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On

TECH-POLICY FORMULATION FOR INDIA @2047: DESIGNING A CONCEPTUAL FRAMEWORK TO ENSURE CITIZEN-CENTRIC GOVERNANCE

Under the supervision of

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A Dissertation Submitted to the Panjab University, Chandigarh for the Award of Master of Philosophy in Social Sciences, in Partial Fulfillment of the Requirement for the Advanced Professional Programme in Public Administration (APPPA)

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I have the pleasure to certify that Brigadier Samir Bhalla**,** has pursued his research work and prepared the present dissertation titled 'Tech-Policy Formulation for India @2047: Designing a Conceptual Framework to Ensure Citizen-Centric Governance', under my guidance and supervision. The same is the result of research done by him and to the best of my knowledge; no part of the same has been part of any monograph, dissertation or book earlier. This is being submitted to the Panjab University, Chandigarh, for the purpose of Master of Philosophy in Social Sciences in partial fulfillment of the requirement for the Advanced Professional Programme in Public Administration (APPPA) of Indian Institute of Public Administration (IIPA), New Delhi.

I recommend that the dissertation of Brigadier Samir Bhalla is worthy of consideration for the award of M. Phil degree of the Panjab University, Chandigarh.

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EXECUTIVE SUMMARY

The dissertation's primary objective is to develop a conceptual Tech Policy Framework for New Age Technologies (NATs) to ensure citizen-centric governance for India@2047. The study has been conducted through a review of the relevant literature, primary survey, and secondary data. The purpose of the literature review was to examine the existing challenges in tech policies, global governance and tech policy practices, and futuristic technologies. The primary survey was conducted using questionnaires designed for citizens, start-ups, and industry in order to know citizen aspirations for India@2047, current tech policy challenges, and essential tenets for incorporation into tech policy framework. The secondary data pertaining to global indices, national indices, and R&D spending was collected from the reports of the United Nations, the World Bank, WEF, DARPG, and other reputed organizations. In addition, civil servants, academic institutions, and private organizations were consulted in order to collect information about Vision India@2047. The survey revealed the dream of citizens of India@2047 to be a 'Developed Nation' that is a 'Global Power' and a 'Technology Leader' with 'Inclusive Growth' for all citizens. The survey revealed that the current challenges in tech policy namely, Delay in the formulation of tech policy itself, Lack of R&D infrastructure, Insufficient funding for New Age Technologies, Absence of support from PSUs for collaborative work with startups in New Age Technologies, Nascent Intellectual Property Rights (IPR) structure in the country, Difficulty of marketing innovation, Absence of a testing platform for New Age Technologies, Underdeveloped telecommunication infrastructure, Huge digital divide in the country, Data privacy concern and Inadequate infrastructure for cyber security. The literature review revealed, Lack of legislature and

acts in the country for New Age Technologies and inadequate R&D infrastructure as compared to other developed nations in the world.

Vision India@2047 strives to bring citizens and government closer, with inclusive growth for all sectors of the society so that India could become the 3rd largest economy of the world. This vision strives to keep the citizen at the core of the public administration, also referred to as 'citizen-centric' approach, wherein all the citizens are provided personalized and contextualized public services effectively, efficiently and equitably irrespective of demography, class, caste and gender. In order for the vision to become a reality, the government needs to focus on Education, Nutrition and Health so as to achieve the SDGs goals of 2030 in the earliest timeframe, which is possible only if a collaborative approach is inculcated, where industry players too would have a considerable role to play. For assuring success of such multi-stakeholder strategies, New Age Technologies (NATs) shall inevitably serve as a catalyst. Data would become the new engine of growth and propel e-services to be predictive and proactive. New Age Technologies need to be adopted into various e-governance public service deliveries. However, for e-services to make a tangible difference, e-services' need to be trusted by citizens. This requires a robust cyber security system particularly for protecting the critical information infrastructure, so that citizen's trust in the use of digital systems is maintained. Further, to create agile and stable e-service systems, the best of the talent need to work for the government in different sectors as domain specialists, may be on contractual basis, and in conjunction with civil services to achieve the objectives. The e-services in the country need to be benchmarked at global, national and local level regularly to know the standing and where to improve.

Indeed, New Age Technologies (NATs) play a very important role in every facet of Vision India@2047 and need to be adopted in the country at the earliest. Innovation, which is defined as the creation, development and implementation of a new product, process or service, with the aim of improving efficiency, effectiveness or competing advantage, enables early adoption of these technologies in the national context. Innovation also plays a very important role in economic as well social development. Innovation needs to be well supported by huge investment in R&D and a supportive market. To further boost the economy, innovation needs to be matured so that it could be redeemed as a Digital Public Infrastructure (DPI) in the country and as a Digital Public Goods (DPG) elsewhere in the world.

The present status of the country in the global context could be gauged through several global indices. Over the past few years India has improved its rank as well as score in global benchmarking indices for e-Government Development Index, Network Index, Governance Index, Innovation Index, Competitiveness Index, AI Readiness Index etc, but it still lags behind the leaders in each of the indices. In case India has to become a developed nation, these indices need to be improved in a structured manner at all levels. The global best practices of governance need to be adopted in the Indian context and simultaneously India needs to strengthen its tech policy framework. The tech policy formulation needs to be steered by a lead agency in the country and should be operational at the highest level.

An agile and collaborative Legal and Regulatory ecosystem is required. India needs to design and enact/ enhance several policies including Science, Technology and Innovation (STI) Policy 2020, Data Centre Policy 2020, National Data Governance

Framework Policy 2022 and Digital Personal Data Protection Policy 2022 at a faster time frame. These all policies are presently at a consultative stage. In the present study, Tech Policy Framework for New Age Technologies has been built on five pillars namely 'National Security', 'Economic Development', 'Privacy and Data Management', 'Infrastructure', and 'Social Cohesion and Cultural Diversity'. The important tenets of the tech policy framework under these pillars are several namely, Developing secure supply chain, Developing cyber resilience systems, Building quantum resistant systems, Improving telecommunication infrastructure, Boosting innovation, Ensuring market availability for innovative products, Building a stronger IPR structure for innovations, Inculcating data privacy by design, Building futuristic data centers to build on renewable energy, Enhancing R&D funds, Strengthening Public-Private partnerships, Incubating capability centers for futuristic technologies, Creating single platform for public service delivery with unique Digital ID for citizens, Building skill sets for future workforce for New Age Technologies and Designing a multilingual digital competency tool to enhance competence of citizens.

As we navigate the rapidly changing technological landscape, it is essential that we prioritize citizen-centric governance in our tech policy frameworks. Such frameworks must be designed with an eye toward the future, anticipating potential challenges and opportunities as we seek to harness the power of New Age Technologies. Effective tech policy requires a deep understanding of the needs and aspirations of citizens, as well as the complex interplay between technology and society. By adopting a collaborative and inclusive approach to tech policy, we can ensure that our efforts to promote innovation and economic growth are balanced with a commitment to protecting individual privacy,

data security, and social cohesion. Ultimately, the success of our tech policy frameworks will depend on our ability to stay ahead of the curve, embracing new ideas and strategies while remaining grounded in our shared values and commitment to the common good.

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ABBREVIATIONS

5G - 5th Generation

6G - 6th Generation

AEPS - Aadhaar Enabled Payment System

AI - Artificial Intelligence

API - Application Programming Interface

AI - Artificial Intelligence

ARC - Administrative Reforms Commission

CPGRAMS - Central Public Grievance Redressal and Monitoring System

DGB - Digital Government Blueprint

DBT - Direct Benefit Transfer

DARPG - Department of Administrative Reforms and Public Grievances

EAC-PM - Economic Advisory Council to the Prime Minister

EU - European Union

FICCI - Federation of Indian Chambers of Commerce & Industry

GDPR - General Data Protection Regulation

GPRA - Government Performance and Results Act

GDP - Gross Domestic Product

HCAI- Human-centered AI

IP - Intellectual Property

IPR - Intellectual Property Right

IoT - Internet of Things

ICT- Information & Communication Technology

KSI - Keyless Signature Infrastructure

KIPO - Korean Intellectual Property Office

MeitY- Ministry of Electronics and Information Technology

ML- Machine Learning

NASSCOM - National Association of Software and Service Companies

NeSDA - National e-Governance Service Delivery Assessment

NIST - National Institute of Standards and Technology

NSF - National Science Foundation

NATs - New Age Technologies

NCNC - No Cost No Commitment

NRIs - Non Resident Indians

OECD - Organization for Economic Cooperation and Development.

PSUs - Public Service Undertaking

R&D - Research and Development

RaC- Rules as Code

S&T- Science and Technology

SCDPM - Special Campaign for Disposal of Pending Matters

SGoS- Sectoral Groups of Secretaries

SDG - Sustainable Development Goals

SNSP - Smart Nation Sensor Platform

UPI - Unified Payments Interface

UN - United Nations

UNDP - United Nations Development Programme

WOGAA - Whole-of-Government Application Analytics

WEF- World Economic Forum

Chapter 1: Introduction

"In this decade of 'Amrit Kaal', we will give priority to next generation reforms..... We will ensure that all the facilities like service delivery should reach citizens up to the last mile; It should reach the last person seamlessly, without hesitation or any kind of difficulty. For the overall development of the country unnecessary interference by the government and government processes in the lives of the people has to be ended."

Honorable Prime Minister Narendra Modi

1.1 Background

The concept of good governance has been defined by Kautilya in his treatise Arthashastra wherein the traits of the king of a well governed State has been defined as "in the happiness of his subjects lies his happiness, in their welfare his welfare, whatever pleases himself he does not consider good but whatever pleases his subjects he considers as good". Citizen-centric governance refers to a form of governance where citizens and their needs are at the center of the decision-making process. It is a model of governance that prioritizes the interests of the people, their participation, and their engagement in government processes. It is a system that seeks to enhance the participation of citizens in the governance process through channels such as public consultations, civic engagement, and digital technologies. In addition, it also aims at providing public services effectively, efficiently and equitably to the citizens. As per 2nd ARC report, the four pillars of governance are "Ethos (of service to the citizen), Ethics (honesty, integrity and transparency), Equity (treating all citizens alike with empathy for the weaker sections),

and Efficiency (speedy and effective delivery of service without harassment and using ICT increasingly) and which should be the ultimate aim of any government".

Governance is defined as "the institutional capacity of public organizations to provide public and other goods demanded by a country's citizens or the representatives thereof in an effective, transparent, impartial, and accountable manner, subject to resource constraints. This is a broad and a largely abstract definition, but it provides a common ground to all the different approaches of governance" (Katsamunska, 2016).

Through 'citizen-centric e-services,' the Indian government has been making continuous efforts to establish systems of good governance through various programmes and laws. These services have digitally empowered society and transformed the economy. They aim to restyle how citizens can avail the government services and participate in the economy using less cash, opting instead for UPI, internet banking, direct benefit transfer, digital payment platform etc., using unique identification techniques, like Aadhaar, so as to drive financial inclusion with minimum lapses and delays. By ensuring digital access, digital inclusion, and digital empowerment, the Digital India Programme has leveraged digital technologies to bring about a positive change in good governance that is simple, cost-effective, transparent, and efficient. These e-services have materialized the maxim "Maximum Governance, Minimum Government." It is a deliberate strategy for introducing reforms in governance and transforming the nation by applying innovations and technology to make governance simple, quick, flexible, and effective. These e-services have resulted in participatory governance, a crucial aspect of any good democracy. Efforts have been made, through the application of digital technologies, to improve the delivery systems so that the benefits of government welfare

programmes reach the intended recipients, including the poorest of the poor, in a convenient and tamper-proof manner. The full potential of the technology has to be utilized so as to reach the last mile and for inclusive growth by overcoming the current challenges. These challenges need to be addressed through proper regulations. The emergence of a large number of digital web based delivery systems and services, has led to challenges in managing and deployment of these growing services and data. Another challenge is the data coherence of current e-Government initiatives, which requires the implementation of a policy for the adherence of data to common standards so that the data is consistent and up-to-date across all government websites. Also, as more and more organizations go online and data verification between departments contributes to major data exchange across departments, the need for cross-departmental communication arises, which falls under the scope of interoperability due to the heterogeneity of technology (hardware, software) used in solution implementations (Technology led Citizen Centric Governance, 2023). Also the present concern of data privacy which comes up every time a new digital service is launched needs to be addressed through proper legal and regulatory framework. All digital initiatives must be benchmarked on a regular basis in order to evaluate the State, Union Territory, and Central Ministry levels of e-Government service delivery.

Over the next 25 years till 2047, India is projected to reach an economy of $ 26.0 Trillion with $15000 per capita GDP at a sustained economic growth of 6% (Memani, Srivasatava, & Kapadia, 2023). The mission is to make India the third largest economy in the World and to move into the category of developed nation. Also the vision of

achieving citizen-centric governance with inclusive and equitable growth has to be achieved in the period of Amrit Kaal, over next 25 years.

Technology has played a very important role in transforming the society and economy world, over the last three centuries. The New Age Technologies like AI, Blockchain, IoT, Drone, 5G, Quantum and other similar technologies are promising in enabling inclusive growth as well as enhancing the economic growth of any country. These technologies can support and accelerate the objectives of each of the 17 Sustainable Development Goals (SDGs) set by United Nations – "from ending extreme poverty to reducing maternal and infant mortality, promoting sustainable farming, and providing quality education for universal literacy" (Küfeoğlu, 2022). The New Age Technologies can serve as a powerful tool to achieve SDGs through means and mechanisms that strictly adhere to the basic principles of Good Governance (Malhotra, 2022). But the technologies also bring out numerous challenges which if not controlled and monitored can have adverse effects on the society. The New Age Technologies needs to be regulated in a balanced manner through smart policies so as to maximize the growth of technology for betterment of society as well economic development and also takes care of the adverse effect of these technologies. The sooner specific economies implement the inventions and technological phenomena of the New Age Technologies, the sooner the economic effects of this revolution will manifest in the global economy. (Rymarczyk, 2020). Hence, leveraging of the New Age Technologies shall enable in sustaining the economic growth at the desired levels so as to make India a developed nation by 2047. The rate at which these technologies are advancing, disrupting, transforming, and converging to produce even more complex technologies has left

governance structures with issues such as policy decay, maintaining trust, etc (Malhotra, Emerging Perspectives of Government With Advent of Frontier Technology: Indian Context, 2019). Therefore, governance must be agile, which can only be achieved by integrating these technologies into governance structures (WEF, 2018). The policy formulation has to match and keep pace with the technology to prevent policy decay, maintain trust and to be more accountable, adaptive and inclusive to shape the societal impacts of these technologies efficiently. The formulation of tech policies involves a complex process that involves various stakeholders, such as government, industry, citizens, startups, and academia. It requires a careful balancing of competing interests, ensuring that tech policies are effective, inclusive, and responsive to the needs and concerns of citizens. To achieve this, the current state of tech policy in India and the perspectives of various stakeholders, including government, industry, civil society, and academia has been considered. Also best practices from other countries have been considered for development of the conceptual tech policy framework.

1.2 Statement of the Problem

New Age Technologies play a pivotal role in the economic development of the country as well as have scope in enabling the public service delivery system across all the spectrum of citizens. With renewed zeal in Digital India endeavors and with rapid proliferation of India stack, in the last few years, India too has leapfrogged in application of digital technologies in various aspects of governance. This is particularly relevant in India’s Amrit Kaal journey to celebrate India@2047 as the third largest economy in the World.

However, the adoption of New Age Technologies in Governance has one major headwind – which is in terms of agility in policy formulation process. Undeniably, the policy formulation process needs to keep pace with the changing technologies to ensure trust of the citizens as well as to accelerate the adoption of these technologies. Therefore, a good and responsive tech policy framework needs to be formalized to ensure meaningful adoption of New Age Technologies in the lives of Indian citizenry. This would directly ensure more citizen-centric governance that is more inclusive.

1.3 Research Objectives. The objectives of the research are :-

(a) To appreciate the core focus areas of Vision India@2047.

(b) To understand the various components and applications of New Age Technologies.

(c) To assess the role of New Age Technologies in governance in fulfilling Vision India@2047.

(d) To recognize the role of agile and responsive policy formulation in successful implementation of New Age Technologies in governance, with special reference to India @2047.

(e) To propose a conceptual tech policy framework to ensure citizen-centric governance in India@2047.

1.4 Research Strategy and Research Design

The research strategy adopted is mixed i.e. both qualitative and quantitative based approach. The research design is exploratory and descriptive in nature.

1.5 Rationale/ Justification

The Indian economy strives to become the third largest with a per capita GDP of $15,000 and a total economic size of $26 trillion by the year 2047. For this as a national strategic driver, an objective of Minimum Government and Maximum Governance has been adopted with the vision of citizen centric approach in Vision India @2047. New Age Technologies plays a pivotal role in achieving these objectives and vision. The present policy framework has not kept pace with fast changing New Age Technologies. Hence, it is imperative to carry out the study of adoption of New Age Technologies in India along with the regulations which govern the development and implementation of these technologies.

1.6 Research Questions. The research questions are as follows-

(a) What are the objectives and core focus areas identified for Vision India @2047?

(b) What are the various components and applications of New Age Technologies?

(c) What is the role of New Age Technologies in governance envisaged for Vision India@2047?

(d) What are the existing policy frameworks for New Age Technologies in India?

(e) What are the global trends in policy formulation for implementation of New Age Technologies in governance?

(f) What is the role envisaged of agile and responsive policy formulation in successful implementation of New Age Technologies in governance in Indian context?

(g) What is the recommended conceptual policy framework to ensure citizen-centric governance in India@2047?

1.7 Scope of the Study

The scope of the study is limited to only recommending the conceptual framework for technical policy for New Age Technologies and aligned to Vision India @2047.

1.8 Research Methods to be Applied and Data Sources

To get responsive feedback on the objectives, relevant information was collected using both primary and secondary sources.

1.8.1 The secondary source of data comprises:-

(a) National e-Governance Service Delivery Assessment (NeSDA) 2021 report of DARPG & NASSCOM and Vision India@2047 report of DARPG.

