6.73 The Authority recommends that DoT should take up the matter with Ministry of Micro, Small and Medium Enterprises (MSME) to carry out a study to find out the actual details about the level of acceptance and adoption of 5G based industrial automation and digital technologies by the MSME sector in the country as compared to other industries. Based on the learning from such study, appropriate schemes, including interest subvention scheme, for upgradation of plant and machinery, may be devised to facilitate the micro, small and medium enterprises to overcome various constraints and move towards industrial automation. In this regard, budgetary provisions (if required), may be created by the Ministry of MSME. [Para 5.78]

6.74 The Authority recommends that Telecom Innovation Centres, may be formulated in alliance with different academic institutions and ministries. These innovation centres could be specialized for development of innovative solutions for 5G use cases and applications in different verticals / sectors such Agriculture, Medicine, Manufacturing, Infrastructure, Power, Telecom, etc. and be made responsible for desired outcome. DoT should be the nodal ministry to monitor and coordinate the activities of the Telecom Innovation Centres. [Para 5.80]"

3.38 The Authority is also of the view that DoT through Inter-Ministerial Working Group (IMWG) formed for implementation and penetration of 5G should coordinate with other sectoral Ministries/ Departments to encourage and develop indigenous AI use cases for various sectors by funding from the respective Ministry/ Departmental Budgets.

3.39 As pointed by the stakeholders, telecom networks can be used to leverage AI/ ML in other sectors also. Most stakeholders pointed out that enactment of PDP Act is essential enabler for AI adoption in the country. There are other challenges also like lack of computing infrastructure and uniform industry wide standards for AI applications. All these issues have been dealt with appropriately in other chapters of these recommendations.

Recommendations

3.40 **The Authority recommends that-**

- i. DoT should collaborate with Access Service Providers for enhancing the capability of currently deployed systems through use of AI/ML and other new technologies, in order to analyse the data on real-time basis for verification of the total number of mobile connections (across Access Service Providers and across LSAs) against the limit set by DoT.**
- ii. DoT's Telecom Security Operation Centre (TSOC) should deploy AI/ML and other new technologies-based tools for generating alerts to minimize network security threats.**
- iii. The Authority recommends that for effective redressal of grievances of telecom customers, AI/ML and other new technologies should be used on data that should flow from networks and redressal systems of Access Service Providers to dash boards of DoT Public Grievance Unit.**
- iv. For effective use of AI/ML for UCC Detection and pro-active actions thereof in order to protect customers from phishing, spam and scam, the Authority recommends that suitable amendments in Indian Telegraph Act, Indian Telegraph Rules and License Conditions related to Unified Licence (UL) with Authorization for Access Services should be made to empower TRAI to direct licensees to enable continuous**

machine-based identification and monitoring of P2P messages sent in bulk for automatic pattern recognition, anomaly detection, traffic analysis, reputation analysis, signature identification, etc.

v. Considering the potential use cases of AI in various aspects of telecommunication and broadcasting, and its benefits, DoT, in collaboration with various stakeholders, should encourage the development of AI in various fields of Communications and Broadcasting such as

- a. RF optimisation,
 - b. carbon emission reduction
 - c. beam forming & beam tracing,
 - d. network slicing,
 - e. edge computing,
 - f. federated learning etc and
 - g. analysis of viewer engagement and optimization of content selection and scheduling
 - h. speech recognition and synthesis
 - i. automated video processing
 - j. content analysis and moderation etc
- } Telecom
- } Broadcasting and Cable TV

through indigenous technologies and may appropriately consider funding through Telecom Technology Development Fund (TTDF) or any other scheme of DoT/Government.

3.41 The Authority recommends that DoT should, in collaboration with organizations such as IISc Bangalore, IIT Madras, IIT Kanpur and other research institutes, launch research in telecommunications in order to develop indigenous AI use cases.

3.42 **The Authority reiterates its following recommendations of its recommendations on ‘Auction of Spectrum in frequency bands identified for IMT/5G’ dated 11th April 2022 -**

“6.72 The Authority recommends that:

- a. 5G-dedicated Inter-Ministerial Working Group (IMWG), under the Chairmanship of Member (Technology), DoT should be formed comprising Ministry of Electronics and Information Technology, Department for Promotion of Industry and Internal Trade, Ministry of Information and Broadcasting, Department of Space, Ministry of Finance, Ministry of Education, Department of Science & Technology, Ministry of Micro, Small and Medium Enterprises (MSME) and Niti Ayog as members, which should be represented by JS Level officers.**
- b. The IMWG may co-opt officers from other concerned Ministry(ies) / Department(s) as per requirement.**
- c. The concerned Ministries/Departments shall establish a special dedicated Digital Cell, headed by the JS Level officer nominated as member in IMWG, with dedicated technical manpower to formulate the use of digital technologies like 5G, IoT, M2M, AI etc. and development of relevant and affordable use cases involving start-up companies, entrepreneurs, application providers etc. The scope of the Digital Cell shall include, but not limited to, involving the relevant stakeholders in discussions, framing and monitoring short-term (annual), medium-term (5-year), and long-term (10-year) plans with quantitative targets in respect of sector specific 5G use cases, providing platform and promoting 5G use cases. The Digital Cell may also need to focus on issues relating to digital literacy, connectivity and affordable user devices for their sector.**
- d. The Ministries/Departments should take up short-term (annual), medium-term (5-year), and long-term (10-year) plans with quantitative targets in respect of sector specific 5G use cases and the same can be considered by IMWG for consistent and coordinated development of use cases and start-up ecosystems to align issues such as connectivity, privacy, data security etc. in the country.**

- e. The participating members of IMWG should be responsible for outlining strategies, defining targets, and budgetary provisions for achieving defined targets for their respective Ministries / Departments.***
- f. The IMWG should conduct periodic meetings and discussions, at least once in 3 months, in which progress achieved will be reviewed and outline path for achieving planned objectives will be framed.***
- g. The IMWG should present consolidated status/proposals to the Department of Telecommunications (DoT) being nodal Ministry, on a regular basis.***
- h. The progress of digital transformation and implementation of 5G use cases in various verticals should also be monitored and documented by IMWG and be submitted to DoT for perusal and appropriate decision.***

[Para 5.77]

6.73 The Authority recommends that DoT should take up the matter with Ministry of Micro, Small and Medium Enterprises (MSME) to carry out a study to find out the actual details about the level of acceptance and adoption of 5G based industrial automation and digital technologies by the MSME sector in the country as compared to other industries. Based on the learning from such study, appropriate schemes, including interest subvention scheme, for upgradation of plant and machinery, may be devised to facilitate the micro, small and medium enterprises to overcome various constraints and move towards industrial automation. In this regard, budgetary provisions (if required), may be created by the Ministry of MSME. [Para 5.78]

6.74 The Authority recommends that Telecom Innovation Centres, may be formulated in alliance with different academic institutions and ministries. These innovation centres could be specialized for development of innovative solutions for 5G use cases and applications in different verticals / sectors such Agriculture, Medicine, Manufacturing, Infrastructure, Power, Telecom, etc. and be made responsible for desired outcome.

DoT should be the nodal ministry to monitor and coordinate the activities of the Telecom Innovation Centres. [Para 5.80]”

- 3.43 The Authority recommends that DoT through Inter-Ministerial Working Group (IMWG) formed for implementation and penetration of 5G should coordinate with other sectoral Ministries/ Departments to encourage and develop indigenous AI use cases for various sectors by funding from the respective Ministry/ Departmental Budgets.**

II. Need of AI Specific Infrastructure

- 3.44 Artificial Intelligence is growing and gaining popularity at a rapid rate. However, at the same time, there are challenges and constraints such as limited access to data, inadequate computing infrastructure, lack of standards and limited R&D efforts. Without access to diverse and comprehensive datasets, developing accurate and robust AI models becomes challenging. AI technologies require substantial computational resources to process and analyze large volumes of data.
- 3.45 Interoperability and compatibility among different AI systems and data sources are essential for seamless integration and communication. However, lack of industry-wide standards hampers the exchange of information making it difficult to leverage AI technologies across different platforms and systems.
- 3.46 Inadequate investment in R&D and industry-academia linkages specifically for AI/ML limit the industry's ability to explore and develop innovative applications, solutions and business models that leverage the potential of AI/ML. Further, there is a need to develop and demonstrate AI solutions in an environment which can simulate real life situations without impacting the regulatory provisions for creating a confidence before actual launch.

3.47 In this backdrop, following issues were raised in the Consultation Paper-

Q.13: Whether telecom/ICT industry is facing constraints such as access to data, lack of computing infrastructure, lack of standards and R&D in the adoption of AI and BD technologies?

Q.14: What measures are required to make data and computing infrastructure available and accessible to developers and also to make data/AI models interoperable and compatible?

Q.25: (a) Whether there is a need to create AI-specific infrastructure for the purpose of startups and enterprises in the telecom sector to develop and run AI models in an optimised manner? (b) Whether such an infrastructure should cover various real-world scenarios such as cloud AI, edge AI and on-device AI?

Q.27. (a) Whether there is a need to establish experimental campuses where startups, innovators and researchers can develop or demonstrate technological capabilities, innovative business and operational models? (b) Whether participation of users at the time of design and development is also required for enhancing the chances of success of products or solutions? (c) Whether such a setup will reduce the burden on developers and enable them to focus on their core competence areas?

Q.28. Whether experiments are required to be backed by regulatory provisions such as regulatory sandbox to protect experimenters from any violation of existing regulations? Whether participation of government entities or authorities during experimentation will help them to learn and identify changes required in the existing regulations or introducing new regulations?

Q.29. In response to Q.27 and Q.28, whether establishing such a campus under government patronage will enable easy accessibility of public resources such as spectrum, numbering and other resources to the researchers? Whether it would be in mutual interest of established private players as well as startups, innovators and enterprises to participate in such experiments?

Q.38. Whether there is a need to establish telecom industry-academia linkages specifically for AI and BD to accelerate the development and deployment of AI products and solutions? Whether there is a need to establish Centres of Excellence (CoEs) for this purpose or it can be achieved by enhancing the role of existing TCoE?