(b) Review of policy documents: General Data Protection Regulation (GDPR) of the EU, US Innovation and Competition Act 2021, EU Ethics Guidelines for Trustworthy AI and Singapore Government Digital Government Blueprint.

(c) Review of World Economic Forum Global Technology Governance Report 2021, Gartner 2023 Technology trends and UN Technology and Innovation report 2021.

(d) Indices by UN, WEF, World Bank and other global agencies for governance and technology.

(e) Secondary data available in the national & international journals, articles published in newspapers & magazines.

1.8.2 The primary data was collected through structured questionnaires (attached as Appendix), with few open-ended questions. The view of the stakeholders like citizens, startups/industry, academia, policy makers etc., through an online survey was taken. Also as part of primary data, interviews were conducted with policy makers, subject matter experts and civil servants. The survey questionnaire consists of questions related to the profile of the respondent, aspirations of the stakeholders, present challenges for startups/ industry in funding, IPR etc.

Chapter 2: Literature Review

2.1 Details of literature reviewed are as under:-

(a) (**NDTV Profit, 2022**), **Economy Can Touch $20 Trillion by 2047**. In the article Economic Advisory Council to the Prime Minister (EAC-PM) has said that "the country can become a 20 trillion dollar economy at a sustained growth rate of 7 to 7.5 percent for the next 25 years". EAC-PM Chairman Bibek Debroy said that India can become an upper-middle-income country by 2047 at this growth rate. He said, even if India achieves relatively conservative rates of growth of 7 to 7.5 percent, the country will get to a per capita annual income of about $10,000.

(b) **(Memani, Srivasatava, & Kapadia, 2023), India@100**. This report by Ernst & Young has analyzed the growth model of the country and suggested that at a growth rate averaging about 6% per annum, India would become a US$26 trillion economy (in market exchange rate terms) by 2047-48 (in nominal terms), with a per capita income beyond US$15,000 (nearly six times the current value).

(c) (**DARPG, 2022), National e-Governance Service Delivery Assessment 2021**. The National e-Governance Service Delivery Assessment (NeSDA) was established in 2019 by the Department of Administrative Reforms and Public Grievances (DARPG) as part of its mandate to promote e-government initiatives and drive digital government excellence. The biennial study evaluates the effectiveness of e-Government service delivery by States, Union Territories (UTs), and key Central Ministries. NeSDA 2021 encompasses services in seven sectors, including Finance, Labor & Employment, Education, Local Governance and Utility Services, Social Welfare, Environment, and Tourism. The evaluation

covered 56 mandatory services for each State and UT as well as 27 services for the central ministries of interest. NeSDA 2021 has demonstrated e-Government advancements across the nation. The report has recommended that to encourage the adoption of new technologies, the government should provide a policy framework for these technologies in the delivery of government services.

(d) **(Jagannathan, 2018), Minimum Government, Maximum Governance', *Swarajya***. The objective of government is to maximize efficiency and optimize processes, as the Honorable Prime Minister explains in this interview. In order to accomplish this goal, it must act as a facilitator rather than an obstruction. Technology is crucial in reaching this goal. The ultimate goal of "Minimum Government, Maximum Governance" is to make people's lives as hassle-free as possible, frequently by eliminating the obstacles that a government can create, and to enable people to realize their greatest potential

(e) (**PIB, 2022**). The 15th Civil Services Day press release, with the slogan "Bringing Citizens and Government Closer" and the topic "Vision India@2047," was released. According to Union Minister Dr. Jitendra Singh, the new government model in India in 2047 would be characterized by a focus on the needs of the people, and civil officials will have no choice but to adopt a citizen-friendly attitude. He said that the position of a civil servant may be redefined in future governance models, and that power may increasingly shift to the hands of the people, personifying the idea of "Minimum Government." The Minister stated that in the ensuing years, an intricately intertwined interface of technology, new indices, and Artificial Intelligence may significantly dominate. Dr. Jitendra Singh

referred to Mission Karmayogi's key motto of changing from "Rule to Role," saying that the Civil Servants must prepare themselves for a new and difficult task as most of the Government's flagship programmes are now heavily focused on Science and Technology.

(f) (**Küfeoğlu, 2022**), **Emerging Technologies, *Springer Link***. The book makes a valiant effort to look into how value-based innovation, entrepreneurial ecosystems, and sustainable development are related. It begins by introducing a theoretical framework for comprehending the impact, supporting mechanisms, and value generation through innovation. Then, a summary of 34 new technologies with varied degrees of maturity is provided, including a few well-known megatrends. The book contains a series of case studies that examine 650 innovative organizations from 51 different nations, looking at their unique technological skills and value-based business model in relation to the UN Sustainable Development Goals.

(g) **(Malhotra, Impact of Digital Technologies on Governance, 2022**). The study reveals that achieving the seventeen aspirational Sustainable Development Goals (SDGs), commonly known as "Global Goals," established by UNDP in 2015, can best meet citizens' expectations. The SDGs seek to bring about social, economic, and environmental sustainability for the planet in order to promote world peace and prosperity for all. Digital technology can be an effective tool for achieving SDGs when used in ways and with tools that rigorously follow the fundamentals of good governance.

(j) (**Malhotra, Emerging Perspectives of Government With Advent of Frontier Technology: Indian Context, 2019**). The study focuses on the rate at which New Age Technologies are growing, disrupting, transforming, and converging to produce more complicated technologies, leaving governance systems with issues such as policy decay, maintaining trust, etc. Therefore, governance must be adaptable, which can only be accomplished by incorporating these technologies into the structures of governance. It emphasizes and elaborates on the techniques and tools required to achieve agility through the use of New Age Technologies.

(k) (**WEF, 2018), Agile Governance-Reimagining Policy-making**. This white paper defines agile governance as adaptive, human-centered, inclusive, and sustainable policymaking, recognizing that the development of policies is no longer the sole responsibility of governments and is instead becoming a more collaborative effort involving multiple stakeholders. It also reveals that it is constantly prepared to swiftly traverse change, accept change either proactively or reactively, and learn from change—all the while adding to the actual or perceived value for end users.

(l) **(Malhotra & Anand, Accelerating Public Service Delivery in India: Application of IoTs and AI in Agriculture, 2020**). This study examines the usage of IoT and AI both now and in the future. In order for emerging nations like India to successfully adopt a data-driven approach in their agriculture sector, it presents a conceptual framework for building an open and integrated national level agriculture stack. It highlights issues and offers policy suggestions that could

strengthen current legal frameworks for the successful integration of IoT and AI into India's current public service delivery models.

(m) (**GDPR, 2018**). The General Data Protection Regulation is the world's strictest privacy and security regulation (GDPR). Although it was developed and approved by the European Union (EU), it imposes requirements on all organizations that target EU residents or collect information about them. The regulation became effective on May 25, 2018

(n) (**Chhabra, 2022**),**Technology Adoption and Governance of AI in India**. With particular reference to India, the study sought to get insight on the use of AI in several sectors. It also looked at the USA and Singapore's best practices for adopting AI and made recommendations for what may be implemented in India. A conceptual framework for AI adoption, use, and governance in India has also been provided by the study.

(o) **(Malhotra, Role of Digital Technologies in Governance, 2018)**. The study has focused on three key areas. First, using digital technology to further the Sustainable Development Goals (SDGs) and improve ties between the government and its people. Secondly, the adoption of digital technologies in governance typically faces several challenges, particularly in the Indian context. Thirdly, the governance landscape has changed as a result of emerging technologies like artificial intelligence, transparently immersive techniques, and newer digital platforms. Additionally, it has suggested some workable plans that can improve the use of digital technology in governance, particularly in the context of India.

(p) (**Technology Sector In India 2020 - TECHADE, 2020)**. The NASSCOM strategy study focuses on five megatrends: “Asian Economic Dominance, Mass Urbanization and Hyper-Personalization, Environmental Sustainability Stress, Data-Led Economy, and Disrupted Future of Work”. To address these megatrends, governments, businesses, and citizens will need to collaborate as never before, and technology will be the key to their success. In addition, nine interconnected, rapidly evolving, high-impact digital technologies – “Big Data Analytics, Cloud Computing, Cyber security, Artificial Intelligence, Internet of Things, 3D Printing, Robotics, Blockchain, and Immersive Media - have the potential to generate up to USD 33 trillion”.

(q) **(Good Governance Practices for the Protection of Human Rights, 2007)**. According to the UNDP Policy Document on Good Governance Practices for the Protection of Human Rights, in order to respect this citizen-centricity, the concept of "Good Governance" has become widely recognized as the ideal form of governance in all democracies. Participation, transparency, responsiveness, effectiveness, and accountability are the cornerstone concepts of good governance.

(r) **(Davis, Signé, & Esposito, 2022)**. New Age Technologies are altering market dominance and introducing a variety of risks that can only be managed via regulation. Unfortunately, current approaches to technology governance are insufficient, fragmented, and lack a focus on achieving actionable objectives. This paper proposes three tools that can be utilized to support 21st century technology regulation that is fit for purpose, First, transparent and comprehensive policy

making levers that clearly communicate goals and identify trade-offs at the national and international levels; second, revamped efforts to collaborate across jurisdictions, especially through standard-setting and evidence gathering of critical incidents across jurisdictions; and third, a shift towards agile governance, whether acquired through the system, design, or both. The report also focuses on five pillars of the technology policies adopted globally.

2.2 Summary. After the literature review, it is evident that designing a conceptual framework for adoption of New Age Technologies for creating an enabling environment for economic growth, growth of technology and citizen centric governance by promoting innovation, improving public services, enhancing digital literacy, and protecting citizens' rights. The literature brings out the technology policy formulation involves the development of policies and strategies that guide the use, development, and regulation of technology in society. The policy formulation needs to be collaborative in nature and need to engage with a wide range of stakeholders, including industry, civil society, academia, startups and the citizens, to ensure that policy decisions are informed and reflect the needs and interests of different groups. Another aspect which gets highlighted is the need for policymakers to balance innovation and regulation. While technological innovation can drive economic growth and social progress, it can also have negative consequences such as job displacement and privacy breaches. Policymakers need to develop strategies that support innovation while also mitigating its negative impacts. The literature also emphasizes the importance of keeping up with the rapid pace of technological change and adapting policies accordingly. In a rapidly changing technological landscape, policymakers need to be proactive in identifying emerging

trends and updating policies to tackle new challenges. The literature review also emphasizes the importance of transparency and accountability in tech policy formulation. Policymakers need to be open about their decision-making processes and be accountable to the public for the outcomes of their policies. Overall, the literature on tech policy formulation highlights the need for policymakers to take a holistic, collaborative, and adaptive approach that balances innovation and regulation and prioritizes transparency and accountability.

Chapter 3: Vision India@2047

3.1 Introduction

3.1.1 Vision India@2047 is a visionary plan for a future-ready India that would be apt in the centennial year of Indian independence. The plan is guided by the aspirations of India@2047, which include achieving new heights of prosperity, providing the best facilities in both villages and cities, promoting gender equality, eliminating unnecessary government interference in the lives of citizens, and constructing the country's most modern infrastructure and so on (Consultation on Vision India@2047, 2022). Based on the literature review, approach which is been utilized in the formulation of Vision India@2047 is summarized as under:

(a) Establish procedures, rules, and policies to maximize the utilization of human capital and initiative. The benchmarking of legislation, policies, and procedures to ensure they conform to international and global norms.

(b) Encourage equitable ease of life for all citizens.

(c) To achieve growth that is equitable and inclusive across all sectors, regions, and states.

(d) Utilize new-age technology, international capital, and expertise all across sectors and ensure that our institutions and corporations emerge as world leaders in specified industries. Moreover, to establish three to four global unicorns in each industry through mergers or restructuring. Considering technology will be a major driver in all sectors, it is necessary to develop a framework for using technology in all areas. Additionally to include ten Indian educational institutions in the world’s top 100 institutions.

(e) Exploit India's market size to attract investments, technological production, and a larger share in international value chains, among other things.

(f) Partner with a foreign R&D company to construct ten start-up art labs in the nation.

(g) To make India self-reliant in its acquisition of defense capabilities, free from all foreign dependency.

(h) Free the spirit of cooperative and competitive federalism while promoting inclusive growth and regional development that is balanced.

(j) To construct state-of-the-art, futuristic urban infrastructure and urban space.

3.1.2 Ten Sectoral Groups of Secretaries (SGoS) are formulating the Vision India@2047 strategy. Agriculture, commerce, infrastructure, industry, urban landscape, security & defense, technology, and governance are the recognized important areas. This vision has been developed through consultation, brainstorming, and ideation with academia, industry, start-ups, think tanks, research institutes, universities, civil society organizations, and subject matter experts from within and without the government. The country's younger generations are also participating in these conversations and deliberations. In addition, acceptable models from other nations are been analyzed and lessons applicable to the Indian context are implemented (Ministry of External Affairs, 2023). Moreover, cross-cutting issues and opportunities that have an impact on the vision have been given serious consideration. Such as, carving a place for India in global value chains, leveraging sunrise sectors of growth where we have inherent advantage, climate change to be in alignment with India's net zero commitment by 2070, R & D as a top

priority and bringing innovations to market, employment issues such as the gig economy, increasing women's participation, human capital development, and social security improvement via benchmarking. In Governance, which spans all sectors, the emphasis is on - Government as an enabler of the private sector, Digital governance, Data-driven policy making, Establishing institutional domain expertise across all verticals of governance, Promoting innovative workplace solutions, and Incentivizing state reforms.

3.1.3 The period till 2047 has been referred to as Amrit Kaal, which in Vedic astrology means a sort of golden era or a significant moment in time with opportunities for success. During this era, the aim is to minimize economic disparity, improve self-sufficiency among Indian residents, progress technology, lessen dependency on the government, and make India self-sufficient.

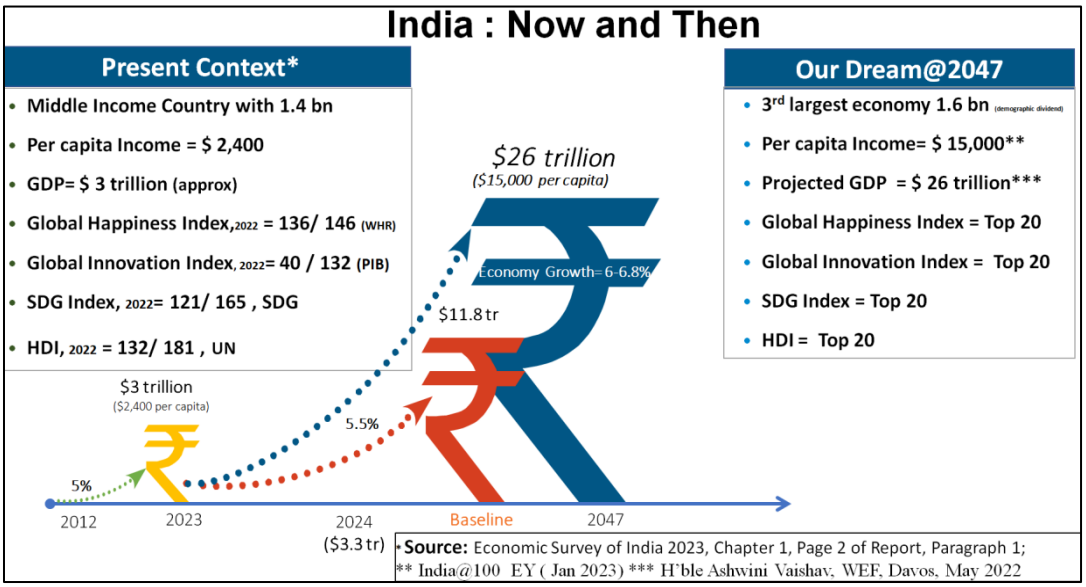

Figure 3.1 India's Aspiration at 2047

The objective by 2047 for India is to become the third largest economy in the world. With this as the national strategic driver, an overarching objective of "Minimum Government and Maximum Governance" has been adopted for Governance. It is envisioned that India @2047 will be affluent and inclusive, with the fruits of growth

reaching all areas and inhabitants, notably our youth, women, farmers, OBCs, SCs, and STs. The aspiration of India@2047 is well depicted in Figure 3.1.

3.2 Governance Vision @2047

3.2.1 SGoS 9 is the Governance sectoral committee with 15 members from several domains. The ultimate objective for the year 2047 is to establish a transparent system, efficient procedure, and efficient governance in order to make development all-encompassing. During his speech on the 15th Civil Services Day In June 22, the Honorable Prime Minister outlined the time of Amrit Kaal, in which our democratic system should be committed to three goals that will define the next quarter-century.

(a) The life of the common people in the country should be made easier, and they should feel it. People's interactions with the government should be effortless. The benefits and services should be readily accessible to them. The system is responsible for bringing the aspirations of the average person to fruition. That should be our collective objective: to see the resolution through to completion. It is our job to hold the hands of the common people at every stage of this trip to the realization of their dreams.

(b) Due to India's expanding prominence and altering profile, it is imperative that everything we do be undertaken in a global context. This alignment with global operations will allow us to determine our priorities and area of concentration. Schemes and models of governance must be established with this perspective in mind. The systems and models should be upgraded at a consistent rate, as challenges of today cannot be met with systems from the last century.

(c) Our primary responsibility to uphold the unity and integrity of the nation cannot be compromised in any way. Even local decisions should be evaluated against this benchmark. Every action should be judged based on its capacity to strengthen the unity and integrity of the nation. The maxim "Nation First" should constantly guide our judgements.

3.2.2 According to subject-matter experts encompassing policymakers, academics, and industry, seven fundamental goals have been established to assist make this vision a reality.

(a) The government to perform its essential responsibilities, while the delivery of public services will be altered in conjunction with the private sector and civil society. The government should focus on three primary functions - Education, Health, and Nutrition in order to meet the 2030 Sustainable Development Goals.

(b) Digital technologies will play a larger role in putting citizens first.

(c) A Whole-of-Government (WOG) approach must be applied in order to provide governance at the local level.