Comments of the Stakeholders

- 3.48 Some stakeholders submitted that there is a need for AI-specific infrastructure for startups and enterprises to innovate and deploy smart AI applications and services. One stakeholder suggested that the proposal for establishment of India's own **AI compute infrastructure** should be aimed to facilitate and speed up research and solution development for solving India's societal challenges using high performance and high throughput AI-specific supercomputing technologies. Another stakeholder was of the view that there is a need for AI specific computing infrastructure to train and develop an AI model. One stakeholder suggested that the creation of AI-specific infrastructure for start-ups and telecom enterprises to develop and run AI models in an optimised manner is a useful approach.
- 3.49 Many stakeholders suggested setting up **experimental campuses** which can provide impetus to new and innovative products and solutions that leverage AI/ML. Some of these stakeholders were of the view that establishing such campuses under government patronage can enable easy accessibility of public resources such as **spectrum, numbering and other resources to researchers** thereby facilitating research and development in the field of AI.
- 3.50 A few stakeholders submitted that AI specific Infrastructure already exists and will evolve further with adoption of 5G. Private cloud service providers such as AWS, MS Azure, GCP are already providing and augmenting excellent AI compatible infrastructure and TSPs are building their infrastructure to work on AI use cases. These stakeholders further submitted that start-ups have the freedom and option to choose from the available infrastructure.
- 3.51 Some stakeholders submitted that the creation of a **regulatory sandbox** can play a positive role in nurturing the entire ecosystem. Some stakeholders were of the view that regulatory sandboxes can be useful constructs which provide companies with opportunities to test their AI

systems in a controlled environment while allowing regulators to better understand the technology and the adequacy of the regulatory framework. Some stakeholders submitted that it is too early for any regulatory mandate/intervention specific to the Telecom sector; however, at a much larger principle level the adoption of a regulatory sandbox may help to achieve the goal of AI through experimentation.

- 3.52 Many stakeholders emphasised the need of establishing the **Centers of Excellence (CoEs) for applied AI research that involves collaboration between academic institutes and industry partners.** The industry-academia partnership and technological advancements are intertwined and such linkages are mandatory for AI/ML; therefore, these stakeholders suggested that the CoEs should not be independent of the industry. One stakeholder was of the view that establishing industry-academia linkages specifically for AI/ML in the telecom sector can accelerate the development of AI products and solutions. However, the stakeholder suggested that a cost-benefit analysis should be conducted before reaching conclusions on the establishment of Centres of Excellence (CoEs) for this purpose.

Analysis

Establishment of AI specific Infrastructure

- 3.53 To support startups and enterprises in developing and optimizing AI models there is a growing need for AI-specific infrastructure. The creation of dedicated AI infrastructure would provide a platform for startups and enterprises to develop and run AI models in an optimised manner enabling them to focus on their core competencies while reducing the burden on developers. Such an infrastructure should

cover various real-world scenarios such as cloud AI, edge AI and on-device AI⁴³.

- 3.54 AI has become the foundation of intelligent applications with accelerated computing at its core. Accelerated computing enables faster processing and minimal latency offloading demanding tasks from CPUs. GPU-accelerated computing is widely used in various industries such as video editing, medical imaging and enterprise applications. India with its thriving start-up ecosystem and research capabilities has the potential to become a global hub for AI development. To fully leverage AI technology India needs to enhance compute infrastructure in data centres.
- 3.55 The paper “AIRAWAT-establishing an AI specific cloud computing infrastructure for India” was released by NITI Aayog in January 2020⁴⁴. It proposes the design, governance and implementation of AIRAWAT (AI Research, Analytics and knowledge Assimilation platform”), an AI-first compute platform for India. It aims to facilitate and speed up research and solution development for solving India’s societal challenges using high performance and high throughput AI-specific supercomputing technologies. The paper also benchmarks other similar facilities being developed across the world and highlights the urgent need for such an infrastructure in India.
- 3.56 The National Supercomputing Mission (NSM) which is being jointly steered by Ministry of Electronics and IT (MeitY) and Department of Science & Technology (DST) plans to build and deploy 24 facilities with cumulative compute power of more than 64 Petaflops. It is being implemented through two leading organizations – Centre for

⁴³ Cloud AI refers to the use of cloud computing platforms and services to access and run AI models remotely. Edge AI refers to the use of edge computing devices and networks to process and analyse data locally, near the source of generation. On-device AI refers to the use of embedded chips and software to run AI models on smartphones, tablets and other smart devices.

⁴⁴ https://www.niti.gov.in/sites/default/files/2020-01/AIRAWAT_Approach_Paper.pdf

Development of Advanced Computing (C-DAC) and the Indian Institute of Science (IISc), Bangalore with an objective to meet the increasing computing demands of the scientific and research community. Till now C-DAC has deployed 11 systems at IISc, IITs, IISER Pune, JNCASR, NABI-Mohali and C-DAC under NSM Phase-1 and Phase-2 with a cumulative compute power of more than 20 Petaflops.

3.57 In October 2022 under NSM, Param-Kamrupa, a high-performance computing cluster was deployed at IIT Guwahati to give a boost to diverse fields from healthcare to advanced weather prediction. Lot of people from diverse fields of study and research, not only of IIT Guwahati but also of nearby Institutes can take the advantage of this facility.

3.58 As pointed out by NITI Aayog in its paper “AIRAWAT-establishing an AI specific cloud computing infrastructure for India” published in 2020⁴⁵, AI computing infrastructure is distinct from High Performance Computing (HPC) infrastructure, there is a need to develop AI specific compute infrastructure at some of these facilities. Some of the infrastructure components that are essential for AI include-

(i) **Data storage and management systems** that can handle large volumes and variety of data such as cloud storage, data lakes, data warehouses and databases;

(ii) **Data processing and analytics platforms** that can perform data cleansing, transformation, integration and analysis such as Apache Spark, Apache Hadoop, Apache Kafka, etc.,

(iii) **Data visualization and reporting tools**, Machine learning and deep learning frameworks that can enable the development and training of AI models,

⁴⁵ https://www.niti.gov.in/sites/default/files/2020-01/AIRAWAT_Approach_Paper.pdf

(iv) **Machine learning operations (MLOps) tools** that can facilitate the deployment, monitoring and governance of AI models, and

(v) **Hardware accelerators** that can boost the performance and efficiency of AI computations such as GPUs, TPUs, etc. The computing infrastructure landscape for AI is continuously evolving and the exact requirements of that need to be assessed regularly.

3.59 AI specific requirements need to supplement the supercomputing facilities being created under NSM. The Authority is of the view that the specific requirements of AI infrastructure should be evaluated by AIDAI from time to time and recommended to the Government. Accordingly, it has been included in the proposed scope of the AIDAI.

Establishing experimental campuses

3.60 Establishing experimental campuses based on the principles of the collaboration among government, academia and industry including start-ups would help startups, innovators and researchers in their pursuits to develop and demonstrate technological capabilities, innovative business and operational models. These campuses should act as a domain-specific specialised incubation facility for start-ups in the area of AI where the highest standards and the best practices in terms of infrastructure, technology, leadership, mentoring, training, research & development, funding and networking for the given focus area are made available.

3.61 One notable example of such an experimental campus is Station F in Paris, France.⁴⁶ Station F offers various programs, resources and networking opportunities fostering a vibrant startup ecosystem. Startups at Station F benefit from access to mentors, investors and a diverse community enabling them to focus on their core competencies while receiving the necessary support. Another relevant example is the

⁴⁶ <https://stationf.co/>

Tech City UK initiative, now known as Tech Nation.⁴⁷ It was established by the United Kingdom (UK) government (now acquired by Founders Forum Group) to support the growth of digital startups and innovation. Another example from India is ARTPARK (AI & Robotics Technology Park) at IISC Bangalore. It is a unique non-profit organization promoted by the Indian Institute of Science (IISc) to foster innovations in AI & Robotics by bringing together the best of the startup, industry, research and government ecosystem. It is seed funded by the Department of Science & Technology (DST), Govt. of India under the National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS) and the Govt. of Karnataka.

- 3.62 For realizing the vision of “*Make AI in India and Make AI work for India*”, In the budget for the FY 2023-24 the Government has proposed three Centres of Excellence for Artificial Intelligence (CoE-AI) to be set-up in top educational institutions⁴⁸. These CoE-AI should also act as the experimental campuses that would help startups, innovators and researchers to develop and demonstrate technological capabilities, innovative business and operational models. At these centres leading industry players as well as startups should partner with academia in conducting interdisciplinary research, develop cutting-edge applications and scalable problem solutions in various fields such as agriculture, health, sustainable cities, etc. thereby galvanizing an effective AI ecosystem and nurture quality human resources. In the Budget for FY 2023-24, the Government announced that one hundred labs for developing 5G use cases would be set up in Engineering Institutions. These labs should be linked with the CoE-AI for ease of transfer of knowledge and sharing of resources.
- 3.63 Establishing an experimental campus under government patronage will facilitate easy accessibility of public resources including spectrum,

⁴⁷ <https://technation.techcityuk.com/about-us/>

⁴⁸ <https://pib.gov.in/PressReleasePage.aspx?PRID=1895315>

numbering and other relevant resources to researchers. The government's involvement ensures streamlined processes and guidelines for accessing these resources.

3.64 In many cases, innovative technologies and business models are not fully compliant with current rules and regulations. Therefore, the experiments at CoE-AI may be complemented by permitting setting up of Regulatory Sandbox to facilitate an enabling environment as it provides a framework that allows startups to test their products or solutions in a controlled environment with minimal regulatory requirements. It will further help experimenters to reduce the risks and costs associated with compliance and legal issues.

3.65 In order to coordinate various activities being undertaken in CoE-AIs and also to facilitate start-ups and innovators to access various facilities across all such campuses there is a need to develop a portal which will have information with respect to various facilities available in the CoE-AIs, the process to access the facilities, fee structure, if any, and other relevant details.

3.66 In light of the above, the Authority is of view that-

- i. Three Centres of Excellence for Artificial Intelligence (CoE-AI) proposed in the Union Budget is a welcome step. However, more such campuses at least one in each State/UT are needed to be established, for facilitating educational institutions, startups, innovators, researchers and other public/private entities to develop and demonstrate technological capabilities. These centres should have access to high bandwidth, computational facilities and data sets for training AI models. All such centres should also be linked with proposed 5G/6G labs for sharing of resources and knowledge. To galvanize an effective AI ecosystem and to nurture quality human resources, the CoE-AIs should allow industry players and startups to partner with Academia in conducting research, developing cutting-edge applications and scalable problem solutions in various

fields such as agriculture, healthcare, education, smart cities, smart mobilities, etc.

- ii. There is a need to develop a centralized portal. One of the CoE-AIs should establish a centralized portal to be used by all CoE-AIs. The portal should have information regarding various facilities available with individual CoE-AI, process to access such facilities, fee structure, if any, and other relevant details.
- iii. The setting up of Regulatory sandbox for testing AI based solutions should be permitted by the proposed body- AIDAI on need basis. Accordingly, it has been included in the proposed scope of the AIDAI.
- iv. AIDAI should provide a platform for industry and academia collaboration to ensure responsible use of AI and capacity building. Accordingly, it has been included in the proposed scope of the AIDAI.

RECOMMENDATIONS

3.67 In view of the above discussion, **the Authority recommends that-**

- i. **At least one Centre of Excellence for Artificial Intelligence (CoE-AI) should be established in each State/UT for facilitating educational institutions, startups, innovators, researchers and other public/private entities to develop and demonstrate technological capabilities. These centres should have access to high bandwidth, computational facilities and data sets for training AI models. All such centres should also be linked with proposed 5G/6G labs for sharing of resources and knowledge. To galvanize an effective AI ecosystem and to nurture quality human resources these CoE-AIs should allow industry players as well as startups to partner with Academia in conducting research, developing cutting-edge**

applications and scalable problem solutions in various fields such as agriculture, healthcare, education, smart cities, smart mobilities, etc.

- ii. **One of the CoE-AIs should establish a centralized portal to be used by all CoE-AIs. The portal should have information regarding various facilities available with individual CoE-AI, process to access such facilities, fee structure, if any, and other relevant details.**

III. Skill Development

- 3.68 Technical skills and data literacy are obviously important for AI/ML. Many enterprises have an abundance of data but leveraging it for AI projects requires skills. The demand for skills cuts across industry verticals. **AI skills include programming, data analysis, machine learning, natural language processing, computer vision and more.** Developing these skills can help individuals and organizations to leverage the power and potential of AI in various domains and applications.
- 3.69 To develop skills for AI various graduation/post-graduation courses are provided in many universities. However, there may be need to assess the requirement of skilled manpower and accordingly, making a clear roadmap on capacity building and skilling.
- 3.70 It has also been observed that some organizations and companies have been organizing Bootcamps to impart better skills to their employees to improve the overall performance of the organizations. On similar lines, the industry may also organize bootcamp programs to build a workforce for new technologies. Further, industry-academia partnership in research through CoEs and research institutes may help in advancing research and creating a skilled workforce.

3.71 In this backdrop, stakeholders were asked to respond to the following questions in the Consultation Paper:

Q.15 Whether there is a gap between requirement and availability of skilled AI workforce? If so, what measures are required to be taken to ensure availability of adequate skilled workforce in AI domain?

Q.33. Whether active participation in the international bootcamp programs such as MIT Bootcamps, Design Thinking Bootcamp by Stanford University, etc. will help India's telecom industry workforce to find international developers community, navigate challenges and learn from experiences of others? Whether similar programs are also required to be launched at the national level? What steps or measures do you suggest to encourage active participation at the international level and setting up of such programs.

Q.34. Whether the courses or programs related to AI/ML currently being offered by various institutions and universities in India are adequate to meet the capacity and competence required to develop and deploy AI solutions or products in the telecom networks? If not, what additional steps or measures are suggested to fill the gap?

Q.39. Whether there is a need to establish telecom industry-academia linkages specifically for AI and BD for AI related skill development? Please give the suggestions for strengthening the industry-academia linkages for identification of the skill development courses.

Comments of the Stakeholders

3.72 On the issue of lack of skilled manpower most stakeholders commented that there is an increase in the number of institutes offering AI courses at a graduate and undergraduate level. However, there are still some gaps in the availability in the professional courses for AI and Big Data technologies. Some stakeholders suggested that the CoEs could focus on grooming post-graduate and PhD level students as domain experts with guidance from industry experts. Additionally, funding should be provided to top institutes and tech startups that are developing analytics and AI products to bridge skill gaps in the field of AI. Some stakeholders suggested that there is a need for research and development (R&D) centres for data analysis and testing of AI models.

- 3.73 A few stakeholders were of the view that close coordination between academia and industry is crucial to ensure that courses in universities are up-to-date and aligned with industry practices and thus producing job-ready graduates. One stakeholder suggested that online courses on AI ethics education should be developed in local languages. The stakeholder further submitted that the way of imparting knowledge has changed & opportunities for more flexible, shorter-term and targeted learning opportunities have proliferated and therefore, institutions and universities in India may take same approach and redesign the AI/ML programs. Some stakeholders proposed that there is an urgent need to bolster the AI skill development ecosystem to ensure the availability of skilled manpower for the growth of AI. Deepening the existing industry-academia linkages can help advance research and create a skilled workforce.
- 3.74 Some stakeholders submitted that academic institutes in India should organise various bootcamps which will help India's workforce from all sectors of the economy to interact with international developers' community, navigate challenges and learn from experiences of others. A few stakeholders have suggested that academia and professionals who are keen on upskilling themselves in these developments can participate in such global forums.
- 3.75 Some stakeholders were of the view that there may not be a specific mandate or intervention required for the telecom sector in this context. Instead, the focus should be on developing curriculum and syllabus related to sector-specific knowledge and skills as part of the training programs. Some stakeholders submitted that the industry can also organise bootcamp programs to build the workforce for new technologies and skill employees for the development of AI solutions. This can help foster a skilled workforce that is well-equipped to tackle the challenges and opportunities presented by AI in the telecom sector and beyond.

3.76 One stakeholder submitted that industry-academia linkages do already exist and opportunities for deepening them may be explored. For example, IIT Bombay is part of IBM’s “AI Horizons Network”, an international consortium of leading universities around the world which included MIT, University of Michigan, University of Maryland among others working with IBM to develop AI related capabilities.

Analysis

3.77 Developing and deploying AI models require a human resource with technical expertise in AI and data science. This includes data scientists, machine learning engineers and software engineers who can develop and deploy AI models as well as IT professionals who can integrate AI systems with existing telecom infrastructure. However, shortage of skilled talent in Data Science and AI limits the ability of industry to develop and deploy AI applications effectively.

3.78 The current courses and programs related to AI/ML offered by institutions and universities in India may not be entirely adequate to meet the capacity and competence required to develop and deploy AI solutions or products in the telecom networks. There may be a gap between the requirement and availability of a skilled AI workforce. There are also fears of widespread job losses due to proliferation of AI based solutions. Large scale reskilling and upskilling efforts will be required to avoid job losses.

3.79 Government, through MeitY, DST, DoT, and Ministry of Education has already taken up a number of measures to skill and upskill students, start-ups and Government Officials in the field of AI which include the following⁴⁹:

- (i) Ministry of Electronics and IT (MeitY) has initiated a programme titled FutureSkills PRIME (www.futureskillsprime.in) in

⁴⁹ <https://pib.gov.in/PressReleasePage.aspx?PRID=1811372>

collaboration with NASSCOM, a B2C (business to consumer) framework for re-skilling/ up-skilling of IT professionals in 10 Emerging Technologies including AI.

- (ii) Trainers and Government Officials are being trained on AI and other emerging technologies by National Institute of Electronics and Information Technology (NIELIT)/ Centre for Development of Advanced Computing (C-DAC) Resource Centres. To further strengthen the physical and digital connectivity, 40 C-DAC/NIELIT Centres spread across the country are also institutionalizing blended-learning programmes.
- (iii) Government has launched 'National AI Portal' (<https://indiaai.gov.in/>) which is a repository of AI based initiatives in the country at a single place. As in March-2022, there were 1024 national and international articles, 655 news, 200 videos, 90 research reports, 279 Startups and 120 Government initiatives listed at National AI Portal.
- (iv) National Program on Responsible Use of AI for Youth- With the objective to empower the youth to become AI ready and help reduce the skill gap, government along with Industry partner has started this initiative to promote AI awareness among Government school going children. In Phase I, 50,666 students and 2536 teachers from 2252 schools from 35 States and UTs attended orientation sessions on AI.
- (v) To foster innovation through research, government has created several 'Centres of Excellence' on various Emerging Technologies including AI. These centres connect various entities such as startups, enterprises, venture capitalists, government and academia to look into problem statements and develop innovative solutions.
- (vi) Department of Science & Technology is implementing the National Mission on Interdisciplinary Cyber-Physical Systems

(NM-ICPS) to promote R&D, Human Resource Development (HRD), Technology Development, Entrepreneurship Development, International Collaboration, etc. As part of the Mission implementation, 25 Technology Innovation Hubs have been established in reputed institutes across the country in advanced technologies including ML and AI.

(vii) Government of India has launched Mission Karmayogi that is envisaged initially to cover about 46 lakh officials of the Central Government and eventually to transform approximately 1.5 crore Government officials across Centre, States and local bodies. As part of the mission, iGOT Karmayogi, a large-scale comprehensive learning platform has been established.

3.80 Several universities and institutes in India are offering UG/ PG courses in AI, Big Data, and Data Analytics. Also, there is availability of a large number of open-source online courses on the topics. CBSE has also introduced some courses on AI at School level.

3.81 Despite all these efforts, there seems to be a gap between the requirement and availability of a skilled AI workforce. As per a report by NASSCOM⁵⁰, the demand for professionals has doubled in the past 3-5 years with a sudden surge in demand for digital skills especially for talent around AI/ML, Big Data Analytics and Data Science. It is estimated that by 2026, India would need more than a million Data Science & AI professionals. The gap between total demand and supply is around 51%. As such India which leads the world with its software professionals have great opportunity to be a market of skilled AI professionals and Data Scientists for entire world. However, this would require additional skilled workforce.

3.82 In view of shortage in the pool of skilled manpower in the field of AI and Data Science, there is need to enhance the capacity of AI and Data

⁵⁰ NASSCOM Report - "State of Data Science and Skill in India" - Feb 2023.

Science streams in various technical institutes and skill development programs. An equal need is to ensure that the curriculum of such courses and skill development programs is kept updated from time to time. Collaboration with industry can be handy for this purpose.

- 3.83 The Authority is of the view that DoT in collaboration with MeitY and Ministry of Education should form a committee drawing members from these two ministries, Ministry of Skill Development, All India Council for Technical Education (AICTE) and Industry. The Committee should assess current availability and future requirements of AI/ML professionals and skilled manpower in the country and suggest various technical programs for increasing the availability of such professionals and skilled manpower as per assessed future requirements and also for reskilling the existing workforce for facilitating them to AI based opportunities from time to time. It should suggest mechanism for industry/Academia collaboration in designing and upgrading AI related curriculum to meet the required skillsets. It should also suggest mechanism to take up collaborative research projects and to open up opportunities for internship and training in industry.
- 3.84 The Authority is of the view that there is a need to impart basic knowledge of Ethical Use of AI to all the students in schools and colleges. Therefore, DoT should take up with All India Council for Technical Education (AICTE) for mandating a course on Ethical Use of AI to students in all technical institutes. DoT should also take up with Ministry of Education for introducing such courses/ modules in other non-technical institutes and schools starting from basic education as well.
- 3.85 The Authority is also of the view that there is a need to familiarise the Government employees with the Ethical Use of AI as well as Basic Concepts of AI. These courses should be mandatory for Government employees as part of their training program. Therefore, DoT through its apex institute, National Telecommunications Institute for Policy

Research, Innovations & Training (NTIPRIT), should at the earliest develop appropriate courses for Government officers and employees on Ethical Use of AI as well as on Basic Concepts of AI. These courses should be made available on iGOT Platform under Mission KarmaYogi. DoT should also take up with the Department of Personnel and Training (DoPT) for mandating these courses for all Government officers and employees as part of their training program.