(d) All regions will experience equitable development, and inclusive development will be supported.

(e) Judicial system will be citizen centric.

(f) The databases of various government agencies must be interoperable and linked. The data to be utilized to develop AI/ML algorithms to facilitate public delivery service.

(g) The government should hire and attract the best talent through fixed-term contracts with competitive compensation in specialized sectors.

3.2.3 Seven priorities that serve as the "Saptarishi" guiding light for the Amrit Kaal period have been outlined in the Budget 2023 (Key Features of Budget 2023-24, 2023). The vision for Amrit Kaal outlined in the Union Budget is centered on – "Opportunities for citizens with an emphasis on youth, growth and job creation, and a robust and stable macroeconomic environment."

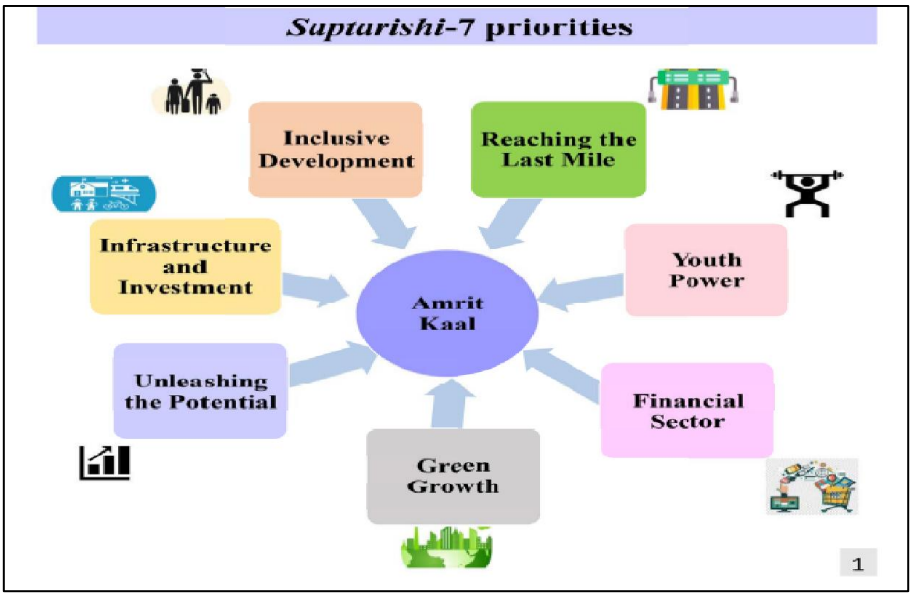

Figure 3.2 'Saptarishi' - Amrit Kaal Period

3.2.4 The vision of the Department of Administrative Reforms and Public Grievances (DARPG) is to advance administrative reforms throughout the government and address all public service complaints. Using the best global practices and spreading good governance techniques to ease citizen-government interactions. Using Artificial Intelligence (AI) and Machine Learning (ML) and evidence-based policy making, the vision aims to enable the transition from digitization to digitalization to digital transformation in order to create an agile, collaborative, and connected government (Vision India@2047, 2022). Promoting excellence in governance and pursuing administrative reforms by enhancing government policies, structures, and processes,

promoting citizen-centric governance with a focus on grievance redressal, innovations in e-governance, awards, and documentation and dissemination of best practices.

3.2.5 DARPG has effectively implemented / is in the process of implementing its five-year vision through different programmes, plans, and reforms during the period 2019–24. First, by broadening the scheme for the Prime Minister's Awards for Excellence in Public Administration, more innovative services at distinct levels, i.e. Central, State, and District, has been represented. The focus has been on enhancing the individual leadership and innovativeness of government employees. Second, reforms of Central Public Grievance Redress and Monitoring System (CPGRAMS) by connecting the grievance with the field office responsible for resolution, enabling auto-escalation of the grievance to the next higher level if not resolved within the stipulated time for resolution, allowing for better identification of gaps between policy and delivery, and allowing for regular grievance analysis. IIT Kanpur has established a Data Governance Quality Unit for the application of AI/ML to improve CPGRAMS analytics. Thirdly, the implementation of e-Office 6.0/7.0 as part of secretariat reforms in Central Ministries and Departments, as well as the sanctioning of new projects for North Eastern States and other states/UTs.. The Good Governance Index for states and territories has been released for 2019 and 2021. The benchmarking of governance at the State and District levels permits policy intervention for measuring the success, effect, and delivery of the government's most important policy measures. Fifthly, conducted National Conferences on e-Government attended by government employees, academics, and industry experts. National e-Government road maps have been formalized with the participation of all stakeholders. The National Centre for Good Governance has been established as the apex Institute for

Good Governance in order to conduct top management leadership programmes for international civil servants, enhance the capacity of State civil servants, implement capacity building programmes, and conduct workshops and webinars on advancing good governance processes. All of these projects will continue till 2047 and are also part of DARPG's Vision India@2047.

3.2.6 Under the leadership of the Minister of State for PMO, Personnel, PG, and Pensions, the DARPG established a group of 15 Sector Specialists and National Experts from Senior Civil Servants, IITs, IIMs, Central and State Universities, and Public Policy Research Organizations. Under the supervision of the Advisory Group, a working group under the leadership of the Secretary DARPG has been established to formulate Vision India@2047. The outlines of India's futuristic governance strategy are as follows:

(a) Technology will play a crucial role in India's future governance models, reinventing citizen-government relations in which technology serves as a facilitator and the citizen as the master.

(b) Governance would be data-driven, with evidence-based futuristic indexes developed for governance benchmarking.

(c) The fundamental and non-negotiable values of ethics and integrity - the pursuit of Naitik Bharat – will remain the primary priority.

(d) The significance of interactions between young start-up innovators from the business sector and young technology specialists with young innovators from the government in order to generate creative and original ideas.

(e) Constructing digital institutions utilizing Blockchain and establishing district-level innovation projects with an inclusive internet ecosystem.

(f) Concentrate on governance models that provide thousands of citizen-centric services with guaranteed connectivity and speed using 6G technology.

3.2.7 DARPG Vision Plan for India@2047

3.2.7.1 Focus on Young Civil Servants

(a) Future governance models would be exceedingly complicated and require substantial domain expertise. Young public officials must have access to an interface between technology, academia, and start-ups in order to remain current in these fields.

(b) Forty nucleus teams have been formed of young civil service officers, IIT Madras faculty, seed-stage businesses and established young entrepreneurs to envision India@2047. This team will continue to operate for the next three, ten, and twenty-five years. These teams are responsible for preparing a vision paper on the 10 thematic areas, to be incorporated in the Vision 2047 DARPG document and which will be periodically updated. The ten thematic areas are based on the ambitious governance policy initiatives of the future: Energy and Net Zero, Education, Health Care and Assistive Technology, Water, Infrastructure and Communications, Transport and Mobility, Urbanization and Housing, Rural Development and Agriculture, Fintech and Inclusion, Information Security and Defense. The 10 formed cells would be connected to the Line Ministries/Departments to enable a higher level of expertise.

3.2.7.2 Digital Transformation of Governance. The government's policy maxim "Maximum Governance – Minimum Government " perfectly describes a futuristic governance model with an emphasis on the digital transformation of governance. It

demands a series of profound and coordinated transformations in culture, workforce, and technology that facilitate the transformation of governance models in strategic directions. As part of Vision India@2047, the following measures would be taken to achieve a simplified government through automation:

(a) Regular National e-Services Delivery Assessments and technology upgrades in e-Governance models to ensure AI-based Government, Citizen Centric Digital Platforms, and Collaborative Government would be used to monitor the levels of automation in Governance Institutions.

(b) State capacity enhancement via mid-career capacity building programs for State/UT public servants by the National Centre for Good Governance to sensitize on a Whole-of-Government approach in order to meet the policy issues of Vision India@2047.

(c) Cooperation, communication, and information sharing between the Centre, States, and Districts to De-Silo Governance Best Practices.

3.2.7.3 Benchmarking Governance

(a) Good Governance Index - A biannual evaluation of the status of Governance in States/UTs.

(b) District Good Governance Index - A digital evaluation of the status of governance in Districts of States/UTs.

(c) Grievance Redressal Index - An evaluation of citizen satisfaction with grievance redressal in Central Ministries/Departments.

(d) Bringing in greater synergy between Good Governance Index and World Governance Index.

3.2.7.4 DARPG administrative reforms for the 21st Century shall embrace international best practices and which shall be modified on a regular basis. Internationally, the administrative reforms are based on the Performance, Customer, and Innovation Revolution and technology is being utilized to empower the citizens. The strengthening of bilateral and multilateral relationships for the mutual benefit of sharing global good governance practices is to be adopted. Also a world-class center for administrative reforms of the next generation to be established in coordination with the International Institute of Administrative Sciences.

3.2.7.5 Public Grievance Redressal. It shall be based on agencies with a single point of contact, which will assist citizens in utilizing information to seek better services. This includes the creation of "One Nation-One Portal, Multilingual CPGRAMS for better citizen outreach, data analytics to monitor the quality of grievance redressal, feedback call-centers, and CPGRAMS portal transcripts for citizens". Also reengineering of government processes is being carried out to serve the citizens efficiently. The delivering of critical information and action item reminders, as well as customizing services depending on user profile and areas of interest is being carried out. Increased public participation in government will be accomplished through crowdsourcing of ideas, hackathons, analysis and identification of complaint-prone regions, and a strengthening of monitoring and evaluation.

3.2.7.6 Zero Tolerance to Corruption. The objective is to implement stricter monitoring in order to detect and combat corruption, through structural, procedural, and institutional changes. Structural redesign would include implementing procedures for concurrent evaluation by an internal auditing body in order to detect any misconduct in a timely

manner. Process reengineering would include measures to ensure the timely disposition of cases. Institutional modification would concentrate on aspects of digital transformation of processes, the reduction of subjectivity, the constant evaluation of processes for further enhancements, and the promotion of trust-based systems.

3.2.7.7 Electoral Reforms This would leverage technology to reduce disruptions during the voting process. This would focus on the aspects; seeding electoral cards with Aadhaar cards; Introduce e-voting facilities along with manual voting to achieve maximum voter turnout, e-voting facility for NRIs or through Indian missions abroad, and One Nation - One Election (simultaneous elections of Urban and Rural bodies), thereby fostering an environment in which elections can be held continuously and simultaneously, as and when the need arises, without disruption to governance.

3.2.7.8 Swift Justice for Everyone. To tackle the problem of pending cases and modernize the judiciary with digital innovations, the action areas have been categorized under four headings.

(a) **Judicial Infrastructure**. The action areas under the judicial infrastructure theme aim to fully digitize the judicial system and provide public access to judicial papers and judgments.

- Implementation of the One Nation-One Judiciary Data Grid in which courts and tribunals will be linked to the police, forensic lab, hospitals, prisons, and tax courts via a single grid.
- Development of the One Nation-One Application.
- Digital Legislative and Central Repository for State and Federal Legislation.

- Implementation of an AI-integrated legal system to eliminate the need for manual intervention.
- Establishment of Virtual/Internet/Mobile Courts (Phone based).
- Creation of intelligent, AI-enabled courts with 100% digitized e-services for court processes.

(b) **Legislation**. Reforms to the law will emphasize on convenient disposition of court proceedings.

- Modification of procedural laws governing court processes for establishing and enforcing deadlines for case disposition.
- Synchronization of various statutes and regulations.
- Formulate laws, regulations, and ethical standards pertaining to AI development.
- A digital platform similar to PRAGATI for stakeholder consultation.

(c) **Productivity**. To increase and manage the efficiency of courts and judicial procedures, the following steps must be taken:

- Universalizing required case management hearings and implementing diversified case flow management.
- A technological solution for verification and affirmation.
- Creation of an All-India e-Repository of case records across all levels of courts, facilitated by links with Police Station, Revenue, and Municipal records, to prevent delays in the transmission of records and to allow public inspection.

- In order to assure citizen happiness, a Justice Needs and Satisfaction Index will be implemented.

3.2.7.9 Augmenting India's Mobility - Indian Diaspora. India will have one of the largest and youngest labor forces in the world in the future. To leverage it internationally and improve India's standing abroad, a number of steps and measures will be taken, such as: Mainstreaming Indian Diaspora into the National development agenda by establishing sectoral consultative policy hubs in sunrise sectors. Free mobility and migration through accords with OECD and other emerging nations to make the world's skill capital. Integrated e-Migrate Platform for overseas jobs and pre-departure orientation including grievance redressal mechanism for all migrants. Dual Citizenship to people of the Indian Diaspora to tap into their full potential in various professions by amending The Citizenship Act.

3.3 Reforms to Human Resources. In various parts of the world, human resource and governance processes have undergone a number of reforms:

(a) **Talent Cloud Initiative**. Talent Cloud approach to attract talent for project-based employment in the Government of Canada, aiming to significantly reduce the time to staff project-based (term) positions and constructing the world's first public sector "gig" marketplace based on worker rights for the next generation. It is a personnel system designed to address the challenges the Canadian public sector faces in the digital age (Privacy Impact Assessment for Talent Cloud, 2020). These challenges include “a critical shortage of talent across the government (particularly in the digital and technology professions), a lack of agility in the government's present recruitment model that prevents the rapid

formation of cross-sector teams to respond to government priorities, issues of inclusion and diversity with a focus on the retention, promotion, and recognition of indigenous talent, and expensive inefficiencies in the current public service staffing model (particularly with regard to high-demand skills and emerging fields)".

(b) **Revolving Doors Policy**. The term "revolving door" introduced by the United States and the United Kingdom refers to the transfer of personnel from public service to the private or nonprofit sector, and vice versa. This promotes mutual understanding and has a favorable effect on public policy. There are sufficient regulatory framework checks and balances to ensure fairness and that individuals who misuse public information or access do not receive an unfair business advantage (Rapnet, Naidoo, & Vandercruyssen, 2021).

(c) **Performance Related Pay**. This strategy has been adopted in South Korea, Singapore, and certain OECD nations, where pay is based on performance and not seniority in the public sector (Kim, 2014).

(d) **Digital Training Platforms**. For the public sector to provide successful digital services, trained personnel are essential. Since technology is constantly evolving, so must the capabilities required to alter services in order to remain competitive. To keep up with evolving user expectations, government agencies must attract, retain, and develop personnel with specialized digital skills, enhance the digital literacy of senior leaders, and ensure that existing personnel have access to the tools and resources necessary to deliver better digital services. Countries such as Singapore, Brazil, South Korea, Australia, and the United

Kingdom provide a variety of digital training platforms for enhancing the public sector's digital skill sets.

(e) **Ethical Reforms Act of 1989, United States**. The Ethics Reforms Act of 1989 is an amendment to the Ethical Government Act of 1978. These acts mandated that the financial and employment histories of public officials and their immediate family be made public. It also imposed prohibitions on lobbying efforts by former public officials for a specified length of time. It also established the U.S. Office of Independent Counsel, which is responsible for investigating government officials. The amendment contained civil penalties for appointees who violate post-service employment laws and expanded its applicability to all executive department workers who hold a Presidential commission (Mokhiber, 1998).

3.4 Governance Process Reforms

(a) **Evidence-Based Policy Act**. The objectives of evidence-based policymaking are to use what we already know through programme assessment to make policy decisions and to acquire additional knowledge to better guide future judgments. This strategy places research findings, data, analytics, and evaluation of new innovation ahead of anecdotes, ideology, marketing, and status quo inertia. Evidence-based policymaking for public policy is a crucial resource for any nation seeking to address significant challenges while maximizing the effectiveness and efficiency of public spending. In the Netherlands, the government has implemented a Programme-Based Budgeting system, which employs data and evidence to influence decisions regarding the allocation of

government resources and to measure the impact of government spending (Debets, 2007). Furthermore in the United Kingdom, the government has formed the Office for National Statistics to provide unbiased, high-quality statistics and information to support evidence-based decision making, and the country has a long history of using data and research to guide policy making. Likewise, Ireland, Singapore, Australia, Estonia, and the United States have adopted evidence-based policy making.

(b) **Rules as Code (RaC) for Digital Government, Digital Economy, and Digital Society and Smart Cities**. "Rules as Code" is a methodology for developing and publishing machine- and human-readable regulations, legislation, and policies. The strategy entails defining government rules that are better suited for digital service delivery, developing software tools to convert the rules into code, and using the code as the basis for service delivery and decision-making. Machine-readable rules aid both government employees and citizens in comprehending and executing their objectives. Future legal framework must be compatible with a world dominated by technology, software, and computer code. There are issues with the current methods of creating, sharing, and interpreting rules. When the regulations get more complex, amendments can cause conflicts with unforeseen consequences. The government can benefit by adopting RaC as it can speed up digital service delivery, jobs of policymakers and legislative drafters become easier and it also improves the clarity of written laws during drafting or through simulators. France has embraced this method using an open source application called OpenFisca to codify its benefits and tax laws. In accordance

with Singapore's Smart Nation vision, comprehensive deep-tech infrastructure to make law compatible with a software-driven world is being developed. New South Wales, in Australia, seeks to codify standards to aid charities and nonprofits in understanding how regulations relate to them and to make them reusable (Waddington, 2021).

(c) **Modernization of Government Performance and Results Act-GPRA 2010**. This legislation of the United States modernizes the federal government's performance management framework, keeping and enhancing several GPRA provisions. The objective of the act was to facilitate the use of performance data for decision-making. In addition, it includes goal setting and performance measurement in public management for transparency, accountability, and result oriented of the government agencies' (Hollandworth III, 2022).

(d) **Digital Citizen Engagement Platforms**. As economies and societies grow increasingly digital, governments around the world prioritize the use of digital technology and data to promote civil society's participation and engagement in public concerns. Singapore, Australia, the United States, and the United Kingdom have established these engagement systems.

(e) **E-Gov Act Korea's**. This act is intended to “facilitate the efficient implementation of electronic government, increase productivity, enhance transparency, and democracy in the public administration, and improve the quality of life for citizens by establishing fundamental principles, procedures, and methods of promotion for the electronic processing of administrative affairs” (KLRI, 2017). Positive administrative effects include “reduced red tape;

strengthened formalization; increased span of control of middle managers at central agencies and local governments; improved policy goal-setting and the search for policy alternatives; enhanced business processes and administrative efficiency; and increased end-user satisfaction with the results of e-government systems and services" (Lee, 2016).

(f) **Korean Intellectual Property Office Portal.** KIPO was founded with a mission to increase national competitiveness and job creation by establishing new markets and directing the growth of firms with Intellectual Property, and with a mission to move towards being a leading IP nation in the period of the Fourth Industrial Revolution. KIPO enables development of expertise and quality of work and services in assessment of intellectual property (IP) applications, as well as for trials and appeals; to integrate scientific methods and new technologies into IP structure and operation; to promote the formation and utilization of IP rights to stimulate innovation-driven growth; to provide better protection of IP rights; and to strengthen engagement in international cooperative activities with other nations (KIPO).

3.5 Global Good Practices of Governance. On the basis of a literature review, the finest global governance practices have been recognized. India can adopt the tried and true practices of other nations by making the required alterations to fit the Indian context. Globally, the primary focus is on enhancing the efficiency and effectiveness of government personnel. The global governance best practices have been implemented in the following fields: (the list is not exhaustive).

(a) **Data-Driven Decision Making**. In the current digital age, data plays an increasingly vital role in the digital transformation of the government. Citizen-generated data enables governments to gain a greater comprehension of their needs, thereby promoting citizen-centric and data-driven decision making for the development or improvement of government digital services. Knowing the preferences of citizens also enables governments to engage with communities more effectively, resulting in stronger public-private partnerships. In addition to effectively utilizing data for service delivery and public communications, government agencies can also use data to create policies that meet the needs of citizens and businesses. Singapore is a premier example of a nation that bases its decisions on data. Many instances are provided below.

- In Singapore, WOGAA is an end-to-end website performance evaluation platform consisting of a front-end interface for citizen feedback and a back-end dashboard for data analytics visualization. It gains real-time insights into the functioning of government websites and digital services via a user-friendly interface. In addition, it aggregates data points from across the whole-of- government (WOG) to enable agencies to assess the performance of their website services and obtain a comprehensive view of government digital services. This enables government agencies to make data-driven decisions and proactively enhance the performance of citizen and business services, resulting in cost savings.

Figure 3.3 WOOGA - Website Performance Evaluation

- Smart Nation Sensor Platform (SNSP) is a Strategic National Project that provides whole-of-government products and services for gathering, exchanging, and analyzing sensor data, as well as controlling IoT and robotics systems. SNSP is an integrated, countrywide platform that collects vital data using sensors to solve problems and facilitate the development of intelligent solutions. SNSP uses sensors such as smart lampposts (Lamppost-as-a-Platform) for urban planning, smart water meters for tracking usage and leaks, computer vision-powered drowning alert systems, etc. These essential indicators enable government entities to get insight into user behavior and modify solutions to better serve residents and companies.

- Personalise.gov.sg is a whole-of-government personalization engine that customizes digital touch points such as emails and websites to give residents with the most pertinent services. The engine is built on top

of a Customer Data Platform that ingests a plethora of data from government systems, which is then fed into deep machine-learning models to determine the most relevant or tailored content for the consumers. By the personalization of government digital services, more efficient targeting and engagement strategies for achieving policy-based outcomes have been developed. This has strengthened government-citizen interactions and increased public confidence in the government.

(b) **Evidence-Based Decision Making**. A decision-making strategy based on evidence combines critical thinking with the best available evidence. It reduces the reliance of decision makers on anecdotes, conventional wisdom, and personal experience. The government of the United Kingdom established the Office for National Statistics to provide unbiased, high-quality data and information in support of evidence-based decision making and policy formulation.

(c) **E-Governance**

- The Korean digital government master plan till 2025 creates digital by design public services, provides personalized service delivery channels, interacts with citizens for information only once, and opens its data and services to the public by default. The mission of the digital master plan is threefold: implementing intelligent public service, facilitating data-driven government, and bolstering the digital transformation's foundation.
- In Korea, Service Delivery is facilitated by a Single Service Window, an integrated one-stop public service portal known as Government24 that provides over 90,000 public services.

- In Estonia, 99 percent of public services are available online 24 x7. E-services are only not available for marriages and divorces. Due to a secure, convenient, and adaptable digital ecosystem, Estonia has attained an exceptional level of transparency in governance and built trust in the digital society. The government has also devised an e-Prescription system through which doctors can electronically prescribe drugs. This eliminates the need for paper prescriptions and facilitates drug access for citizens (Estonia - Facts and Figures, 2022).
- Singapore has adopted SingPass, an online platform that grants residents access to more than 2,000 public and private sector services online and in person. Currently, 95% of all government transactions are digital from end to end. Using SingPass, citizens can, for instance, apply for a work permit, pay taxes, and provide feedback to government authorities. More than 3.5 million Singpass app users are among the 4.5 million Singpass residents. The Singpass app allows users to check in to digital services, authenticate their identity over counters, digitally sign papers, and more. Singpass is one of eight national strategic projects overseen by the Government Technology Agency (GovTech) and driving Singapore's Smart Nation goal. Singpass facilitates inclusion and access of all citizens (Digital Government Transformation - Singapore, 2022).

(d) **Mobile Governance**. Singapore has released a range of mobile applications that users can use to obtain information and services, such as parking availability and public transportation schedules. In addition to being able to report

concerns such as broken streetlights and potholes, these applications also allow users to check the progress of their government services.

(e) **Judicial System**. Digital justice systems in Estonia have three primary components: the “e-File central information system, the court information system, and a public site for citizens and other parties”. e-File is the center of the Estonian legal system. It delivers data to the court information system as well as the police, jails, prosecutors, and criminal case management information systems. All contact between parties is conducted electronically, including workflow, the creation and transmission of summonses, minutes of hearings, and decisions, and all parties can follow processes electronically. The decisions can be both electronically and physically signed (Lauringson, 2022).

(f) **Electronic Voting Systems**. Since 2005, Estonia has utilized an internet voting technology (i-Voting) that enables residents to vote remotely and with greater ease. With their electronic ID card or, alternatively, the Mobile-ID SIM card, Estonians can vote online in municipal, national, and European Parliament elections. In the 2019 elections, 46.7% of votes were cast online. The technology uses end-to-end encryption to ensure that votes are recorded accurately and cannot be tampered with, and allows citizens to vote from anywhere with an internet connection. Also, 30% of Estonians voted via i-voting from 128 countries across the world (Estonia - Facts and Figures, 2022).

(g) **Blockchain**. As a result of Estonia's experience with cyber attacks in 2007, scalable Blockchain technology was developed to safeguard the integrity of data housed in government repositories and protect it from insider threats. KSI is

a Blockchain technology developed in Estonia and utilized globally to secure the integrity of networks, systems, and data while maintaining complete data privacy. Estonia became home to the NATO Coordinated Cyber Defense Centre of Excellence and the European Information Technology Agency (Estonia - Facts and Figures, 2022).

(h) **Automated Decision Making**. In automated decision-making systems, governance actors use digital devices, data processing and data analytics to directly implement and enforce environmental laws, rules, and policies via automated intervention.

- Wireless radio-frequency identification technology is utilized to levy a congestion tax on diesel vehicles in the Stockholm city center zone. The drivers of diesel-powered vehicles that need to enter the city core are provided with transmitters. Strategically mounted cameras automatically map a vehicle's license plate to the corresponding transmitter. Vehicles without transmitters incur a levy. The environmental challenge has been handled using a technical protocol that processes information made visible and comprehensible by digital technology and provides output that intervenes automatically (Kloppenburg, Gupta, & Kurk, 2022).
- In the United States, predictive analytics and AI-based technologies have been implemented to enhance decision-making in areas such as crime prevention, traffic management, and public services. Similar to Los Angeles, the predictive police system utilizes data from crime reports and other sources to identify likely crime hotspots. Additionally,

the system employs machine learning algorithms to forecast when and where specific crimes are likely to occur, allowing authorities to deploy resources proactively. In contrast, the city of Boston utilizes a data analytics platform to enhance decision-making and service delivery across all city agencies.

(j) **Chatbots**. As per website aimultiple.com, the top use cases for chat bots in government and public sector service are (Eshghi, 2023):

- EMMA is a chatbot built for the Department of Homeland Security's U.S. Citizenship and Immigration Services. It handles queries in both English and Spanish and services one million applicants every month. It can answer inquiries on immigration services, the green card application process, passports, and other USCIS-offered services.
- Gov.sg is the Facebook messenger chatbot for Singapore's Ministry of Communications and Information. It provides citizens with information on government agencies, news, press releases, the workforce, complaints, public service interruptions, and public health statistics.
- "Alex" is the chatbot of the Australian Taxation Office. It is designed to assist individuals and businesses with tax and legal matters, such as intellectual property (IP) rights, tax filings, income, and deductions.
- Bürokratt is an interoperable network of public and private sector AI solutions that, from the perspective of the user, functions as a single channel for public services and information.

(k) **Electronic ID Cards**. All Estonians have a state-issued digital identification called eID, which serves as the foundation for all public and private services in the country's e-state. Individuals use their e-IDs for payment of bills, online voting, sign of contracts, purchase, and have accessibility to their health records, among other things. They can use e-ID using a “state-issued ID or ID card, Mobile-ID on their smartphones, or the Smart-ID application”. Estonia also has a programme called e-Residency for anyone, regardless of citizenship or location, who aspires to become an e-resident of Estonia and utilize its numerous digital services. People from all over the world choose to become e-residents so that they can establish and operate a trustworthy, location-independent EU company online, with all the tools necessary to conduct global business entirely online. In 2021, the e-Residency programme generated €24 million in direct economic revenue (Vahtla, 2022).

(l) **Digital Competence Framework for Citizens (DigComp 2.2)**. DigComp provides a common understanding of what digital competence is across the European Union and beyond, as well as a foundation for digital skills policy. It provides numerous examples of knowledge, skills, and attitudes that enable citizens to interact confidently, critically, and safely with digital technologies, as well as new technologies such as systems powered by artificial intelligence (AI). DigComp's objective is to digitally upskill the entire population; by 2030, 80% of European Union citizens will have basic digital skills (Digicomp 2.2, 2022).

3.6 Good Governance Initiatives in India. Digital India was launched in 2015 with the objective of transforming India into a digitally enabled society and knowledge

economy through three primary vision areas: “Digital Infrastructure as a basic utility for each citizen, Governance and Services on demand, and Digital Empowerment of citizens”. This has been implemented with a specific emphasis on utilizing digital tools and techniques to enable paperless, cashless, and presence less government. Many "citizen-centric e-services" have been introduced in an effort to digitally empower the society and revolutionize the economy. They are technology-driven, and as a result, technology is increasingly used to modify the delivery mechanisms for education, the economy, and citizen services. Citizen-centric e-services that prioritize transparency, accessibility, quality, efficiency, cost, delivery, mobility, and user experience (MeitY Dashborad, 2023).

(a) **Aadhaar**. Aadhaar is the foundation of the country's ongoing digital transformation. It is sufficiently unique and robust to eliminate duplication and fake identities, and is therefore used as the basis/primary identity for a number of government welfare systems, fostering openness and good governance. The Aadhaar identity platform is one of the cornerstones of "Digital India." It has been utilized in a variety of services and has contributed to delivering financial inclusion and transparent direct benefit transfers to the bank accounts of citizens. It is a “strategic policy instrument for social and financial inclusion, public sector delivery improvement, convenience enhancement, and promoting hassle-free people-centered government”. It has been utilized as a permanent financial address and helps the financial inclusion of the underprivileged and weaker segments of society; hence, it is a tool for distributive justice and equality. It has enabled DigiLocker, thereby enabling Paperless government through the

distribution of digital versions of public documents to citizens and the promotion of consent-based data exchange for obtaining services. It has enabled eSign, which enables authentication of digital transactions without the need for physical presence. The Aadhaar Enabled Payment System (AEPS) supports digital payments and financial services.

(b) **Direct Benefit Transfer (DBT)**. It facilitates immediate deposit of government benefits into the bank accounts of recipients. In all DBT-integrated programmes, de-duplication and eradication of ghost beneficiaries have proven impressive. DBT is advantageous for “citizen-centric services such as LPG Distribution, Public Distribution System (PDS), Mahatma Gandhi National Rural Employment (MNREGA), Fertilizer Subsidies, and the National Social Assistance Programme". DBT enhances the Government system's efficiency, effectiveness, transparency, and accountability, and instills citizen confidence in its governance. There are currently 310 DBT programmes administered by 53 ministries. Since its commencement in 2013, the eradication of fraudulent beneficiaries has yielded cumulative gains of Rs 2,22,963 Cr.

(c) **DigiLocker**. It aspires to empower citizens digitally by offering access to authentic digital documents in their digital document wallet, enabling paperless governance. It has 149.61 Million registered users and 5.62 Billion documents issued.

Figure 3.4 DigiLocker: Concept

(d) **Pradhan Mantri Jan Dhan Yojana**. This mission on financial inclusion seeks to "ensure that all Indians, particularly low-income groups and disadvantaged sections, have access to financial services, including a basic savings bank account, need-based credit, remittances, low-cost life and general insurance (Atal Pension Yojana), and pension PMSBY and PMJJBY". Since its launch in 2014, it has banked 48.06 billion beneficiaries with a total balance of 186,178.75 Crore in beneficiary accounts.

(e) **Centralized Service Locations (CSCs)**. CSCs provide rural and urban Indians with access to digital services, thereby helping to a financially and digitally inclusive society. CSCs operate under a PPP model in which micro-entrepreneurs create sustainable livelihoods and usher in a digital revolution in India's rural areas. It has spread to 2.3 lakh Gram Panchayats and provides affordable digital connectivity to rural areas. By producing jobs and fostering rural entrepreneurs, particularly women, these centers have helped to the empowerment of neglected segments of society. CSCs have also participated in the Stree Swabhiman movement to raise awareness about menstrual health and have established numerous sanitary pad distribution centers.

(f) **UMANG**. Unified Mobile Application for New-age Government (UMANG) is a single app to access important e-government services anytime, anywhere, and in different languages using a mobile device (presently 13 languages). It gives access to high-impact programmes offered by numerous central and state agencies. This app has expedited India's mobile governance. The application also has an international version known as UMANG International that is available in eight countries.

S. No.	Duration	Registered Users - Cumulative (Crore)	No. of Services - Cumulative	Departments Integrated - Cumulative	Transactions - Cumulative (Crore)	States on boarded - Cumulative
1	HY-1 (2021-22)	3.74	21,624	265	195.56	32
2	HY-2 (2021-22)	4.34	22,086	285	245.48	33
3	HY-1 (2022-23)	4.7	21,840	300	317.18	34
4	HY-2 (2022-23)	5.04	21,887	320	343.53	34

Table 3.1 UMANG - Status

(g) **E-Hospital**. This application is made available to government hospitals around the nation as Software as a Service (SaaS). “Patient Registration (OPD & Casualty), IPD (Admission, Discharge & Transfer), Billing, Lab Information System, Radiology Information System, Clinic, Dietary, Laundry, Store & Pharmacy, and OT Management” are the modules of the e-Hospital programme that are now available in the cloud.

(h) **GeM**. A web-based platform for the procurement of goods and services for public use. Through the participation of sellers from small towns in public procurement, end-to-end automation has broadened the base of sellers. It has also improved the effectiveness of public procurement by increasing its openness. This platform has evolved into a single localized national market where buyers and sellers from anywhere in the country can engage in commerce. It is also a digital

tool for empowerment and entrepreneurship. This stimulates the growth of micro, small, and medium-sized enterprises, as well as other merchants.

(j) **Digital Payment**. Many innovative digital payment tools have been adopted, including Unified Payment Interface (UPI), Bharat Interface for Money (BHIM)-UPI, BHIM-Aadhaar, BHARAT QR Code, Aadhaar Enabled Payment System (AePS), National Electronic Toll Collection (NETC) FASTag, etc. Digital payment has established a new ecosystem for new business models, such as flow-based financing, credit scoring, and insurance underwriting, that provide innovative options to meet the needs of citizens.

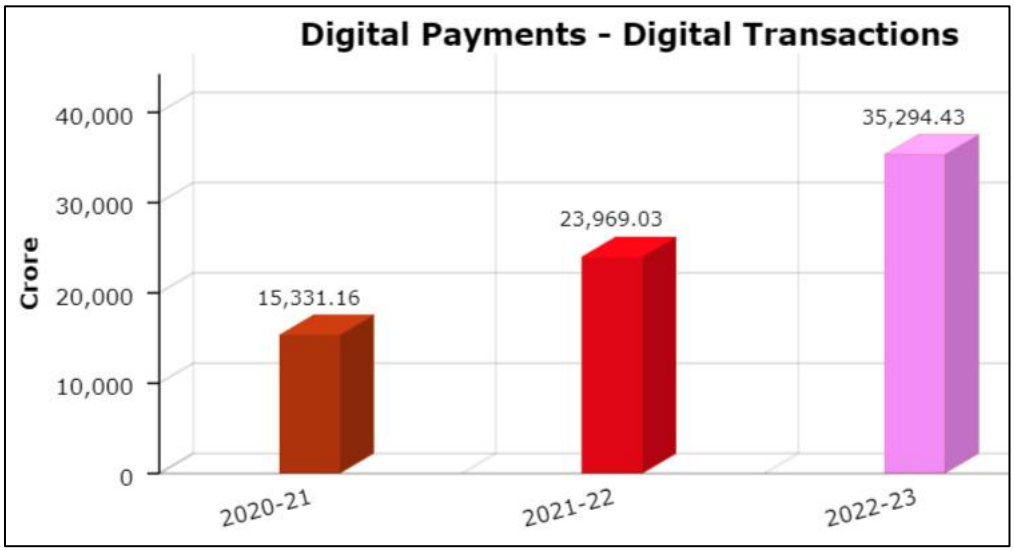

Figure 3.5 Digital Payments Data - India

(k) **Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA)**. Globally this is the biggest digital literacy programme, designed to enable people in rural areas access the benefits of the digital world and bridge the digital divide. The objective is to ensure that at least one family member is digitally literate.