Recommendations

3.86 In view of above, the Authority recommends that DoT should collaborate with MeitY and Ministry of Education to form a committee drawing members from these two ministries, Ministry of Skill Development, All India Council for Technical Education (AICTE) and Industry. The committee should study and recommend following aspects related to Artificial Intelligence from time to time:

- i. Assessment of current availability and future requirements of AI/ML professionals and skilled manpower in the country and suggest various technical programs for increasing the availability of such professionals and skilled manpower as per assessed future requirements and also for reskilling the existing workforce for facilitating them to AI based opportunities.**
- ii. Mechanism for industry/Academia collaboration in designing and upgrading AI related curriculum to meet the required skillsets.**
- iii. Mechanism to take up collaborative research projects and to open up opportunities for internship and training in industry.**

3.87 The Authority recommends that DoT should take up with All India Council for Technical Education (AICTE) for mandating a course on Ethical Use of AI to students in all technical institutes. DoT should

also take up with Ministry of Education for introducing such courses/ modules in other non-technical institutes and schools starting from basic education as well.

- 3.88 **Authority recommends that DoT through its apex institute, National Telecommunications Institute for Policy Research, Innovations & Training (NTIPRIT) should at the earliest develop appropriate courses for Government officers and employees on Ethical Use of AI as well as on Basic Concepts of AI. These courses should be made available on iGOT Platform under Mission KarmaYogi. DoT should also take up with the Department of Personnel and Training (DoPT) for mandating these courses for all Government officers and employees as part of their training program.**

IV. Accreditation of AI Products and Compendium of Toolkits

- 3.89 Building trust on AI systems is one of the key enablers associated for quick adoption of AI. The accreditation of AI solutions is considered a possible key requirement for promoting the use of AI systems and creating confidence among citizens. It is equally important that accreditation procedures do not create an obstacle to innovation. There may also be a need to frame procurement mechanisms of AI products or solutions which may help in connecting with genuine suppliers. The assistance in the form of a collection of pragmatic approaches for adoption of AI or in the form of toolkits to measure readiness and assess alignment with ethical principles are the approaches to build readiness in industry and bolster adoption of AI.

- 3.90 With this background the stakeholders were asked to respond to following questions which were raised in the Consultation Paper-

Q.35. Whether establishing a system for accreditation of AI products and solutions will help buyers to purchase such solutions or products? If yes, what should be the process of accreditation and who should be

authorised or assigned with the task of accrediting such products or solutions?

Q.36. Whether creating a framework to prepare a list of prequalified suppliers of AI products or solutions will help industry including government agencies to procure AI products or solutions? Whether there is a need to formulate a standard Code of Conduct or guidelines for AI related procurements? What should be the typical elements of such a Code of Conduct or guidelines including guidelines on trusted sources and who should be tasked to formulate such a Code of Conduct or guidelines?

Q.37. Whether there is a need to prepare and publish a compendium of guidance, toolkits and use cases related to AI and BD, to foster adoption in the telecom sector? If yes, what should be the process to prepare such a compendium and who should be assigned this task?

Comments of the Stakeholders

- 3.91 Many stakeholders submitted that this technology is still evolving and, therefore, there is no need for accreditation at this stage. One of these stakeholders was of the view that it may be premature to create a list of prequalified suppliers or create a system for accreditation for AI products or solutions. The stakeholder further submitted that such an approach may be counter-productive to the evolving AI ecosystem in India by creating entry barriers for start-ups and innovators. Some stakeholders suggested that a system of accreditation of AI Products and solutions is required to help buyers not familiar with these products and solutions and also ensure quality and genuineness of the same. One of these stakeholders submitted that Telecom Engineering Center (TEC) may be assigned the task of accreditation.
- 3.92 One stakeholder submitted that TRAI should consider the benefits of limiting public procurement guidelines to a narrow section of high-risk use cases or scenarios only because preventing global competition in public procurement denies government agencies access to the full range of world-class products and services available globally. One stakeholder suggested that an optional system for accreditation of AI products and solutions may be created for listing of certified products and solutions which should be like 'ISI mark' of Bureau of Indian Standards that is

not mandatory but is more a mark of confidence for the consumer that the ISI marked products will meet the functional, quality and safety requirements expected from such a product.

- 3.93 Some stakeholders submitted that there is currently no need to create a list of prequalified suppliers of AI products or solutions as the market is able to meet the demand for qualified suppliers. The statement also suggests that as AI adoption grows and evolves many of the issues related to accreditation and quality assurance will naturally be resolved. Some stakeholders submitted that compendium or manual of guidance, toolkits and use cases offered by AI products and solutions will help the consumer to understand its features, configurations, perceived risks and threats, etc. better and adopt with full awareness and trust. However, according to these stakeholders the same shall not be restricted to the telecom sector.
- 3.94 A few stakeholders submitted that a cross-sectoral multi-stakeholder body (MSB) should develop and refine the guidelines/ principles for adoption of AI in India. These stakeholders further submitted that this multi-stakeholder body should be responsible for laying down the Code of Conduct or guidelines for AI related procurements and also publish a compendium of guidance, toolkits and use cases related to AI.

Analysis

- 3.95 Regulation, standards and guidelines define trustworthiness of AI products. It is equally important to have trustworthy information about whether those guidelines are being followed. Establishing a system for accreditation or assurance will ensure **trustworthiness of AI products and solutions**. There are four important groups (**Figure 3.1**⁵¹) who will benefit from the development of an AI assurance ecosystem - the AI supply chain, AI assurance service providers, Researchers and

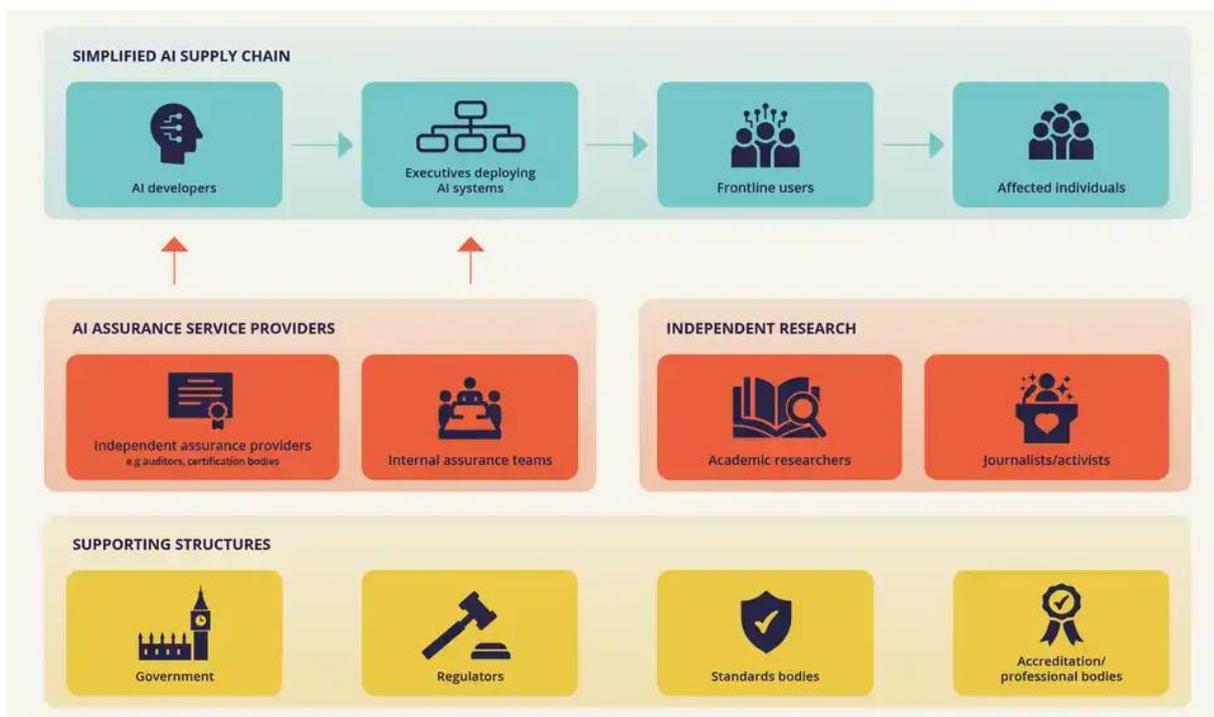
⁵¹ <https://cdeiuk.github.io/ai-assurance-guide/needs-and-responsibilities/>

supporting governance structure for AI assurance. The efforts of different players in this space are interdependent and complimentary. Building a mature assurance ecosystem will require an active and coordinated effort of these players.

3.96 For building trustworthy AI products and services the following considerations have to be kept in mind:

- i. **Developers** need clear standards, regulations and guidelines in place so that they can have trust that the technologies they develop will be compliant and have a wide acceptance.
- ii. **Deployers** require clear and reliable evidence from developers and/or vendors that the AI systems they buy and deploy meet applicable ethical, legal and technical standards to gain enough confidence to deploy these systems.

Figure 3.1: Key Players of the AI assurance ecosystem



- iii. **Independent assurance provider / Testing agency** require clear, agreed standards as well as reliable evidence from developers/vendors/executives about AI systems to have

confidence/trust that the assurance they provide is valid and appropriate for a particular use-case.

- iv. **Governments and Regulators** require confidence that AI systems being developed and deployed in their jurisdiction will be compliant with applicable laws and regulation and will respect citizens' rights and freedoms and will not damage the government's reputation.

International Experience

- 3.97 ITU-T FG-AI4H⁵² is a collaboration of International Telecommunication Union (ITU) with the World Health Organization (WHO) to form a Focus Group on Artificial Intelligence for Health to establish a standardized assessment framework for the evaluation of AI based methods for health, diagnosis, triage or treatment decisions. For AI applications, Institute of Electrical and Electronics Engineers (IEEE)⁵³ has projects and working groups to publish some standards which can be used as key reference for policymakers, professionals and firms. Industry Specification Group (ISG)⁵⁴ within European Telecommunications Standards Institute (ETSI) aims to establish standards for a cognitive network management system. Industry Specification Groups operate alongside traditional standards-making committees in a specific technology area. They provide an effective alternative to the creation of industry fora.
- 3.98 May 2021, in Germany, the Federal Ministry of Economics and Climate Protection (BMWK), the Federal Ministry of Labor and Social Affairs (BMAS) and the Federal Ministry of Education and Research (BMBF) set up a coordination group⁵⁵ for AI standardization and conformity. The

⁵² <https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/default.aspx>

⁵³ https://standards.ieee.org/wp-content/uploads/import/documents/other/ec_about_us.pdf

⁵⁴ <https://www.etsi.org/about/our-operations>

⁵⁵ <https://www.din.de/de/forschung-und-innovation/themen/kuenstliche-intelligenz/fahrplan-festlegen/koordinierungsgruppe-ki>

group is intended to develop standards for tools and processes for application of AI.

3.99 Public Services and Procurement Canada (PSPC) in collaboration with the Treasury Board of Canada Secretariat (TBS) conducted a procurement initiative⁵⁶ aimed at creating a roster of suppliers capable of delivering responsible and effective AI services, solutions and products to the Government of Canada. This prequalification process enables federal government departments and agencies throughout Canada to access a streamlined procurement pathway for acquiring AI solutions by leveraging the services of these pre-qualified suppliers.