(l) **Mission Mode E-Courts Project**. The defined objective of the project is "to provide efficient and time-bound citizen-centric services; to develop, install,

and implement efficient justice delivery systems in courts; to automate processes easing accessibility of information to its stakeholders; and to increase judicial productivity, qualitatively and quantitatively, thereby rendering the justice delivery system accessible, cost-effective, dependable, and transparent". The first two phases of implementation have enabled district and subordinate courts with ICT. Phase III of the e-Courts initiative is based on two fundamental aspects: accessibility and inclusivity. It envisions a judicial system that is more easily accessible regardless of geographic distance, efficient and equitable for every individual seeking justice, makes more efficient use of human and other resources, and incorporates NATs such as AI/ML, Blockchain, and robotics for a positive environmental impact.

(m) **MyGov**. This is a citizen engagement platform that interacts with numerous government bodies/Ministries to involve individuals in policy development and solicits people's input on issues/topics of public interest and welfare. The citizen-centric platform enables individuals to engage with the government and contribute to effective governance.

(n) **Pro-Active Governance and Timely Implementation** (PRAGATI). It is a multi-purpose and multi-modal platform that aims to solve the problems of the common man while simultaneously monitoring and reviewing significant programmes and projects of the Government of India and State Governments. It has enabled e-transparency, e-accountability, and real-time presence and communication among the essential stakeholders. This programme has proven efficient in addressing and resolving difficulties by reducing the communication

gap between departments and so reducing the time required to complete projects and programmes.

(o) **Co-Win Portal**. Cloud-based IT solution for planning, execution, monitoring, and assessment of COVID-19 vaccination.

(p) **Ayushman Digital India Mission**. It intends to construct the necessary backbone to support the nation's integrated digital health infrastructure. Using digital highways, it will bridge the current gap between the diverse Healthcare ecosystem stakeholders. It intends to give digital health IDs for all Indian people so that hospitals, insurance companies, and citizens can electronically access health records as necessary. It will give "equitable access" to quality healthcare by promoting the use of telemedicine and enabling the portability of health services on a national scale.

(q) **PM Gati Shakti**. It is the national master plan for "multi-modal connectivity on a digital platform connecting 16 ministries for integrated planning and coordinated implementation of infrastructure connectivity projects". It will "provide integrated and seamless connectivity for movement of people, goods and services from one mode of transport to another. It will facilitate the last mile connectivity of infrastructure and also reduce travel time for people".

3.7 National e-Governance Service Delivery Assessment (NeSDA). DARPG and NASSCOM benchmarked the e-Governance services in 2021 to examine States and Union Territories on the breadth and effectiveness of public service delivery across all socio-economic citizen groups. This benchmarking was conducted for seven metrics, seven industries, and thirteen ministry services/portals. The seven metrics were –

"Accessibility, Content Availability, Ease of Use, Information Security & Privacy, End-service Delivery, Integrated Service Delivery and Status & Request Tracking". In the survey, 56 state/UT e-Services and 27 services of the Central Ministries were evaluated (DARPG, 2022).

(a) **Enhancement of the e-Government Landscape.** It has been captured in three major takeaways: an increase in e-Service delivery by 60% by 2019 (from 872 to 1400 e-services), an increase in integrated/centralized portals for e-Service delivery, and an improvement in all seven assessment parameter scores. Increasing the delivery of e-Services across priority sectors is consistent with the goals of achieving SDGs for sustainable development and improving the quality of life for citizens. Implementation of integrated service delivery yields numerous advantages, including faster deployment of services, standardized interfaces, reduced friction, and increased confidence, all of which contribute to an improvement in the overall citizen experience. In order to increase the adoption of e-Services, State/UT governments must address the primary reasons presently attributable to non usage of e-Services by citizens.

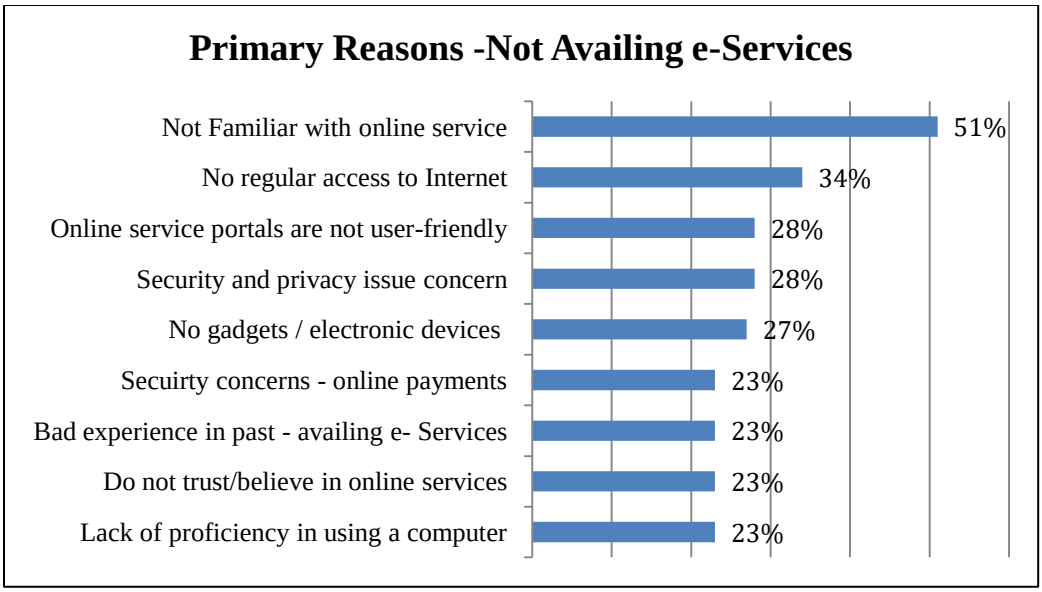

Figure 3.6 Primary Reasons - Not Availing e-Services by Citizens

(b) Adopting NATs for service delivery, multilingual support, multi-device support, addressing online complaints, providing support for citizens with special needs, and launching promotional campaigns for e-Literacy to bridge the digital divide are all steps that can be taken to improve the usability and utility of portals, thereby increasing their acceptance and usage among citizens.

(c) To maintain pace with global trends, the following digital government trend recommendations must be adopted:

- **Integrated Delivery Services**. Whole-of-government is an integrated approach that enables collaboration between departments and between levels through institutional structures that produce a comprehensive, synergistic, and coordinated system of public service delivery. This requires administrative and political intent. According to the report, the majority of services are not provided through a central portal, but rather through individual departmental websites, resulting in multiple

user IDs for accessing the portals. The India Enterprise Architecture framework developed by MeitY to be adopted for all portals, so as to give uniform experience as well single digital ID to citizens for accessing e-services.

- **Data-Centric E-Government**. Data is a strategic asset, and governments must adopt a strategic approach to the utilization of data and technology in order to enhance government intelligence, support policymaking, service design, and service delivery, and improve government intelligence.
- **Policy Framework for Adoption of New Age Technology**. The pace at which New Age Technologies (such as "data analytics, artificial intelligence, machine learning, robots, bots, Internet-of-Things, Blockchain, Drones, Geo-spatial technologies, etc.") are emerging exceeds the rate at which governments can respond to and take use of such technologies. In order to encourage faster adoption of new age technologies, a policy framework for adopting new technologies in delivery of government services needs to be provided.
- **Continuous Monitoring, Evaluation and Improvement**. A transparent system must be implemented so that citizens are aware that they have been heard and that their feedback is directing substantive change.
- **Cyber Resilience**. A set of standard security rules and technologies designed to prevent the misuse of information, including

basic security criteria and accreditation processes for software applications and systems.

- **Future Workforce**. The strategic road map for a digital government should include measures for “talent retention, knowledge development, addressing talent shortages, and improving public service delivery”. Futuristic workforce should be capable of building on people's beliefs and aspirations and fostering a governing culture that puts people first.
- **E-Literacy to Promote Inclusivity**. It should be guaranteed that local language content and training are available.
- **Prescriptive Analytics**. The use of analytics technology, such as natural language processing (NLP) and ML, in services to anticipate user requirements and recommend the best course of action should be standardized. The vast quantities of available data can facilitate evidence-based decision making to discover the public's needs and effectively meet their expectations.
- **Mobile-First Approach**. To leverage on the widespread adoption of mobile devices across the nation, mobile-first design for service delivery should be the priority.
- **Service Affordability**. Digital India is all about growth for all. Amenities such as excellent “education, health care, energy, and water supply” should be made accessible all across socioeconomic classes of

individuals. Approaches that do not need the government to shoulder full expenditures should also be explored.

3.8 Global Benchmarking Indices - Performance of India

(a) **United Nations e-Government Survey.** This evaluates the capabilities of the 193 UN members to exploit Information and Communication Technologies (ICT) to deliver online services and engage their citizens in public policies. It integrates access features, such as infrastructure and educational levels, to reveal usage of ICT to enhance access and inclusion for its citizens. The EGDI is a "composite measurement of 3 crucial facets of e-government: provision of online service, telecommunication connectivity and human capacity". Denmark has the maximum EGDI score of 0.9717 (E-Government Development Index, 2022).

Year	**2018 India**	**2020 India**	**2022**		
Index	**Rank** **Score**	**Rank** **Score**	**India**	**Avg**	
				World	**Asia**
E Development Index	90 0.5669	100 0.5964	105 0.5883	- 0.6102	- 0.6493
Online Services Index	- 0.9514	- 0.8529	0.7934	0.5554	0.6137
Telecomn Infrastructure Index	- 0.2009	- 0.3515	0.3954	0.5751	0.6166
Human Capital Index	- 0.5484	- 0.5848	0.5761	0.7001	0.7175
e-Participation Index	15 0.9551	29 0.8571	61 0.5909	- 0.4450	- 0.5024

Table 3.2 Comparison of EGDI

(b) **Network Readiness Index 2022**. Based on four pillars - Technology, People, Governance, and Impact - these index rates nations according to their readiness for the digital/network economy. The Technology pillar evaluates the level of technology necessary for a nation to participate in the global economy.. The People pillar provides access to the resources and skills needed to use technology for productivity. The Governance pillar is about network economy, regulation, and digital inclusion. The Impact pillar is concerned with the network economy's readiness to enhance the growth and well-being of society and the economy. India ranks 61st out of 131 countries with the score of 51.19. The United States has a maximum score of 80.3 (Dutta & Lanvin, 2022).

(c) **Global Innovation Index.** Innovation is defined "as the creation, development and implementation of a new product, process or service, with the aim of improving efficiency, effectiveness or competing advantage, enables early adoption of these technologies in the national context" (Hudson, 2014). This index rates global economies based on their innovation capabilities. Among the 132 economies listed in the GII 2022, India ranks 40th with a score of 36.6 and is better than 2021. Switzerland is the most innovative economy in the world in 2022 with a score of 64.6 (Global Innovation Index, 2022).

(d) **World Competitiveness Ranking 2022**. The purpose of this IMD survey for 63 nations is to evaluate the enabling environment for efficient infrastructure, institutions, and regulations for the construction of a sustainable value chain. India is currently ranked 37, six positions higher than in 2021 with a score of 66.1. Denmark tops the table with a score of 100 (IMD, 2023).

(e) **Global Cybersecurity Index (GCI).** The GCI measures a country's level of preparedness for cyber security challenges such as cyber crime and cyber terrorism. India ranks 10th out of 194 countries in the 220 index, showing significant improvement from its previous ranking of 47th in 2017. USA is at the top of the ranking in this index (Global Cybersecurity Index, 2022).

(f) **Global Corruption Index (GCI)**. It measures the state of corruption and white collar crime in 196 countries and territories worldwide. India's score is 46.3 and its position is 92. Norway is the least corrupt with a score of 7.12 (Global Risk Profile, 2022).

(g) **Henley Passport Index** It is a ranking of all passports in the world based on the number of countries to which their holders can travel visa-free. The rank of India is 82 out of 193 countries, while its access score (visa-free destinations) is 60 out of 227. Japan is on the top of the table and has an access score of 193 (Henley Passport Index, 2022).

(h) **Global Competitiveness Index (GCI) 2020**. GCI encourages policymakers to prepare for long-term prosperity rather than short-term growth. The report of 2020 post-COVID, the goals for recovery and revitalization, and the building blocks of a transformation to new economic systems that combine "productivity," "people," and "planet" objectives. According to the research, India's innovation ecosystem priorities have improved. India has performed badly in reconsidering employment rules and social protection in light of the new economy and labor demands. India has also performed poorly in terms of encouraging and expanding patient investments in research, innovation, and

invention that can generate new "markets of the future." Overall, India received a 49.5 (out of a possible 100) for its economic systems' preparedness for increased sustainability and shared prosperity. Finland has the highest score of 69.9 (Klaus Schwab, 2020).

(j) **Worldwide Governance Indicators**. This World Bank report provides the aggregate and individual governance indicators for more than 200 nations and territories across six dimensions of governance. The table shows India's Percentile Rank (Kaufmann & Kraay, 2022).

Indicator	Year	Percentile Rank (Out of 100)
Voice and Accountability	2016	61.58
	2021	51.69
Political Stability & Absence of Violence/ Terrorism	2016	14.76
	2021	24.53
Government Effectiveness	2016	56.73
	2021	62.50
Regulatory Quality	2016	42.31
	2021	49.52
Rule of Law	2016	52.88
	2021	51.92
Control of Corruption	2016	45.19
	2021	46.63

Table 3.3 Worldwide Governance Indicators - India

(j) **Global Sustainable Competitiveness Index (GSCI)**. Sustainable competitiveness is the capacity to generate and sustain inclusive wealth without reducing the future capacity to maintain or increase present wealth levels. It analyzes countries' sustainable competitiveness using six sub-indices: 'Natural Capital, Resource Efficiency & Intensity, Social Cohesion, Intellectual Capital,

Economic Sustainability, and Governance Efficiency". In 2022, the global average score for Sustainable Competitiveness is 43.1/100. In 2022, India's score is 39.25 and its position is 120 out of 163 countries, compared to 40.9 and 130 in 2021 (Solability, 2022).

(k) **AI Readiness Index**. The assessment by Oxford Insights ranks India 32nd out of 181 countries, with a score of 63.67, in terms of AI adoption preparedness for the delivery of public services to citizens. India's score is significantly more than the global average of 44.61, but lower than the maximum score of 87. In the three assessment pillars, namely the Government Pillar, the Technology Sector, and the Data & Infrastructure Pillar, India must strengthen the Technology Sector, particularly in terms of its innovation ability and the maturity of its AI tools. In terms of skill sets, India has a strong human capital profile (Government AI Readiness Index 2022, 2022).

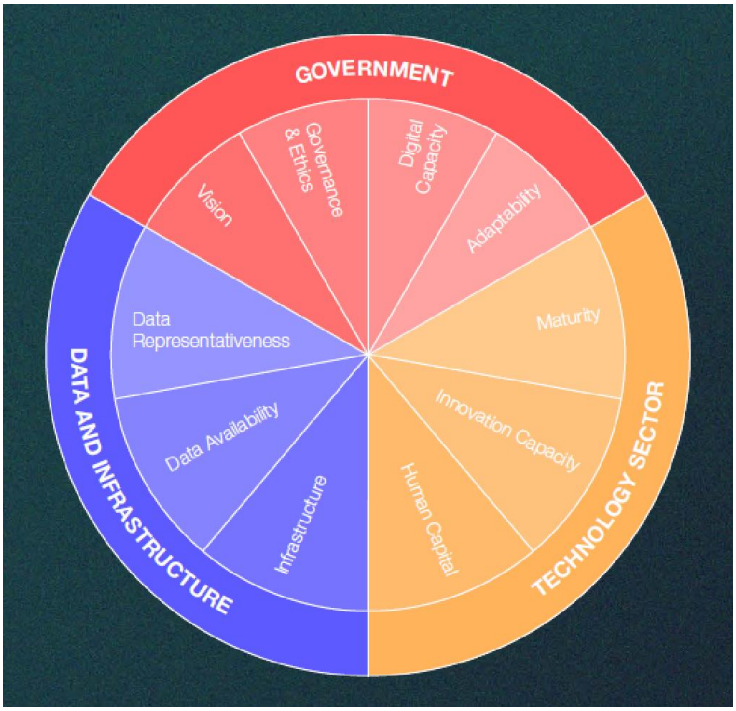

Figure 3.7 AI Readiness Index 2022

(l) **India Inequality Report 2022**. This report brings to light the level of the digital disparity in India and its impact on essential services such as "education, health and financial inclusion". According to the report, access to digital technologies remains limited to "largely male, urban, upper-caste, and upper-class households and individuals". This disparity is largely attributable to unequal access to and utilization of Information and Communication Technologies (ICTs). Socioeconomic factors such as gendered social norms, affordability, geographic location, and digital literacy determine the ownership and usage of the available devices (Mahendru, Dutta, & Mishra, 2022). As per paper, "only 38% of households in India are digitally literate, in urban areas, digital literacy is relatively higher at 61% relative to just 25% in rural areas" (Mumtaz & Mothkoor, 2021).

3.9 Summary.

(a) Vision India@2047 strives to bring citizens and government closer, with inclusive growth for all sectors of the society so that India could become the 3rd largest economy of the world. This vision strives to keep the citizen at the core of the public administration, also referred to as the 'citizen-centric' approach, wherein all the citizens are provided personalized and contextualized public services effectively, efficiently and equitably irrespective of demography, class, caste and gender. In order for the vision to become a reality, the government needs to focus on Education, Nutrition and Health so as to achieve the SDGs goals of 2030 in the earliest timeframe, which is possible only if a collaborative approach is inculcated, where industry players too would have a considerable role

to play. For assuring success of such multi-stakeholder strategies, New Age Technologies (NATs) shall inevitably serve as a catalyst. Data would become the new engine of growth and propel e-services to be predictive and proactive. Further, to create agile and stable e-service systems, the best of the talent need to work for the government in different sectors as domain specialists, may be on contractual basis, and in conjunction with civil services to achieve the objectives.