3.100 World Economic Forum (WEF) has released “Guidelines for AI procurement”⁵⁷ in 2019 which helps :

- i. Policy officials to accelerate attainment of their policy goals;
- ii. Procurement officials and commercial teams to develop AI-related requests for proposals and to manage procurement processes;
- iii. Data practitioners (e.g. statisticians, data scientists, digital and technology experts) to safeguard public benefit and identify and manage potential risks; and
- iv. AI-solutions providers to better understand the core expectations for government AI projects and to align their proposals with emerging standards for public procurement.

3.101 Model AI Governance Framework and Compendium of Use Cases- The Infocomm Media Development Authority (IMDA), Singapore and the Personal Data Protection Commission (PDPC), Singapore have released the Model AI Governance Framework (Model Framework) to guide organisations on how to deploy AI in a responsible manner. They have also published compendium of use cases⁵⁸ that illustrate how

⁵⁶ <https://www.canada.ca/en/government/system/digital-government/digital-government-innovations/responsible-use-ai/list-interested-artificial-intelligence-ai-suppliers.html#wb-auto-5>

⁵⁷ https://www3.weforum.org/docs/WEF_Guidelines_for_AI_Procurement.pdf

⁵⁸ <https://www.pdpc.gov.sg/help-and-resources/2020/01/model-ai-governance-framework>

organisations have implemented or aligned their AI governance practices with the Model AI Governance Framework. This Compendium of Use Cases demonstrates how various organisations across different sectors have either implemented or aligned their AI governance practices with all sections of the Model Framework. The Compendium also illustrates how the organisations have effectively put in place accountable AI governance practices and benefit from the use of AI in their line of business.

3.102 The trustworthiness of AI products depends upon the accreditation framework which consists of formulation of appropriate standards, testing for compliance of those standards and evidence for the compliance i.e, certification and finally the accreditation of the testing agencies. Accreditation can promote standardization and interoperability within the AI industry. With an accreditation system in place buyers are provided with a clear set of guidelines and benchmarks to assess AI products and solutions. This simplifies the decision-making process by narrowing down the options and enabling buyers to focus on solutions that have already been evaluated and accredited. It saves time and effort in evaluating numerous vendors and provides a more streamlined purchasing experience.

3.103 As per NITI Aayog's report on "National Strategy for Artificial Intelligence" published in June 2018⁵⁹, *"most discussions on ethical considerations of AI are a derivation of the FAT framework (Fairness, Accountability and Transparency). A consortium of Ethics Councils at each Centre of Research Excellence (CORE) can be set up and it would be expected that all COREs adhere to standard practice while developing AI technology and products"*.

3.104 In context of India, Telecom Engineering Centre under DoT is responsible for formulating the standards, testing and certification of

⁵⁹ <https://niti.gov.in/sites/default/files/2019-01/NationalStrategy-for-AI-Discussion-Paper.pdf>

telecom equipment TEC may also play the role of accreditation of labs for testing and certification of AI products and solutions. In addition to this, sector-specific accreditation frameworks will also be required for sectors like healthcare, automotive, etc. The respective sector regulators may be involved while formulating the sector-specific accreditation frameworks for AI based products and solutions being developed and deployed in the respective industry verticals.

3.105 To help Government and other public sector organisations in taking an informed procurement decision it will be required to provide a list of trusted suppliers capable of delivering responsible and effective AI services, solutions and products. This prequalification process will enable Government departments and agencies throughout the country in acquiring AI solutions by leveraging the services of these trusted suppliers. Further, by implementing responsible AI governance practices organisations can distinguish themselves from others and show that they care about building trust with consumers and other stakeholders. This will create a virtuous cycle of trust allowing organisations to continue to innovate for their stakeholders.

3.106 In light of the above, the Authority is of the view that AIDAI should carry out following activities -

- i. Collaborating with standard setting bodies of various sectors for establishing generic and interoperable standards for AI based products and solutions.
- ii. Coordinating with technical standard setting bodies of government like Telecom Engineering Centre (TEC) for accreditation of various labs for testing and accreditation of AI products and solutions and giving recommendations thereof.
- iii. Developing model AI Governance Framework to guide organizations on deploying AI in a responsible manner.

- iv. Developing model Ethical Codes for adoption by public and private entities in different sectors.
- v. Compilation and sharing of best practices deployed across sectors for use of responsible AI.
- vi. Creating public/institutional awareness for responsible use of AI.

Accordingly, above functions have been included in the proposed scope of the AIDAI.

V. Conducting challenge-based program and Bounty Program

- 3.107 The risks and constraints with technologies are being addressed by various organisations/companies by organising challenge-based programs. These programs help in improvising the solutions or products by allowing different stakeholders to participate and to demonstrate their products or provide ideas on the solutions. If the participants are able to disrupt the AI solution, the operator needs to further work on the AI solution to improve its capabilities before launching in a real environment.
- 3.108 A bounty program is a deal offered by many websites, organisations and software developers wherein individuals receive recognition and compensation for reporting bugs especially those pertaining to security exploits and vulnerabilities. These programs allow the organisations to discover and resolve issues in products or solutions before the general public is aware of them thus, preventing incidents.
- 3.109 Can the similar approach be adopted in the telecom sector for adoption of AI where the telecom operators may organise challenge-based programs or bounty programs to resolve the issues and improve the performance of the AI solutions in the network? In this backdrop, stakeholders were asked to respond to the following questions in the Consultation Paper-

Q.30 Whether active participation in the international challenge programs such as ITU AI/ML 5G challenge will help India's telecom industry in adopting AI? Whether similar programs are also required to be launched at the national level? Whether such programs will help to curate problem statements or help in enabling, creating, training and deploying AI/ML models for Indian telecom networks? What steps or measures do you suggest to encourage active participation at international level and setting up of such programs.

Q. 31 Whether AI/ML developers should launch bounty programs to establish trust in the public about robustness of measures taken by them to protect privacy in their products or solutions? Whether conduction of such programs will help companies or firms to improve their products or solutions? Whether such programs should be conducted under the supervision of the government, or an institution established/assigned for this purpose?

Comments of the Stakeholders

- 3.110 Many stakeholders agreed that challenge-based programs or bounty programs can provide a platform for showcasing innovative solutions and allowing others to identify vulnerabilities or issues in those solutions. These demonstrations can help build trust in AI solutions. One stakeholder submitted that MeitY introduced and implemented many programs to deploy emerging technologies like AI, ML, Blockchain, IoT and Big Data.
- 3.111 One stakeholder submitted that the launch of programs/challenges may provide deeper insights into deploying AI/ML models. It helps build a competitive pool of AI skilled resources. Another stakeholder opined that these programs are taking place at a national level, mainly by private sector, associated with rewards and recognition. As per this stakeholder the requirement is to spread it across universities and institutions. A few stakeholders submitted that participation in the international programs such as ITU AI/ML, 5G challenge will help the industry in adopting AI.

Analysis

- 3.112 Participation in the international challenge programs such as ITU AI/ML 5G challenge provides an opportunity to Indian Telecom Industry to showcase their skills and capabilities, learn from international best practices and collaborate with other stakeholders in the field of AI and 5G. Similar programs should be launched at the national level as they can be tailored to address the specific challenges faced by India's telecom industry and, thus, help in developing solutions tailored to the Indian context. To encourage participation in these programs measures such as creating awareness about the benefits of joining such programs, providing support and guidance to participants throughout the process such as technical assistance and providing incentives and recognition to participants can be some of the measures to encourage active participation.
- 3.113 Launching bounty programs can help companies or firms improve the robustness of their products or solutions and can also help establish trust with their users. Such programs can help AI/ML developers to improve their products or solutions by identifying and fixing potential risks before they cause harm or damage.
- 3.114 DoT has launched a scheme 'Digital Communication Innovation Square (DCIS)' which is a new initiative to foster innovation and entrepreneurship in the digital communication sector. DCIS aims to provide a platform for startups, researchers, industry partners and government agencies to collaborate and co-create solutions that address the challenges and opportunities of the digital economy. To promote the ecosystem for research, design, development, proof of concept testing IPR, creation, pilot project and manufacturing i.e. complete value chain to make India a global hub for production of telecommunication equipment and a centre for digital communication services and to create synergies among the Academia, Research Institutes, Start-ups and Industry for capacity building and

development of a balanced telecom ecosystem by organizing workshops/seminar/webinar etc. are some of the objectives of the scheme. DCIS is part of the Champion Services Sector Scheme which supports the development of high-growth and high-value services sectors in India.

3.115 In 2021, DoT has established a mechanism for sourcing of telecommunication equipment only from trusted sources to enhance the security of telecom networks and to address the national security concerns as per National Security Directive on Telecommunication Sector (NSDTS). Procurement and use of trusted software and hardware of AI system is very important. Therefore, there is a need to promote the use of indigenous technology for AI system. The Authority is of the view that DoT should use 'Digital Communication Innovation Square (DCIS)' scheme to support the startups and other organizations for holding AI/ML events such as challenge programmes and bounty programmes for demonstration of their ideas, collaborating with stakeholders and improvising their solutions/products. DoT should also, through Inter-Ministerial Working Group (IMWG) coordinate similar efforts in other sectoral Ministries/Departments.

3.116 In view of the above, the Authority recommends that DoT should use 'Digital Communication Innovation Square (DCIS)' scheme to support the startups and other organizations for holding AI/ML events such as challenge programmes and bounty programmes for demonstration of their ideas, collaborating with stakeholders and improvising their solutions/products. DoT should also, through Inter-Ministerial Working Group (IMWG) coordinate similar efforts in other sectoral Ministries/Departments.

VI. Democratization of Models

3.117 The success of large models trained on expansive datasets has unlocked high performance across ML models. The coalescence of these foundational models (e.g. BERT, CLIP, the GPTs, Gopher) has

democratized access to high-quality generic architectures. Also, the fine-tuning of foundational models can lead to high performance for downstream tasks. To accelerate adoption of AI in telecom sector, should industry train their AI models by fine-tuning or deriving from large foundational models? Accordingly, following question was raised in the Consultation Paper seeking the comments of the stakeholders-

Q.26: Whether the emerging trends of development of foundational AI models such as GPT-3, Gopher etc. are leading to democratisation of AI space by offering finetuned or derived AI models? Whether such a trend will also help in reducing costs for the AI developers? Whether similar approach will help in development of large-scale AI model for the telecom sector?

Comments of the Stakeholders

- 3.118 Some stakeholders suggested that the use cases define a model to be chosen and it is up to the developer which model or set of models is most appropriate. Therefore, as per the opinion of these stakeholders, no prescriptive regulatory intervention should be applied in case of the development activity as this area is ever evolving.
- 3.119 One stakeholder submitted that the existing foundational models may be used and it may be best to train other models on them. However, the telecom sector and other sectors of the economy cannot be tied down to the existing models. The stakeholders further submitted that new models would evolve with time and driven by market forces and competition, new models which help in saving time and costs will emerge. One stakeholder was of the view that availability and development of foundational models reduces the initial groundwork for development of AI models and allow the developers to focus on solving enhanced problem-solving using AI.