(b) Based on the various indices, overall while India has made significant progress in governance and technology in recent years, there is still work to be done in terms of improving regulatory quality, reducing corruption, and ensuring that all citizens have access to reliable and affordable internet services. However, India's strong performance in areas such as human capital and research, as well as its growing reputation as a leader in innovation, suggests that the country is well positioned to continue making progress in these areas in the coming years. By continuing to invest in innovation, digital infrastructure, and good governance, India can help to ensure that it remains a leader in these areas and continues to make progress towards becoming a developed nation by 2047.

(c) Digital India has improved access to technology in India, particularly in rural areas. The program has expanded internet connectivity and provided access to low-cost smart phones, making digital services accessible to millions of citizens who were previously disconnected. This has enabled people to access information, education, healthcare, and financial services through digital channels, improving their quality of life and creating new opportunities for entrepreneurship and economic growth. Digital India has also modernized the

government's service delivery systems, making it easier and more efficient for citizens to access public services. While challenges remain, Digital India has made significant strides in creating a more inclusive and digitally empowered society in India.

(d) Also the National e-Governance Service Delivery Assessment undertaken by DARPG along with NASSCOM to assess and benchmark the e-services pan India would help the administrative machinery to improve the citizen centric services across respective states and UTs. The report highlighted the need to create a secure and scalable digital public goods ecosystem that is accessible to all citizens. It also highlighted the need to integrate different government services and provide them through a single platform to improve the user experience and increase efficiency. It has recommended the adoption of a service-oriented architecture to enable the integration of services across different departments and levels of government. This would also require the development of common data standards and protocols to ensure interoperability and data sharing between different systems. The integration of services would enable citizens to access multiple services through a single interface, reducing the need for multiple visits to government offices and improving the overall quality of service delivery.

Chapter 4: Role and Applications of New Age Technologies

4.1 New Age Technologies. New Age Technologies (NATs) are a wide range of cutting-edge technologies that are shaping the way we live and work. These technologies are characterized by their ability to process and analyze large amounts of data, their ability to learn and adapt, and their ability to connect and communicate with other devices. They also have the ability to connect, automate, and optimize various processes and systems, and they are expected to have a major impact on industries such as healthcare, transportation, manufacturing, and finance and most importantly in delivery of public services for citizens.

4.2 Emerging Trends and Technologies

4.2.1 As per Gartner, there are 26 high impacting emerging trends and technologies, which are three to eight years away from reaching widespread adoption. To stay competitive and a global leader, advantage needs to be taken of the economic and social opportunities they provide (Nguyen, Jump, & Casey, 2022). These technologies have been summarized into the four themes,

(a) **Smart World**. As the world becomes smarter, interactions between gadgets are transitioning from purely physical to virtual and hybrid, and physical spaces are also transforming into contextually aware environments. AI employs advanced analytics and logic-based techniques, such as machine learning, to evaluate events, support and automate decision-making, and take action.

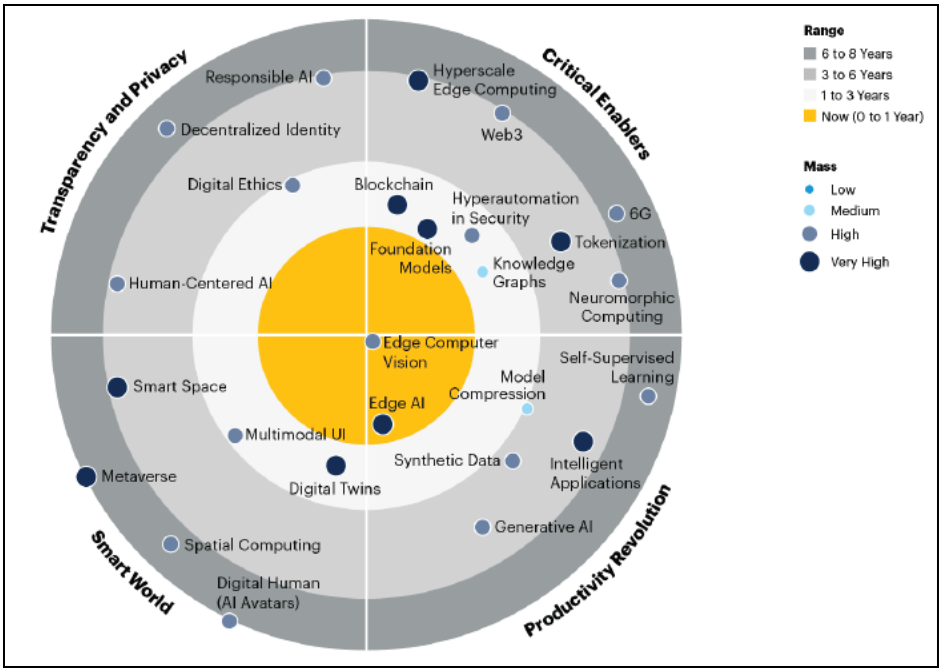

Figure 4.1 Impact Radar (Gartner)

(b) **Enabling Productivity Revolution**. Edge AI has enabled computation at the point of data production. This enables real-time processing of intelligence, enables models to function in remote contexts, and is more cost effective as it eliminates the requirement of 24/7 data streams to the cloud. In addition, intelligent applications are integrating optimization, advisory, and decision-support capabilities into process-centric application workflows. AI tools such as synthetic data and model compression are the synthetic production of datasets to help AI applications overcome data access difficulties. The second enabler in the adoption timeframe is self-supervised learning, which eliminates the human-in-the-loop requirement during model training by allowing labeled data to be generated from the data itself. Model compression decreases the size of a model with minimal influence on performance, allowing larger, more complicated algorithms to be implemented on devices with limited resources. These advances

in AI tools, methods, and applications are enhancing AI's utility and automation potential and driving a revolution in productivity.

(c) **Transparency and Privacy - Foster Trust in Technology**. The relevance of AI decision transparency and regulatory compliance in the deployment of new technologies is of paramount significance. Privacy and accurate processing of personal data is a primary issue for the majority of technology service providers, and will be safeguarded by developing regulatory modifications in numerous nations. With the exponential expansion of data collecting that feeds multiple AI models for real-time decision making or intelligence, this has gotten more difficult. To mitigate AI risks, achieve equitable outcomes, protect privacy, and enable interpretability of AI-based outcomes, tech providers must be ethical and accountable with AI-enabled systems from the design phase forward. Digital ethics, responsible AI, human-centric computing, decentralized identification, and homomorphic encryption are some of the technologies that enable transparency and privacy. From the perspectives of social trust and regulation, these technologies will be indispensable for facilitating the productivity revolution and the widespread adoption of the smart world.

(d) **Critical Technology Enablers**. Foundation models and graph technologies increase the precision of transcription, language processing, and text analytics, hence enhancing the intelligence and usefulness of models. The knowledge graphs build relationships between data that significantly increase model performance. AI hardware such as hyperscale edge computing and neuromorphic computing give increased compute capabilities, enabling more

complicated algorithms to execute in proximity of the data source, hence delivering real-time processing of intelligence and analysis. These advances in hardware and software will enable the next generation of high-performance AI applications. Web3 is a new family of technologies for the construction of decentralized web apps that allow users to control their own identity and data. It is enabled by Blockchain and token technologies. These technologies create new opportunities for managing digital trust, enabling decentralization, executing transactions, and exchanging value between parties. As the digital economy grows, the need for digital mechanisms to manage, exchange, and safeguard physical and virtual assets will only continue to increase, boosting demand for Web3-enabling technology. These crucial enablers are improving the status of hardware and software performance and fostering the development and expansion of the digital economy.

4.2.2 Impact of New Age Technologies

(a) Convergence of New Age Technologies, such as the transformation of physical locations and interactions into information-rich and contextually enhanced hybrid physical-virtual experiences.

(b) Advancements in artificial intelligence (AI) techniques, technologies, and systems are rapidly increasing AI's automation capability and utility.

(c) Increasing public, legislative, and regulatory scrutiny is accelerated by the exponential development in the acquisition of business and personal data.

(d) Key enabling technologies, such as foundation models and neuromorphic computing, enable technological advancements.

4.2.3 Strategy to Adopt New Age Technologies and Trends

(a) Calibrate “investments in smart world" technologies, such as “digital humans, the Metaverse, smart spaces, multimodal UI, and digital twins”, in order to create new customer value via innovative interaction experiences.

(b) Explore new techniques that enhance the value of AI applications, including edge AI, synthetic data, and model compression.

(c) Endorse transparency and privacy, including digital ethics, responsible AI, human-centric computing, decentralized identification, homomorphic encryption.

(d) Assessing the impact of innovative AI algorithms (such as foundational models) and decentralization, for a disruptive effect.

(e) The timeline for adoption of these technologies are as under:-

Present	Next 3 Years	3 to 6 Years	6 to 8 Years
Edge AI	Blockchain	Generative AI	6G
Edge Computer Vision	Digital Ethics	Human Centered AI	Decentralized identity
	Digital Twins	Hyperscale Edge Computing	Self Supervised Learning
	Foundation Models	Intelligent Applications	Spatial Computing
	Knowledge Graphs	Model Compression	Metaverse
	Hyperautomation in Security	Neuromorhpic Computing	Digital Humans/AI Avatars
	Multimodal UI	Responsible AI	
		Smart Spaces	
		Tokenisation	
		Web3	

Table 4.1 Timeline for Emerging Trends & Technologies

4.2.4 Out of these emerging trends, four New Age Technologies which are going to be disruptive in the next three to eight years (Gartner, 2023).

(a) **Neuromorphic Computing**. Using digital or analogue processing, these systems allow for a more precise representation of the biological brain. The development of AI systems on these platforms will provide a better response to the unpredictability. Their ability to instantly respond to real-time events and data will create the foundation for a vast array of future AI-based solutions. Early use cases consist of event detection, pattern recognition, and training on tiny datasets. It will have a substantial impact by bringing power savings and performance enhancement, which are not feasible with current generations of AI chips.

(b) **Self-Supervised Learning**. This increases productivity by employing an automated method for data annotation and labeling. These learn how information relates to other information; for example, which situations typically precede or follow another, and which words often go together. The potential benefits will also extend the applicability of machine learning to organizations with limited access to large datasets. AI applications that rely on labeled data, primarily computer vision and natural language processing, will benefit.

(c) **Metaverse**. Metaverse advances the smart world by offering an immersive digital environment. It allows for persistent, decentralized, collaborative, interoperable digital material that intersects with real-time, spatially organized, and indexed content from the physical world. It is an example of a combinatorial trend in which a number of individually significant, discrete, and independently growing trends and technologies interact to form a new trend. Spatial computing

and the spatial web, digital persistence, multi-entity settings, decentralization technology, high-speed, low-latency networking, sensor technologies, and AI applications are some of the emerging enabling technologies and trends.

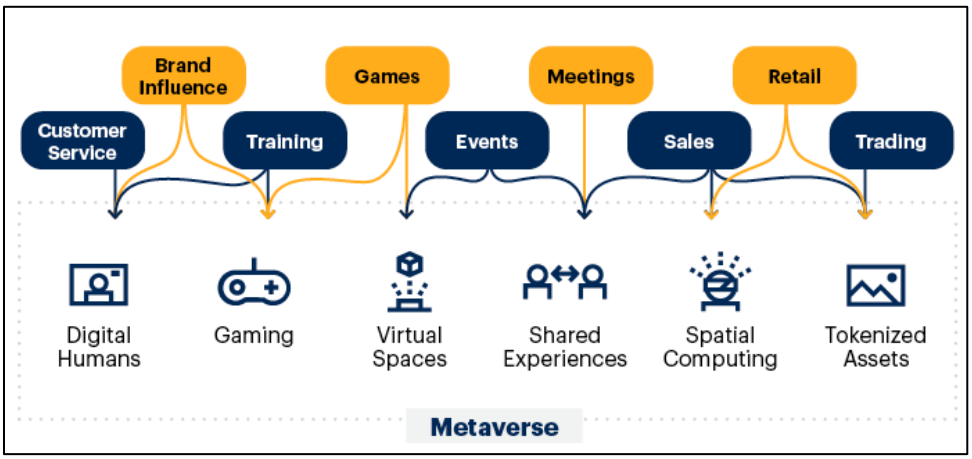

Figure 4.2 Opportunities in Metaverse

(d) **Human-Centered AI (HCAI)**. It is a prevalent AI design principle that aims to improve transparency and privacy for the benefit of people and society. It assumes that humans and AI will collaborate to better cognitive performance, such as learning, decision making, and new experiences. This enables the management of AI risks and the use of automation in an ethical, responsible, and more effective manner, while augmenting AI with a human touch and common sense. The impact potential of HCAI is strong since it harnesses human skills to increase human productivity and eliminate unnecessary limits, biases, and blind spots.

4.2.5 Strategic Technology Trends

4.2.5.1 Gartner has also identified ten strategic technologies which need to be leveraged to accelerate the digital transformation growth and are built around three themes namely Optimize, Scale and Pioneer. The themes are impacted by environmental, social and

governance (ESG) expectations and regulations. Every technology investment needs to be seen with an impact on the environment; keeping future generations in mind i.e. it should be 'sustainable by default'. Optimize technologies which can help organizations optimize resilience, operations or trust. Scale means to achieve the objective of increasing the pace of product delivery and enabling connectivity everywhere. Pioneer is to establish new forms of engagement, accelerated responses or opportunity.

4.2.5.2 The ten strategic technology trends are Digital Immune System (DIS) (Merges technology and best practices to increase resilience), Applied Observability (Focuses on integrated approach to collect insights from observable data), AI Trust, Risk, and Security Management (AI TRiSM) (Elevates trust, governance and reliability of AI models), Industry Cloud Platforms (Custom made cloud for specific use case to increase innovation and efficiency), Platform Engineering (Consolidate tools to accelerate digital delivery), Wireless-Value Realization (greater use of wireless systems to increase analytic capabilities), Superapps (Combines app, platform & ecosystems on one single app) for more personalized digital user interface), Adaptive AI (AI model that adapts and changes with circumstances), Metaverse (Virtual world that digitally represents people, places and objects), and Sustainable Technology (Traverses across all trends, for a sustainability, energy efficiency and strengthen credibility).

4.2.5.3 The strategic technologies are tabulated theme wise as under :-

Optimize	**Scale**	**Pioneer**
Digital Immune System	Industry Cloud Platforms	Superapps
Applied Observability	Platform Engineering	Adaptive AI
AI Trust, Risk and Security Management AI TRiSM	Wireless-Value Realization	Metaverse
"Sustainable Technologies"		

Table 4.2 Strategic Technologies Theme Wise

4.3 Essential Components of NATs. As per NASSCOM, three basic technologies – "Big Data and Analytics, Cloud Computing, and Cyber security – and six advanced technologies – Artificial Intelligence, Internet of Things, 3D Printing, Robots, and Immersive Media – comprise the nine technologies, impact enterprise, government, and end-user segments significantly". These are creating new business opportunities across industries, provider-consumer interaction points, and established market segments (Technology Sector In India 2020 - TECHADE, 2020). The essential components of these technologies are tabulated as under:-

Technology	Key Components
Basic Foundational Technologies	
Cloud Computing	Cloud Management Software, Data Center Hardware, High-Speed Networks and SaaS/PaaS.
Big Data Analytics	Apps & Infrastructure, Data Analytics – AI-Based & Traditional and BI/ Visualization
Cyber Security	Security, Intelligence Detection, Remediation Adaptation, End-User Education
Technology	**Key Components**
Advanced Technologies	
Artificial Intelligence	AI Algorithms, Machine Learning (ML) and Deep Learning
3D Printing	Additive Manufacturing and Rapid Prototyping
Internet of Things	Consumer Wearables, Advanced, Low-Cost Sensors, and Wireless/NFC Devices
Blockchain	Distributed Ledger, Technology (DLT), Cryptocurencies, and DApps
Robotics	Robotic Dexterity, Sensors, Distributed Robotics and Robotic Exoskeletons
Immersive Media	Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR) and Extended Reality (XR)

Table 4.3 Essential Components of NATs

4.4 Role of NATs in Governance. Government interactions with individuals and service delivery have the potential to be transformed by New Age Technologies. The seventeen aspirational Sustainable Development Goals (UNDP, 2015), known as 'Global Goals,' can ideally fulfill the expectations of citizens through the achievement of action areas indicated in those goals. The purpose of the Sustainable Development Goals (SDGs) is to accomplish social development, economic development, and environmental sustainability so that people can live in peace and prosperity. The United Nations has defined these seventeen global governance goals together with 169 targets to be accomplished by the year 2030. NATs can serve as a potent instrument for achieving the SDGs through ways and mechanisms that closely adhere to the principles of Good Governance (Malhotra, Impact of Digital Technologies on Governance, 2022). Many of the ways in which these technologies can help to develop more efficient and effective citizen-centric governance in accordance with Vision India 2047 are highlighted below.

(a) **Environmental Monitoring** Digital technologies can be utilized to address major environmental issues such as climate change, biodiversity loss, and depletion of natural resources. In 2021, the European Union contributed $8 billion in the Destination Earth project. The objective of the project is to "create a highly accurate digital model of the Earth (a "digital twin") in order to monitor and predict environmental change and human impact in support of sustainable development. This is meant to assist policymakers in predicting future climate threats and developing scenario tests to evaluate the efficacy of various climate policies (Kloppenburg, Gupta, & Kurk, 2022).

(b) **Enhanced Service Delivery**. NATs can aid in automating and streamlining service delivery procedures, making them more efficient and accessible to citizens in remote areas. The usage of chatbots and virtual assistants, for instance, can facilitate online access to government services and information for citizens. This can save time and minimize the need for in-person encounters, making it easier for residents to receive government services. In addition, machine learning can be used to anticipate citizen demands and generate personalized recommendations, which can result in improved service delivery.