Analysis

- 3.120 Foundational AI models are large AI models trained on enormous quantities of data usually through self-supervised learning or semi-

supervised learning. This process results in generalized models capable of a wide variety of tasks such as image classification, natural language processing, text generation based on user input, etc. Some examples of foundational AI models are GPT-3, BERT, T5 and DALL-E.

- 3.121 Foundational AI models have the potential to democratize AI by enabling anyone to access powerful capabilities. By building on top of a foundational model, AI developers can create more specialized and sophisticated models tailored to specific use cases or problems without having to start from scratch or collect large amounts of data. This can also help in reducing costs for the AI developers as they can leverage the existing infrastructure and resources of the foundational model providers such as cloud computing and data storage.
- 3.122 For the telecom sector, a similar approach could help in developing a large-scale AI model that can handle diverse and complex tasks such as network optimization, customer service, fraud detection, etc. However, there are also some domain-specific requirements and constraints that need to be considered when developing a large-scale AI model for the telecom sector such as data privacy, security, regulation and interoperability. Further, such a model would also require careful design, evaluation and governance to ensure its reliability, security, and fairness. Therefore, a careful balance between generalization and specialization is needed when adapting foundational AI models to the telecom sector.
- 3.123 The use of foundational models will be decided by the industry based on the use cases. Therefore, the Authority is of the view that, at present, there is no need of any separate regulation to ensure that large AI Foundational models are used in a responsible and ethical way as it will be governed by the overall framework of AI. The proposed AIDAI may review this aspect from time to time and recommend necessary action.

VII. Adoption of MLOps (Machine Learning Operations)

3.124 A Machine Learning Operations (MLOps) environment is where ML models are developed, trained, validated and stored. It is a set of practices that aims to streamline the development, deployment and management of machine learning (ML) models. MLOps can help the telecom industry to automate and scale the ML lifecycle from data collection and preparation to model training and validation to model deployment and monitoring. Training of ML models is based on data from the DataOps feature store.

3.125 In the Consultation Paper, following issue was raised seeking comments of the stakeholders-

Q.32 Whether the telecom industry is required to adopt a Machine Learning Operations (MLOps) environment to develop, train, validate and store ML models? Whether there is also a need to establish a DataOps feature store to help MLOps for training purposes? What standardisation is required in terms of interoperability and compatibility for MLOps to function in a federated manner?

Comments of the Stakeholders

3.126 Some stakeholders submitted that any technology specific mandate/intervention should be avoided. As per these stakeholders, these developments should be left to market forces to adopt depending upon techno-commercial dynamics and outcomes an entity would like to achieve while using these approaches. One stakeholder suggested that adoption of MLOps should not be pushed as compliance obligations but should be encouraged and telecom industry should have freedom to adopt the best environment in their networks.

3.127 One stakeholder was of the view that capabilities of MLOps may be required to be explored and utilised for development and optimization of AI solutions/products. Another stakeholder suggested that this concept has significant potential for the future, the same should be

preceded by enactment of a comprehensive Personal Data Protection Bill.

Analysis

- 3.128 Machine Learning Operations (MLOps) is a set of practices that aims to streamline the development, deployment and management of machine learning (ML) models. MLOps can help the telecom industry to accelerate the delivery and quality of ML models to ensure their scalability, reliability and security. DataOps is a key component of MLOps that focuses on creating and maintaining a data pipeline that can provide high-quality and consistent data for ML models.
- 3.129 For MLOps to function in a federated manner, i.e., to allow multiple parties to collaborate on ML development without compromising data privacy or security, some standardization is required in terms of interoperability and compatibility of the data formats, protocols, APIs and frameworks that are used by different MLOps platforms and the same is likely to evolve as the technology matures.
- 3.130 As suggested by the stakeholders, the adoption of MLOps shall be decided by the industry based on its requirements. Many of the requirements are also proposed to be taken care of through standardisation process and interoperability. Therefore, the Authority is of the view that there is no need of any separate recommendations for adoption of MLOps at this point of time. The proposed AIDAI may review this aspect from time to time and recommend necessary action.

VIII. Privacy Enhancing Techniques

- 3.131 Privacy is a major concern in the context of AI and BData. Privacy-enhancing and privacy-preserving technologies such as encryption, differential privacy, homomorphic encryption, secure multi-party computation and federated learning are used to protect sensitive data. It is important to evaluate whether current solutions are adequate to

handle all perceived risks and concerns; and to assess the need to develop new privacy-preserving architecture. Moreover, challenges such as performance and scalability issues, lack of standardisation and complexity of implementation also need to be addressed. Regulators and policymakers can play a crucial role in establishing clear guidelines and regulations to ensure privacy and security are protected while also enabling innovation and growth in the AI/ML domains.

- 3.132 The next generation telecom network architectures are expected to leverage the advances in AI at edge, federated learning, TinyML and their combination to offer solutions that can meet both privacy and intelligence requirements of various applications. AI at edge refers to the deployment of AI models on resource-constrained devices such as sensors, cameras, etc. that are close to the data sources and can perform in near real-time without relying on cloud processing. TinyML is broadly defined as a fast-growing field of ML technologies and applications capable of performing on-device sensor data analytics at extremely low power.
- 3.133 The concept of Operator Platform refers to a collaborative framework that enables telecom operators to share their network resources and capabilities with each other and with third-party service providers. This can help in providing AI based solutions in a unified and more equitable manner by allowing operators to leverage their collective data, infrastructure and expertise to create and deliver innovative services across different domains and regions. For example, operators can use Operator Platform to enable federated learning which is a distributed machine learning technique that allows multiple entities to train a shared model without exchanging their raw data.
- 3.134 These technologies can provide benefits such as data privacy, latency reduction, energy efficiency, bandwidth saving and personalized learning for diverse use cases in domains such as healthcare, smart

cities, industry 4.0, etc. Some of the key questions that arise in this context that were raised in the Consultation Paper were:

Q.19: (a) Which are the currently used privacy enhancing and privacy preserving technologies facilitating adoption of AI and BD? (b) Are there any challenges in using these technologies? (c) How can these challenges be addressed? (d) Which are the potential technologies likely to be available in the near future to further strengthen privacy?

Q.20: Whether the list of technologies provided in response to Q.19 are adequate to handle all the perceived risks and concerns in the AI domain? Or is there a need to develop new privacy preserving architecture?

Q.21: Whether the next generation telecom network architectures such as AI at edge, federated learning, TinyML or their combination can offer solutions to meet both privacy as well as intelligence requirements?

Q.22: (a) What type of technological advancements are happening for running the AI models on the end user devices to overcome constraints in respect of processor, memory, battery etc.? (b) Whether special tools, programming languages, and skills are required to be developed to build such AI models?

Q.23: Considering availability of new privacy preserving architectures as suggested in response to Q.19 and Q.20, what is the likelihood of emergence of new business and operational models? Whether such models will raise issues related to ownership and responsibilities? What do you suggest to address these issues?

Q.24: (a) Whether the concept of “Operator Platform” would help in providing AI based solutions in a unified and more equitable manner? (b) Apart from popular federated use cases of edge cloud federation, Cloud XR, Cloud Gaming, whether this concept may also be applied for public service delivery and in making public policies that are data-driven? (c) Whether there is a need to take initiatives for developing and demonstrating advantages of concept of “Operator Platform”? If so, what steps and measures are suggested to launch such initiatives?

Comments of the Stakeholders

3.135 Some stakeholders submitted that it is advisable to have the PDP Bill in place before promoting new privacy preserving architectures to ensure that the data principals' rights and interests are adequately protected. Some stakeholder submitted that once the new Data Protection bill is put in place by the Government, technologies such as

AI at edge, federated learning, TinyML or their combination will be able to provide solutions which meet both privacy and security requirements as defined by the Bill.

3.136 A few stakeholders submitted that the next generation telecom network architectures will be able to deliver solutions that meet both privacy as well as intelligence requirements. One stakeholder submitted that privacy-enhancing and security techniques can mitigate data -related risks at design and at runtime. The stakeholder further submitted that the widespread promotion and utilisation of these technologies could contribute to the security and resilience of the data ecosystem of India. A few stakeholders highlighted the need for continuous improvement in privacy-preserving technologies in the face of evolving threats to data privacy. One stakeholder suggested that advanced techniques like de-anonymization can potentially compromise data privacy making it necessary to develop and deploy privacy-preserving architectures that are continually learning and evolving.

3.137 Some stakeholders submitted that while current privacy-enhancing technologies can provide some level of protection they may not be sufficient to address all risks and concerns in the AI domain. One stakeholder submitted that it is important to keep up with the latest developments and technologies to ensure that privacy-enhancing technologies remain effective and relevant in the face of evolving threats and challenges. This requires ongoing research and development as well as collaboration between industry, academia and regulatory bodies to ensure that data privacy is protected in the most effective way possible. Other stakeholder said that privacy enhancing techniques are not a one-size-fits-all solution and can be used in combination to achieve the desired level of privacy and data protection. Therefore, it is essential to carefully consider which techniques to use and how to combine them to achieve the desired level of privacy while ensuring that the data is still useful for the intended purposes.

3.138 Some stakeholders submitted that the next generation telecom network architecture is still at an evolving stage. As per these stakeholders, the aspects touched upon relate to futuristic development which may or may not take place. One stakeholder submitted that as AI is in nascent stage, it is too early to say that next generation telecom network architectures can offer solutions to meet both privacy as well as intelligence requirements. One stakeholder was of the view that a lot of research still needs to be done to make these technologies ready for mass adoption by the AI players. The stakeholder further suggested that any attempt to aggressively promote new privacy preserving architectures without having a comprehensive PDP regulation in place is likely to lead to significant harm to data principals and, therefore, the same should be avoided.

Analysis

3.139 Privacy Enhancing and Preserving technologies (PETs) are a broad range of technologies that are designed to extract data value through data driven technologies such as AI/ML without risking the privacy and security of this information.

3.140 AI-generated synthetic data is one of the most versatile PETs. AI-powered synthetic data generators are trained using real data. After the training, the generator can create statistically identical but flexibly sized datasets without exposing any real personal or sensitive information. Differential Privacy is a technique that adds noise to the data to prevent individual identification while still allowing meaningful statistical analysis. This technique is particularly useful in scenarios where data needs to be shared but the privacy of individuals needs to be protected. Cryptographic algorithms and Homomorphic encryption are examples of PETs. Cryptographic algorithms are methods of securing data and communication using mathematical techniques. Homomorphic encryption is a type of cryptographic algorithm that allows computations to be performed on encrypted data without decrypting it

first. There are several other emerging technologies like Quantum cryptography, blockchain, etc that have the potential to further strengthen privacy in future.

3.141 These privacy-enhancing and privacy-preserving technologies play a crucial role in facilitating the adoption of AI/ML while ensuring that sensitive information is protected. However, the adoption of PETs is not without challenges. Privacy preserving architectures often require additional computation, communication or storage resources to implement encryption, masking or aggregation techniques. This may affect the efficiency, scalability or accuracy of the AI systems. Moreover, some privacy preserving methods may introduce noise or distortion to the data or models which may degrade the quality or reliability of the AI outputs. There may be ethical questions about the quality, validity or accountability of the data or analysis derived from PETs.

3.142 To meet the challenges of privacy and intelligence in the digital era, next-generation telecom network architectures are evolving. Some of the emerging technologies that can enable this transformation are AI at edge, federated learning, TinyML or their combination. These technologies aim to leverage the computational and data resources of low-power and resource-constrained end-user devices such as smartphones, wearables and sensors to perform AI tasks locally or collaboratively without relying on centralized cloud servers. This can enhance the privacy, efficiency and scalability of AI applications as well as enable new use cases that require low latency and high reliability. However, running AI models on end-user devices poses several constraints in terms of processor, memory, battery and network bandwidth. To overcome these limitations, various technological advancements are happening in the fields of hardware, software and algorithms. For example, specialized chips and processors are being designed to optimize AI performance and power consumption on edge devices.

- 3.143 The availability of new privacy preserving architectures may also raise issues related to ownership and responsibilities related to data. For example, if data is shared across multiple parties using a privacy-preserving technology, it may be unclear who owns the data or who is responsible for its security.
- 3.144 Privacy enhancing and preserving technologies (PETs) and next generation architecture of AI models are still evolving and shall mature with time. These will be deployed by the industry based on the requirements and effectiveness of these technologies as long as these technologies are within the regulatory framework. Therefore, the Authority is of the view that AIDAI should facilitate adoption of future technologies and innovative architectures related to AI models. Therefore, it has been included as part of the scope of AIDAI.

CHAPTER – 4: LIST OF RECOMMENDATIONS

4.1 The Authority recommends that for ensuring development of responsible Artificial Intelligence (AI) in India, there is an urgent need to adopt a regulatory framework by the Government that should be applicable across sectors. The 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.

(Para 2.124)

4.2 The Authority recommends that the broad tenets of the suggested regulatory framework should comprise of-

- a. An independent statutory authority.**
- b. A Multi Stakeholder Body (MSB) that will act as an advisory body to the proposed statutory authority.**
- c. Categorizations of the AI use cases based on their risk and regulating them according to broad principles of Responsible AI.**

(Para 2.125)

4.3 The Authority recommends that an independent statutory authority should be established immediately for ensuring development of responsible AI and regulation of use cases in India. The authority should be designated as “Artificial Intelligence and Data Authority of India” (AIDAI).

(Para 2.126)

4.4 The Authority in its recommendations on “Regulatory Framework for Promoting Data Economy” dated 18th November 2022 has recommended the following: -

“For steering the data digitization drive, the Authority recommends that a statutory body, Data Digitization and Monetization Council (DDMC), be established at the Centre by

enactment of new law or by amendment of the present law. The proposed body should have suitable representation from DoT and MeitY, in addition to representatives from Central and State governments. The proposed body should be entrusted with the responsibility to review and prioritize the avenues which would require more concentrated efforts of data digitization and fix timeframes accordingly. DDMC should also assess the data digitization requirements and define the process framework for use of AI and related technology in data processing, data sharing and data monetization while ensuring the privacy and security of the data owner. The proposed body should also be entrusted with framing policies and incentivization schemes for data digitalization, data sharing, and data monetization. DDMC should be the apex body to oversee all issues related to data digitization, data sharing, and data monetization in the country. (Para 2.258)

The Authority further recommends that DDMC should also be entrusted with responsibility of putting in place an overarching framework for ethical use of data both by the Government as well as by the corporates in India. The framework should address the generic as well as vertical sector specific requirements. DDMC should also study the possible impact of upcoming technologies on data ethics and come out with relevant rules/guidelines on the subject.” (Para 5.44)

Since the Data Digitization and Monetization Council (DDMC) which was recommended to be established by TRAI through its aforementioned recommendation was also envisaged to perform several functions related to use of Artificial Intelligence and related technology as well as to study the impact of upcoming technologies on data ethics, the Authority further recommends that the DDMC should now be renamed as “Artificial Intelligence and Data Authority of India” (AIDAI). The Authority recommends that formation of too many statutory authorities/ bodies creates confusion for the sector and therefore, in order to derive synergy, organically the work of AIDAI should be entrusted to TRAI with suitable modifications in the TRAI Act.

(Para 2.127)

4.5 The functions of the DDMC (now proposed AIDAI) as recommended in the said recommendations are summarised below-

- i. Assess the data digitization requirement in the country; review and prioritize the avenues requiring concentrated efforts for data digitization and fix timeframes accordingly.*
- ii. Be the apex body to oversee all issues related to data digitization, data sharing, and data monetization in the country including framing policies and incentivization schemes for data digitalization, data sharing, and data monetization.*
- iii. Define the process framework for use of AI and related technology in data processing, data sharing and data monetization while ensuring the privacy and security of the data owner.*
- iv. Putting in place an overarching framework for ethical use of data both by the Government as well as by the corporates in India. The framework should address the generic as well as vertical sector specific requirements.*
- v. Study the possible impact of upcoming technologies on data ethics and come out with relevant rules/guidelines on the subject.*

(Para 2.128)

4.6 The Authority recommends that AIDAI should be assigned the following functions, which includes the functions of DDMC summarised above –

I. Regulation Making Functions

- i) Framing regulations on various aspects of AI including its responsible use.
- ii) Defining principles of responsible AI and their applicability on AI use cases based on risk assessment. A suggestive matrix for the same is given below:

Sl No	Principles of Responsible AI	High Risk Use Cases (such as system dealing with health of public)	Low Risk Use Cases (such as chatbot)
1	Inclusive growth, sustainable development and well-being	√	
2	Human-centred values and Fairness	√	
3	Transparency and Explainability	√	√
4	Robustness, Security and Safety	√	
5	Accountability	√	

The above matrix is only suggestive and AIDAI should evolve the framework based on its assessment, advice of proposed MSB, global best practices, and public consultation.

- iii) Ensuring that principles of responsible AI are made applicable at each phase of AI framework lifecycle viz. design, development, validation, deployment, monitoring and refinement.
- iv) Developing model AI Governance Framework to guide organizations on deploying AI in a responsible manner.
- v) Developing model Ethical Codes for adoption by public and private entities in different sectors.
- vi) Any other aspect of regulation of AI for orderly growth of the AI sector and protection of the consumers.

II. Recommendatory Functions

- i) Facilitating adoption of future technologies and innovative architectures related to AI models.**
- ii) Monitoring and making recommendations on the enforcement framework on AI applications and its use cases.**
- iii) Coordinating with technical standard setting bodies of government like Telecom Engineering Centre (TEC) for accreditation of various labs for testing and accreditation of AI products and solutions and giving recommendations thereof.**
- iv) Capacity building and infrastructure requirements related to AI- evaluation and giving recommendations to the Government.**
- v) Assess the data digitization requirement in the country; review and prioritize the avenues requiring concentrated efforts for data digitization and fix timeframes accordingly.**
- vi) Be the apex body to oversee all issues related to data digitization, data sharing and data monetization in the country including framing policies and incentivization schemes for data digitalization, data sharing and data monetization.**
- vii) Define the process framework for use of AI and related technology in data processing, data sharing and data monetization while ensuring the privacy and security of the data owner.**
- viii) Putting in place an overarching framework for ethical use of data both by the Government as well as by the corporates in India. The framework should address the generic as well as vertical sector specific requirements.**
- ix) Study the possible impact of upcoming technologies on data ethics and come out with relevant rules/guidelines on the subject.**
- x) Creation of a national level mechanism to bring the State Governments, Local Bodies and other agencies onboard to adopt the national policy on data governance.**
- xi) Creation of a uniform framework to on-board private entities for adoption of national policy on data governance and to**

enable them and public sector entities to digitalize, monetize and share their data within the privacy and other applicable laws and policies.

- xii) Creation of a uniform framework for sharing of data available with Government and its entities with industry, educational institutes, R&D Centres, Startups etc. within the privacy and other applicable laws and policies.**

III. Other Functions-Considering the nature of functions, AIDAI may take up following activities also-

- i. Setting up regulatory sandboxes for testing AI based solutions.**
- ii. Collaborating with standard setting bodies of various sectors for establishing generic and interoperable standards for AI based products and solutions.**
- iii. Collaborating with sectoral regulators and vertical ministries in Central and State Governments as well as with local and other authorities on various issues related to AI.**
- iv. Collaborating with international regulators and organizations for AI related issues.**
- v. Providing a platform for industry and academia collaboration for ensuring responsible use of AI and capacity building.**
- vi. Creating public/institutional awareness for responsible use of AI.**
- vii. Compiling and sharing of best practices deployed across sectors for use of responsible AI.**

(Para 2.129)

4.7 The Authority recommends that a Multi Stakeholder Body (MSB) should be constituted by the Government to act as an advisory body to AIDAI drawing members from:

- i. Department of Telecommunications**
- ii. Ministry of Information and Broadcasting**

- iii. **Ministry of Electronics and Information Technology (MeitY)**
- iv. **Department for Promotion of Industry and Internal Trade (DPIIT)**
- v. **Department of Science and Technology**
- vi. **Ministry of Home Affairs**
- vii. **Two members from Academic and research institutes dealing with AI**
- viii. **Four members from Industry**
- ix. **One Legal expert in the field of AI**
- x. **One Cyber security expert**
- xi. **Any other suitable member (maximum two)**

MSB may invite representatives of relevant Ministry/ Department of Centre/ State Government on need basis as special invitee.

(Para 2.130)

4.8 The Authority recommends that for synergy and coordination among different Central and State Ministries and local bodies and for orderly growth of AI and its use cases, the Ministry of Electronics and Information Technology (MeitY) should be designated as the administrative ministry for AI.

(Para 2.131)

4.9 The Authority recommends that while defining powers and functions of AIDAI, it should be ensured that the clauses related to exercising transparency through open consultation with stakeholders are made applicable to all regulatory decisions and recommendations of AIDAI.

(Para 2.132)

4.10 Considering the sensitivity and far-reaching impact of AI across the nations which defies borders, the Authority recommends that the Indian Government should collaborate with international agencies and governments of other countries for forming a global agency that will act as the primary international body for development, standardization, and responsible use of AI. India should play a leading role in shaping the Global AI standards and governance structures.

(Para 2.133)

4.11 In July 2018, TRAI has released its Recommendations on “Privacy, Security and Ownership of the Data in the Telecom Sector’. The Recommendations addresses multiple aspects of the data protection in the telecommunications sector. The Authority reiterates its recommendations on ‘Privacy, Security and Ownership of the Data in the Telecom Sector’ of July 2018.

The Authority also recommends that all such provisions of the aforesaid recommendations which are in the domain of DoT, should be implemented immediately.