(c) **Enhancing Citizen Engagement**. Citizens can contribute feedback and input on government choices through the use of technologies such as social media and mobile apps. This can facilitate increased citizen participation and accountability. For instance, governments might utilize social media to solicit comments from individuals on proposed policies or to run polls on a variety of problems. Moreover, citizen feedback can be utilized to enhance public services such as transportation and street lighting.

(d) **Increasing Transparency and Trust**. With Blockchain technology, one can generate immutable records of transactions and other data. The distributed structure of the technology makes it difficult to alter a record after it has been created, ensuring the records' transparency and integrity. This can aid in the fight against corruption and increase public confidence in government institutions. In some nations, Blockchain technology has been implemented to provide a safe and transparent system for storing land records and other property-related transactions, for instance.

(e) **Enhancing Security**. By offering real-time monitoring and analysis of data from several sources, IoT and AI technology can be utilized to enhance security and help prevent crime. AI-enabled cameras are able to analyze data and recognise anomalous behavior, thereby alerting security personnel to potential dangers. In addition, AI can aid in the analysis of criminal activities and patterns, which can help in future crime prevention.

(f) **Data Analysis and Decision-Making**. In a constantly changing and dynamic environment, data analytics could be used to make prudent decisions. Many sources, such as social media, sensors, RFID devices, government agencies, and so on, generate a substantial amount of data. If the data generated is appropriately examined using various techniques of big data analytics, it might be of significant assistance to good governance decision making (Malhotra, Anand, & Singh, Applying Big Data Analytics in Governance to Achieve SDGs, 2018). Also, this data can be utilized to make more informed decisions regarding infrastructure investments, such as the construction of new roads or the improvement of public transportation networks. Additionally, data analytics can be used to monitor traffic trends and adjust the timing of traffic signals, thereby enhancing traffic flow and minimizing congestion.

(g) **E-Governance Portals**. These portals facilitate citizen access to government services. They have been used to apply for licenses, pay taxes, register grievances, and gain access to a vast array of additional services. The tracking tools enable citizens to view the status of their request, enhancing both transparency and accountability.

(h) **Smart City Technologies**. Several technologies are utilized by smart city programmes to collect data on traffic, air quality, and energy consumption. This information can then be examined and utilized to enhance the quality of life for the populace. Traffic sensors, for instance, can be used to improve traffic flow, reducing congestion and enhancing air quality. Smart street lights can be utilized to reduce energy usage. Using smart waste management systems can enhance garbage collection and recycling. Moreover, IoT sensors can be utilized to monitor real-time weather, healthcare, and social distance data at public events and gatherings.

(j) **Electronic Voting Machines**. These systems are intended to increase the efficiency and security of the voting process. Votes can be recorded precisely and cannot be tampered with using Blockchain technology. The system can be used to provide remote voting choices, making it easier for citizens to vote, especially those who are unable to go to polling centers or who reside in a different nation.

(k) **ChatBots and Virtual Assistants**. This can facilitate citizens' accessibility to information 24x7. These systems, which have been linked into websites, social media, and mobile apps, can be used to answer queries about government services, provide progress updates on requests, and even help users plan appointments.

(l) **Predictive Analytics**. The use of data and predictive analytics, such as advanced algorithms and machine learning, to predict regional trends and patterns in order to improve service delivery and policy decisions. For instance, police agencies use data on past crime patterns to identify places where crime is most

likely to occur and to implement preventative measures against crime. In addition, predictive models are utilized to identify regions at danger of natural disasters and to implement preventative actions.

(m) **Drones**. Drones can be used to monitor infrastructure and undertake difficult-to-reach tasks, such as taking aerial images, monitoring traffic, monitoring and enforcing rules, and assisting in natural disaster relief. They can be fitted with cameras, sensors, and other hardware to collect data and offer real-time updates. Drones are also utilized for search-and-rescue missions, the delivery of products, and humanitarian aid. They are utilized for airborne surveillance in order to discover illicit activity and environmental problems. Drones are utilized to improve the delivery of public services, including the transportation of medical supplies and equipment to remote or inaccessible places.

(n) **Digital Identity**. Biometric verification technologies, such as facial recognition and fingerprint scanning, are utilized to safeguard access to services and ensure that only authorized users have access to sensitive data. This reduces fraud and increases security.

(o) **5G Networks**, 5G networks, the new generation of cellular networks, offer faster, and more reliable connectivity infrastructure that can support a variety of new applications, such as autonomous vehicles, smart factories, and machine-to-machine communication. It supports high-bandwidth and low latency applications such as virtual reality, augmented reality, and 4K video streaming, which can be utilized in healthcare, education, and several other industries. It can be used to bring high-speed Internet connection to underserved or distant

locations, enabling individuals to get access to previously unavailable services and information.

(p) **Environmental Surveillance**. Using Artificial Intelligence in conjunction with remote sensing, satellite imagery, and drone footage, natural resource, environmentalists are able to make more informed decisions regarding issues such as climate change and conservation.

(q) **Enhanced Communication and Collaboration**. Cloud computing and virtual reality, enables governments to connect and work with internal and external stakeholders more efficiently and effectively.

(r) **Accountability and Transparency**. By creating indelible, verifiable records of transactions and activities, Blockchain and smart contracts have allowed governments to boost openness and accountability.

The successful adoption of these technologies in the context of governance is contingent on a number of variables, including the availability of data, the cost of implementation, the legal framework, and the acceptance of the technology by the citizens.

4.5 NATs Applications Implemented in India. India is actually leading in applications of New Age Technologies in governance and some of the use cases have gone global. The use cases implemented in India are given out in under mentioned paragraphs.

4.5.1 India Stack. It is a set of open "Application Programming Interfaces (APIs) and Digital Public Goods (Aadhaar, UPI, Digilocker, UMANG etc) that aim to unlock the economic primitives of identity, data, and payments at population scale". This Digital

Public Infrastructure (DPI) is being used by governments, businesses, startups and developers to take India towards presence-less, paperless, and cashless service delivery. The rapid adoption has helped promote financial and social inclusion to rural areas. Indian stack has gone global and is being used by around 11 countries (India Stack goes global, 2023).

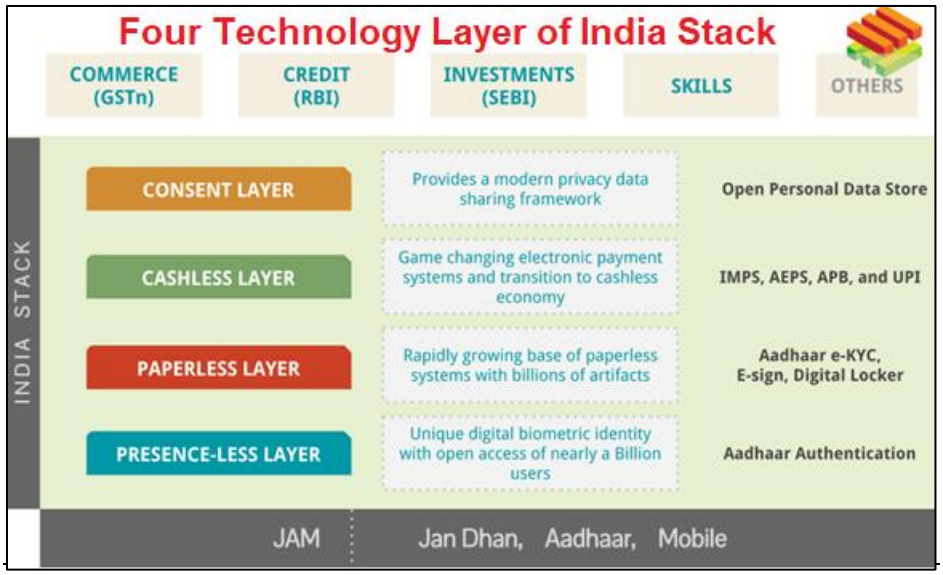

Figure 4.3 Indian Stack

4.5.2 AI/ML

(a) **Farming**. The International Crop Institute for Semi-Arid Tropics (ICRISAT) has developed an AI Sowing App for farming in Andhra Pradesh and Karnataka. The application uses machine learning to recommend optimal sowing dates in Telugu and Kannada, respectively, to farmers. The farmers' yields have increased by 10 to 30 percent as a result. Apps powered by AI also recommend the optimal time to spray pesticides during cotton cultivation. Internet of Things (IoT) sensors aid in water conservation through automated drip irrigation. (ICRISAT, 2017).

(b) **Health Care**. Using AI models to reduce maternal and neonatal mortality. Research on the use of AI to develop a "precision public health" strategy enables limited resources to be utilized in a more targeted manner. To reduce maternal mortality, AI models are being used to predict the dropout risk of expecting mothers based on call logs and demographic information about beneficiaries. The use of missed calls and automated calls ensures that mothers, particularly those from low-income households, do not miss health care appointments. In the healthcare industry, AI and IoT are considered to be more disruptive technologies (PwC, 2018).

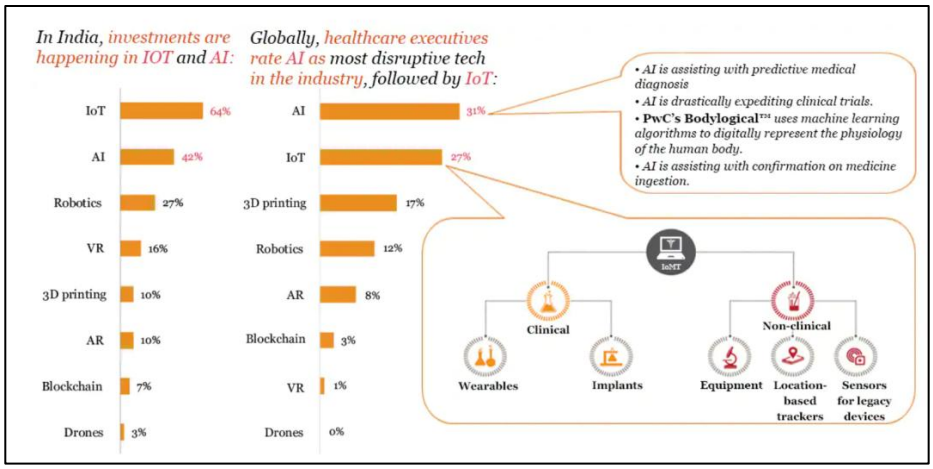

Figure 4.4 Disruptive Technologies in Healthcare: AI & IoT

(c) **Policing**. Several state governments, including those of Delhi, Punjab, Uttar Pradesh, and Maharashtra, have begun using AI and ML to combat crime. Many states have also begun to employ AI and computer vision to monitor traffic, identify traffic patterns and congestion trends, and issue citations to drivers who violate traffic laws.

(d) **Income Tax**. Tax assessments and decisions for audits are led by AI /ML for both direct taxes (such as income tax) and indirect taxes (such as GST). The

'Transparent Taxation Platform' of India employs AI and ML for outlier detection and taxpayer network analysis to identify tax fraud and tax evaders.

4.5.3 Blockchain

(a) **Academic Documents**. CBSE and the Ministry of Electronics and Information Technology (MeitY) have established "Academic Blockchain Documents", in which Class 10^{th} and 12^{th} mark sheets are stored in Blockchain technology, with data being stored over six different digital registers. This reduces the time and effort necessary to authenticate academic documents for higher education, employment, or financial loans (Academic {BlockChain} Documents (ABCD), 2021). A similar project has been implemented by IIIT Basar for tackling fake certificates in the State of Telangana.

(b) **Dharani**. It is an integrated land record management system built on Blockchain to create contemporary, all-inclusive, transparent, and near real-time land records (akin to Core Banking solutions) in Telangana.

(c) **T-Chits**. It is a method for administering Chit fund businesses in Telangana. It incorporates all state foreman organizations and registrars onto an immutable, smart contract-enabled and highly secure Blockchain system. This has enabled subscribers' trust and transparency and has provided regulatory oversight for the government.

4.5.4 Drones

(a) **Land Mapping**. The Ministry of Panchayati Raj has launched SVAMITVA to establish clear property ownership in rural inhabited areas by

mapping land parcels using drone technology and providing village household owners with 'Record of Rights' and legal ownership cards.

(b) **Monitoring Activities**. Indian Railways, National Highways Authority of India (NHAI) and state highway authorities are using drones to monitor stretches of the railway and road infrastructure. Disaster relief agencies, including the National Disaster Management Authority (NDMA) and National Disaster Relief Force, have used drones as part of their operations. Various state governments, including Gujarat, Andhra Pradesh, Jharkhand and Karnataka, have used drones to monitor mining activity.

(c) **Medicine from the Sky (MFTS).** It is a project by the State of Telangana driving the adoption of drones in healthcare logistics for medical deliveries. This has been undertaken in partnership with the World Economic Forum and HealthNet Global (Apollo Hospitals).

(d) **Mapping Property Tax**. The Government of Tamil Nadu has deployed drones in Chennai for mapping property tax and encroachment of government land. The processed data also enable officials to estimate the actual property tax and levy penalties on owners who have illegally paid lower dues. In addition, drones also help authorities plan for disaster management.

4.6 Summary

(a) New Age Technologies are revolutionizing the way we live and work, and the Gartner 26 Emerging Technologies and Trends are at the forefront of this transformation. These technologies have the potential to change the way we interact with the world around us, enabling more efficient and intelligent systems

across a range of industries. AI Engineering and Governance, for instance, can be used to design, develop and deploy AI systems, while ensuring ethical and responsible use of these technologies. Edge AI and Empowered Edge enable faster processing of data and more efficient decision-making, particularly in areas such as healthcare and manufacturing. Digital Twins and Foundation Models enable simulations and predictive analysis, while Algorithmic Trust and Blockchain provide secure and transparent digital transactions. Self-supervised learning has the potential to significantly improve the accuracy and efficiency of machine learning algorithms, particularly in areas such as computer vision and natural language processing. Metaverse has the potential to create new forms of social interaction, entertainment, and commerce and is expected to have a significant impact on industries such as gaming, education, and healthcare, as well as on the way we live and work in the future. It is anticipated that the Metaverse will enable new forms of collaboration and creativity, as well as providing new opportunities for businesses and individuals to connect and engage with one another. Overall, these technologies have the potential to transform industries and societies, making them more efficient, transparent and sustainable.

(b) Adopting New Age Technologies is critical for countries to remain competitive in the global marketplace. These technologies enable more efficient and intelligent systems, which can lead to increased productivity, reduced costs, and improved customer experiences. Additionally, these technologies can provide countries with a strategic advantage in key areas, such as healthcare, manufacturing, and finance. By adopting these technologies, countries can

position themselves as leaders in innovation and attract investment, talent and businesses to their economies. Furthermore, the adoption of these technologies can help address some of the most pressing challenges facing societies, including climate change, healthcare, and education. Overall, the adoption of new age technologies is critical for countries to remain competitive, address societal challenges, and position themselves as leaders in innovation.

(c) New Age Technologies have the potential to transform e-services and enable citizen-centric governance. By leveraging emerging technologies such as AI, Blockchain, and the Internet of Things (IoT), governments can create more efficient and effective e-services, improving citizen satisfaction and engagement. For example, AI-powered chatbots can provide 24/7 support to citizens, answering their queries and resolving their complaints. Blockchain can be used to provide secure and transparent online transactions, reducing fraud and corruption. The IoT can enable governments to collect real-time data on citizen behavior and preferences, improving the targeting and delivery of public services. In addition, the use of new age technologies can also help governments to improve the speed and accuracy of decision-making, as well as enhancing the monitoring and evaluation of public services. This can help to improve the quality and effectiveness of public services, as well as enabling governments to be more responsive to citizen needs and expectations. Furthermore, the adoption of new age technologies can facilitate greater collaboration and participation between citizens and government, enabling citizens to provide feedback and suggestions on public services and policies. Ultimately, the use of new age technologies can

help to create more inclusive, transparent and participatory governance systems, empowering citizens and strengthening democracy. Overall, the adoption of new age technologies can enable governments to become more citizen-centric, creating more accessible, transparent and efficient services that meet the needs and expectations of citizens.

Chapter 5 - A Critical Examination: Existing Policy Framework of New Age Technologies

5.1 Introduction. Good technology governance, strategies, regulations, policies, and standards are necessary for maximizing the benefits of technology while minimizing its threat. New age technologies do not easily fit within the regulatory frameworks that have been utilized historically. They evolve rapidly, transcend traditional industry boundaries, devour data, defy political borders, and derive network effects from sharing information. The traditional concept of regulatory silos no longer applies to modern technologies (Global Technology Governance Report 2021, 2020). Artificial intelligence does not quite fit into existing regulatory frameworks. Existing national financial laws may be violated by international Blockchain ledgers. Drones and the Internet of Things may raise privacy concerns. Autonomous vehicles may alter traditional safety risk assessments. The governance of these new technologies will necessitate the development of new doctrine and protocols that foster innovation while reducing social costs. A collaborative approach is required between Private and Public sector along with other stakeholders for making decisions which shall be in the benefit of generations to come in future. Governance must be more agile and adaptable in order to effectively respond and adapt to the ways in which these technologies are altering business models and social interaction structures. Governance of modern technologies includes a vast array of frameworks, including multi-stakeholder approaches, self-regulation, non-binding guidance standards, certifications, and non-profit guidance.

5.2 Governance Challenges NATs. Each of the NATs pose its own unique governance challenges, which are complex, diverse, and uncertain. These challenges include,

(a) **Pacing Problem**. The pace of technology development far outstrips the capability of regulatory systems to keep up.

(b) **Limitations of Existing Regulatory Jurisdictions**. Many applications of New Age Technologies raise broader ethical and social concerns relating to human enhancement, autonomy, dignity, fairness, equitable access, privacy, and longer-term impacts on society. These issues are largely outside the safety and efficacy scope of current agency jurisdictions and thus often escape any regulatory oversight.