(Para 2.134)

4.12 The Authority recommends that the scope of AIDAI should also include making recommendations to create a national level mechanism to bring the State Governments, Local Bodies and other agencies onboard to adopt the national policy on data governance.

AIDAI should also recommend a uniform framework to onboard private entities for adoption of national policy on data governance and to enable them and public sector entities to

digitalize, monetize and share their data within the privacy and other applicable laws and policies.

(Para 2.135)

The Authority recommends that AIDAI's scope of work should also include recommending to the Government a uniform framework for sharing of data available with Government and its entities with industry, educational institutes, R&D Centres, Startups etc. within the privacy and other applicable laws and policies.

(Para 2.136)

4.13 The Authority recommends that-

- i. DoT should collaborate with Access Service Providers for enhancing the capability of currently deployed systems, through use of AI/ML and other new technologies, in order to analyse the data on real-time basis for verification of the total number of mobile connections (across Access Service Providers and across LSAs) against the limit set by DoT.**
- ii. DoT's Telecom Security Operation Centre (TSOC) should deploy AI/ML and other new technologies-based tools for generating alerts to minimize network security threats.**
- iii. The Authority recommends that for effective redressal of grievances of telecom customers, AI/ML and other new technologies should be used on data that should flow from networks and redressal systems of Access Service Providers to dash boards of DoT Public Grievance Unit.**
- iv. For effective use of AI/ML for UCC Detection and pro-active actions thereof in order to protect customers from phishing,**

spam and scam, the Authority recommends that suitable amendments in Indian Telegraph Act, Indian Telegraph Rules and License Conditions related to Unified Licence (UL) with Authorization for Access Services should be made to empower TRAI to direct licensees to enable continuous machine-based identification and monitoring of P2P messages sent in bulk for automatic pattern recognition, anomaly detection, traffic analysis, reputation analysis, signature identification, etc.

- v. Considering the potential use cases of AI in various aspects of telecommunication and broadcasting, and its benefits, DoT, in collaboration with various stakeholders, should encourage the development of AI in various fields of Communications and Broadcasting such as:

- | | | |
|--|---|------------------------------|
| i. RF optimisation | } | Telecom |
| ii. carbon emission reduction | | |
| iii. beam forming & beam tracing | | |
| iv. network slicing | | |
| v. edge computing | | |
| vi. federated learning etc. and | } | Broadcasting
and Cable TV |
| vii. analysis of viewer engagement and
optimization of content selection and scheduling | | |
| viii. speech recognition and synthesis | | |
| ix. automated video processing | | |
| x. content analysis and moderation etc. | | |

through indigenous technologies and may appropriately consider funding through Telecom Technology Development Fund (TTDF) or any other scheme of DoT/Government.

(Para 3.40)

- 4.14 The Authority recommends that DoT should, in collaboration with organizations such as IISc Bangalore, IIT Madras, IIT Kanpur, and other research institutes, launch research in telecommunications in order to develop indigenous AI use cases.**

(Para 3.41)

- 4.15 The Authority reiterates its following recommendations of its recommendations on ‘Auction of Spectrum in frequency bands identified for IMT/5G’ dated 11th April 2022 -**

“The Authority recommends that:

- a. 5G-dedicated Inter-Ministerial Working Group (IMWG), under the Chairmanship of Member (Technology), DoT should be formed comprising Ministry of Electronics and Information Technology, Department for Promotion of Industry and Internal Trade, Ministry of Information and Broadcasting, Department of Space, Ministry of Finance, Ministry of Education, Department of Science & Technology, Ministry of Micro, Small and Medium Enterprises (MSME) and Niti Ayog as members, which should be represented by JS Level officers.***
- b. The IMWG may co-opt officers from other concerned Ministry(ies) / Department(s) as per requirement.***
- c. The concerned Ministries/Departments shall establish a special dedicated Digital Cell, headed by the JS Level officer nominated as member in IMWG, with dedicated technical manpower to formulate the use of digital technologies like 5G, IoT, M2M, AI etc. and development of relevant and affordable use cases involving start-up companies, entrepreneurs, application providers etc. The scope of the Digital Cell shall include, but not limited to, involving the relevant stakeholders in discussions, framing and monitoring short-term (annual), medium-term (5-year), and long-term (10-year) plans with quantitative targets in respect of sector specific 5G use cases, providing platform and promoting 5G use cases. The Digital Cell may also need to focus on issues relating to digital***

literacy, connectivity and affordable user devices for their sector.

- d. The Ministries/Departments should take up short-term (annual), medium-term (5-year), and long-term (10-year) plans with quantitative targets in respect of sector specific 5G use cases and the same can be considered by IMWG for consistent and coordinated development of use cases and start-up ecosystems to align issues such as connectivity, privacy, data security etc. in the country.*
- e. The participating members of IMWG should be responsible for outlining strategies, defining targets, and budgetary provisions for achieving defined targets for their respective Ministries / Departments.*
- f. The IMWG should conduct periodic meetings and discussions, at least once in 3 months, in which progress achieved will be reviewed and outline path for achieving planned objectives will be framed.*
- g. The IMWG should present consolidated status/proposals to the Department of Telecommunications (DoT) being nodal Ministry, on a regular basis.*
- h. The progress of digital transformation and implementation of 5G use cases in various verticals should also be monitored and documented by IMWG and be submitted to DoT for perusal and appropriate decision.*

[Para 5.77]

6.73 The Authority recommends that DoT should take up the matter with Ministry of Micro, Small and Medium Enterprises (MSME) to carry out a study to find out the actual details about the level of acceptance and adoption of 5G based industrial automation and digital technologies by the MSME sector in the country as compared to other industries. Based on the learning from such study, appropriate schemes, including interest subvention scheme, for upgradation of plant and machinery, may be devised to facilitate the micro, small and medium enterprises to overcome various constraints and move towards industrial automation. In this regard, budgetary provisions (if required), may be created by the Ministry of MSME. [Para 5.78]

6.74 The Authority recommends that Telecom Innovation Centres, may be formulated in alliance with different academic institutions

and ministries. These innovation centres could be specialized for development of innovative solutions for 5G use cases and applications in different verticals/sectors such Agriculture, Medicine, Manufacturing, Infrastructure, Power, Telecom, etc. and be made responsible for desired outcome. DoT should be the nodal ministry to monitor and coordinate the activities of the Telecom Innovation Centres. [Para 5.80]”

(Para 3.42)

- 4.16** The Authority recommends that DoT, through Inter-Ministerial Working Group (IMWG) formed for implementation and penetration of 5G, should coordinate with other sectoral Ministries/ Departments to encourage and develop indigenous AI use cases for various sectors by funding from the respective Ministry/ Departmental Budgets.

(Para 3.43)

- 4.17** The Authority recommends that-

- i.** At least one Centre of Excellence for Artificial Intelligence (CoE-AI) should be established in each State/UT, for facilitating educational institutions, startups, innovators, researchers and other public/private entities to develop and demonstrate technological capabilities. These centres should have access to high bandwidth, computational facilities and data sets for training AI models. All such centres should also be linked with proposed 5G/6G labs for sharing of resources and knowledge. To galvanize an effective AI ecosystem and to nurture quality human resources, these CoE-AIs should allow industry players as well as startups to partner with Academia in conducting research, develop cutting-edge applications and scalable problem solutions in various fields such as

agriculture, healthcare, education, smart cities, smart mobilities etc.

- ii. One of the CoE-AIs should establish a centralized portal to be used by all CoE-AIs. The portal should have information regarding various facilities available with individual CoE-AI, process to access such facilities, fee structure, if any, and other relevant details.

(Para 3.67)

4.18 The Authority recommends that DoT should collaborate with MeitY and Ministry of Education to form a committee drawing members from these two ministries, Ministry of Skill Development, All India Council for Technical Education (AICTE) and Industry. The committee should study and recommend following aspects related to Artificial Intelligence from time to time:

- i. Assessment of current availability and future requirements of AI/ML professionals and skilled manpower in the country and suggest various technical programs for increasing the availability of such professionals and skilled manpower as per assessed future requirements and also for reskilling the existing workforce for facilitating them to AI based opportunities.
- ii. Mechanism for industry/Academia collaboration in designing and upgrading AI related curriculum to meet the required skillsets required.
- iii. Mechanism to take up collaborative research projects and to open up opportunities for internship and training in industry.

(Para 3.86)

4.19 The Authority recommends that DoT should take up with All India Council for Technical Education (AICTE) for mandating a course on Ethical Use of AI to students in all technical institutes.

DoT should also take up with Ministry of Education for introducing such courses/ modules in other non-technical institutes and schools starting from basic education as well.

(Para 3.87)

4.20 Authority recommends that DoT, through its apex institute, National Telecommunications Institute for Policy Research, Innovations & Training (NTIPRIT), should at the earliest develop appropriate courses for Government officers and employees on Ethical Use of AI as well as on Basic Concepts of AI. These courses should be made available on iGOT Platform under Mission KarmaYogi. DoT should also take up with the Department of Personnel and Training (DoPT) for mandating these courses for all Government officers and employees as part of their training program.

(Para 3.88)

4.21 The Authority recommends that DoT should use ‘Digital Communication Innovation Square (DCIS)’ scheme to support the startups and other organizations for holding AI/ML events such as challenge programmes and bounty programmes for demonstration of their ideas, collaborating with stakeholders and improvising their solutions/products.

DoT should also, through IMWG, coordinate similar efforts in other sectoral Ministries/ Departments.

(Para 3.116)

ANNEXURE I

DoT's REFERENCE TO TRAI FOR RECOMMENDATIONS

F. No 4-27/NDCP2018-NT
Government of India
Ministry of Communications
Department of Telecommunications
(Networks and Technology Wing)

Dated: 6th June, 2019

To
The Secretary,
Telecom Regulatory Authority of India,
New Delhi.

Subject: Seeking recommendations of TRAI on NDCP-2018 provision related to Leveraging Artificial Intelligence and Big Data – reg.

The National Digital Communications Policy, 2018 seeks to unlock the transformative power of digital communications networks to achieve the goal of digital empowerment and improved well-being of the people of India; and towards this end, attempts to outline a set of goals, initiatives, strategies and intended policy outcomes.

2. In this regard, under Propel India Mission of NDCP-2018, various strategies have been laid out to accomplish the objectives, where strategy no 2.2 relates to Ensuring a holistic and harmonized approach for harnessing Emerging Technologies.

3. In order to create a road map for Artificial Intelligence(AI) - an emerging technology & its use in the Communication sector, the provision no 2.2(g) of NDCP-2018 envisages "*Leveraging Artificial Intelligence and Big Data in a synchronized and effective manner to enhance the overall quality of service, spectrum management, network security and reliability.*"

4. Accordingly, TRAI is requested to provide its recommendations under section 11 (1)(a) of TRAI Act, 1997(as amended), in respect of the afore- mentioned provision no 2.2(g) of NDCP-2018.

This is issued with the approval of Secretary(T).


(Rajiv Sinha) 06/06/19
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