(c) **Wider Span of Applications**. Technologies such as AI, nanotechnology, and Blockchain have a wider span of applications and are referred to as "enabling" or "platform" technologies. These technologies span many different regulatory agencies, each with their own organic statutes with different requirements, criteria, and goals. The end result of this multitude of applications, regulated parties, stakeholders, and regulators is tremendous regulatory diversity and complexity. Further complicating the regulatory challenge, new age technologies are inherently international in application, creating the need for some type of international coordination.

(d) **Limited or Lack of Regulation**. Lack of preparedness for long-term impact by regulatory bodies for new age technologies like AI, Drones, Blockchain, IoT. For example, Lack of regulation of facial recognition, Blockchain-enabled smart contracts, which instantly transfer funds based on

sensors that mark the physical location of goods, enable deals and business disputes that are beyond current financial regulations and security vulnerabilities of IoT devices leading to the victim of cyber security breaches by hackers.

(e) **Adverse Effect of Technology**. Algorithms are very valuable for society, but without effective governance, algorithms can have adverse and unintended consequences. Bad actors have new tools to influence the public or unjustly harm individuals, organizations and governments. Like Use of cryptocurrencies in ransomware attacks, Deepfakes, in which politicians, celebrities or news anchors can be made to, appear as if they have said things they did not. At the distribution end, Deepfakes poses a question of how much responsibility platforms take for the content they distribute, and their obligation to their users.

(f) **Accountability**. Assigning responsibility for decisions by autonomous systems can be challenging. Legislators can make the process of resolving these ambiguities significantly less chaotic if they are prepared well in time

(g) **Privacy and Data Sharing**. There is a lack of shared technical standards and governance frameworks for sharing information for various purposes for e.g. Data for surveillance by law enforcement agencies, corporate profiteering or policing. But viewing data solely through the lens of privacy is insufficient to address this challenge. In order for technologies to reach their full potential, regulators and legislators should both protect privacy and encourage data sharing.

(j) **Accessibility and Utilization by Law Enforcement Agencies**. Applications of artificial intelligence, such as facial recognition, heighten concerns that private data may be misused for surveillance, border control, and

law enforcement. Currently, the majority of governance frameworks do not instruct law enforcement agencies on how to utilize data generated by technologies such as IoT and drones. As this technology spreads, more data will be collected, and with it, more opportunities for exploitation. To increase confidence in these technologies – and law enforcement – the right balance must be maintained between citizen privacy and legal data access.

(k) **Cyber Security**. Cyber attackers can modify decisions or outcomes in AI-based systems; for example, an adversarial attack could trick a combat drone into misclassifying a crowded civilian area as an enemy, or autonomous vehicles could be hacked to cause gridlock. Data poisoning (altering training data for machine-learning algorithms) and image recognition system deception are two types of adversarial attacks (altering digital images or modifying physical objects). Impacts of these types of attacks could include influencing a search algorithm, recommending a specific company's product, causing a self-driving vehicle to ignore a street sign, and, in the worst-case scenario, killing people by targeting a missile at the wrong location. If criminals had access to sensitive healthcare information, they could intimidate patients and discriminate against certain groups. IoT devices frequently have inadequate security protection, making them especially vulnerable to cyber threats. A public-private partnership with an organization dedicated to advancing the safe commercialization of evolving technology is an efficient model for establishing the minimum level of transparency required for IoT security quickly and effectively.

(l) **Human Supervision**. AI powered systems have been created with the ability to work with minimal human involvement with high confidence levels. The question about where exactly in the decision process humans should insert themselves is still unanswered.

(m) **Cross-Border Inconsistencies and Restricted Data Flows**. Transnational operation of modern technologies further complicates the regulatory process. Data and privacy laws vary from country to country, ranging from no-touch regulations to restrictive systems, which increase the difficulty of designing an effective system and the likelihood that existing technologies will not be compliant. In addition, many nations have restrictions on the sharing of data, particularly in the areas of finance and healthcare. However, data is an essential component of technologies such as AI autonomous vehicles and Blockchain, and restricting its flow can hinder the development of data-dependent fields. Similarly, Blockchain multiparty and cross-border architecture ceases to function effectively when subject to the regulatory positions of different nations. Regulatory perspectives on cloud adoption, national open application programming interface (API) standards, cyber security requirements, and health data vary by country. As multiparty, cross-border Blockchain business models proliferate, authorities will need a thorough understanding of the laws governing transactions, decision rights, consensus, and intellectual property (IP). As the development of these new technologies continues, regulators must anticipate their needs and risks.

5.3 The governance of NATs is to be treated as a "Wicked Problem" due to its numerous difficulties. Similar to wicked problems, the governance of new age technologies is characterized by uncertainty, complexity, diversity, conflict, and controversy. The paper proposes or attempts four alternative strategies: soft law, precaution, resilience, and liability. Each of these approaches offers significant benefits and advantages, but as the sole mechanism for governing 21st-century technologies, they are flawed. The wicked problem framework offers a number of helpful insights that may be applicable to the governance of new age technologies. The first is the understanding that there will be no optimal or perfect solution; therefore, we must "make do" with imperfect solutions. The most effective method for addressing a wicked problem is to combine multiple strategies, which, in the context of new age technologies, means combining two or more of the four governance strategies. Finally, a wicked problem requires some type of coordination mechanism, which has been recognized as a requirement for the governance of new age technologies also. The integration of these three lessons from the experience with wicked problems may result in a more harmonious and effective integrated strategy for governing new age technologies (Marchant, 2020).

5.4 Global Trends - Policy Formulation

5.4.1 Korean Science, Technology and Innovation Policy.

(a) Korea's 4th year S&T Policy (2018-22), vision was to raise quality of life and contribute to humanity through S&T. The policy framework was built on four core strategies namely; To tackle future challenges, Foster on active S&T innovation ecosystem, Job creation in new industries and Create a better life. This was well supported by R&D legal structure with 120 management regulations

under a single act and subordinate statues. Research friendly R&D ecosystem was achieved by - Simplifying national R&D procedures, Creating research environment that fosters challenge and tolerates failure and Establishing integrated R&D information system across the ministries. During the period the basic research was further strengthened, by increasing the budget by 50% to encourage creative and challenging research and also expanding the fields of application from one to six. During this period the innovation capacity of SMEs was enhanced through - funding of R&D by SME increased by 42%, systemized support provided during the growth cycle, opening markets for SMEs products developed from R&D and encouraging open innovation for technological development through universities, startups and research institutes.

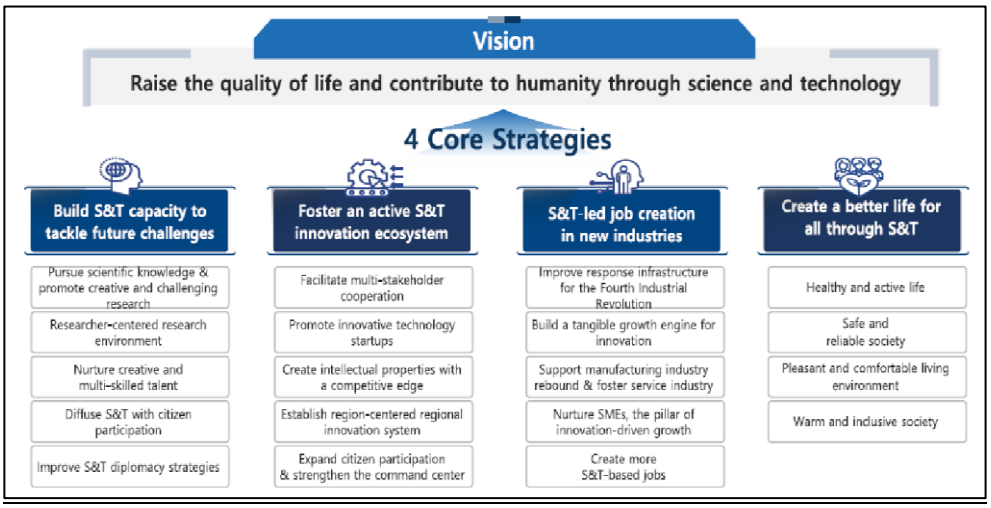

Figure 5.1 4th S&T Policy (Korea, 2018-22)

(b) **Climate Change**. Also as part of the technology framework, a roadmap for net zero 2050 in response to climate change has been built with the aim of decreasing carbon, utilizing carbon and adapting to climate change, where in climate technologies have been identified.

(c) **Mission**. The mission of the S&T policy of Korea is as under:-

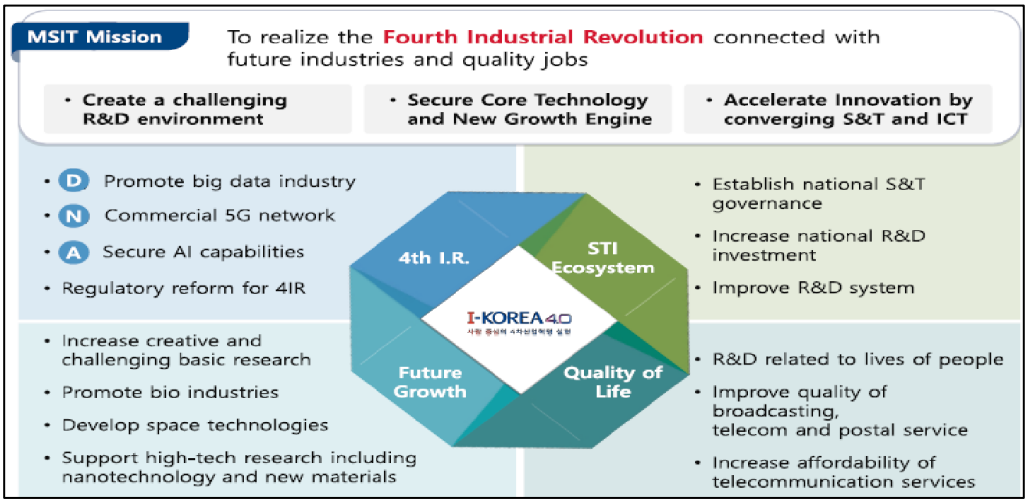

Figure 5.2 Mission of Ministry of Science & IT (Korea)

(d) **Future Policy**. Korea has now made a shift from S&T policy to Science, Technology and Innovation (STI) Policy for 2023-27. The future policy scope would include non R&D policy means (Regulatory reforms), Performance goal shall be measured in quantitative outcome of policy (GDP increase per R&D investment and policy direction is to focus on solving national/social problems (like carbon neutrality by S&T).

(e) **Framework for 5th S&T (2023-27)**. The framework for 5th S&T policy is based on four core strategies Recovery (For strengthening resilience of the economy for fast recovery after crises), Inclusion (To build social safety net to enhance citizens' quality of life), Survival (To cooperate more in reacting to global crisis like climate change) and Innovation (To upgrade foundation for S&T Research by securing more manpower in R&D and improving R&D System.

Figure 5.3 5th STI Plans (Korea, 2022-2026)

(f) Historically Korea's S&T has been focusing on broad goals for each five year plan, Promoted R&D (increased from 2.4% of GDP in 1998 to 4.5% of the GDP in 2022) and innovation as the driver of national economic and social growth, Private sector playing major role in R&D (80% funding in 2019), Funding of Emerging Tech Projects, collaborative approach between government, industry, and the academic community in the process of nation building, High Tech Swap of researchers between industry and academia, Promoting Chaebols (large industrial groups) for investing in R&D, Corporate Institution (led by Samsung, L&G) - academic collaborative approach in publication of research articles in high quality science journals, Setting up Regional Innovation Centres by Caeobols, Funding of Small Sized Business, Nation Building Programmes like building up the national broadband infrastructure and provide public programmes about maximizing its use.

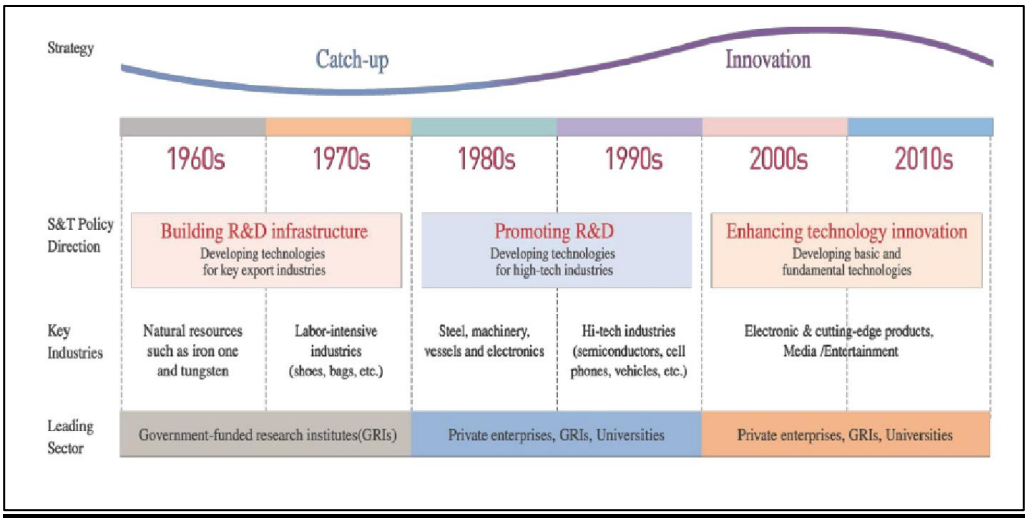

Figure 5.4 Historical View of S&T Policy (Korea)

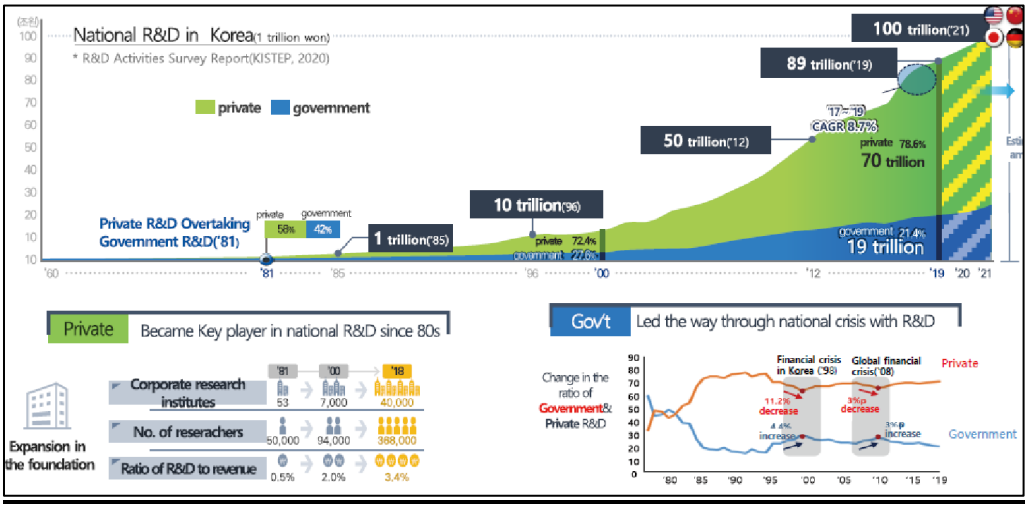

Figure 5.5 Canvas of R&D (Korea)

5.4.2 The US Innovation and Competition Act 2021 aims to increase investment in US technology research and development, strengthen supply chains, and address the growing competition from China. The ultimate goal is to strengthen the factors that have propelled decades of U.S. innovation i.e. interconnectivity between academic research, government grants, venture capital, and free market competition (congress.gov, 2021). The highlights of the act are:

(a) **Strengthening the National Science Foundation (NSF)**: The act includes provisions to enhance the NSF's research capabilities and prioritize

funding for research that addresses pressing societal challenges. It authorizes $81 billion for the National Science Foundation (NSF) over five years, including $29 billion for a new technology directorate that will focus on emerging technologies like artificial intelligence, quantum computing, and advanced manufacturing.

(b) **Strengthening Semiconductor Industry**. The act provides $52 billion in funding to boost US semiconductor manufacturing and research, as well as establish a National Semiconductor Technology Center.

(c) **Improving Technology Supply Chain**. The act authorizes $10 billion for the Department of Commerce to support the development of key industries, such as 5G, advanced manufacturing, and biotechnology, as well as improve supply chain resilience.

(d) **Enhancing Technology Transfer**. A new directorate for Technology and Innovation has been created within the National Science Foundation to better facilitate technology transfer and commercialization of research.

(e) **Addressing Cyber Threats**. It provides funding for cyber security research and development, as well as for the establishment of a new Cyber Response and Recovery Fund to help government agencies and critical infrastructure providers recover from cyber attacks. National Institute of Standards and Technology (NIST) is to develop cyber security standards and share best practices with research institutions.

(f) **Support for Small Businesses**. Funding for small businesses to help them adopt new technologies and increase their competitiveness in the global marketplace.

(g) **Strengthening Competition Laws**. A No of provisions aimed at strengthening antitrust laws and promoting competition in the technology sector. It establishes a new technology competition task force and provides new funding for the Department of Justice and Federal Trade Commission to enforce antitrust laws.

(h) **Addressing Geopolitical Competition**. The act aims to counter China's efforts to spread its influence through economic coercion and other means.

5.4.3 General Data Protection Regulation (GDPR). It is a 2018 EU law that regulates data protection across the single market and gives individuals in the expanding digital economy greater control over how their personal data is used. It applies in all EU Member states, which makes it easier for both businesses and citizens (GDPR, 2018).

(a) This law is applicable to all the organizations that process personal data and operate within, or sell goods to the EU. The processing covers every type of data usage and includes collection, storage, retrieval, alteration, storage and destruction.

(b) It applies to both data ‘controllers’ and ‘processors’. Data controllers determine the purpose and manner in which data is processed. Data processors are any third-party undertaking data processing on behalf of a controller.

(c) The law defines personal data as ‘any information relating to an identified or identifiable natural person’. Under this law there are few special categories of sensitive personal data that are given greater protections. Implementing appropriate measures to protect information relating to employees, customers and

partners is of paramount importance. The definition of personal data also includes all information that could be used to indirectly identify individuals.

(d) Seven principles that gives out guidelines for handling the personal data:-

- Processed lawfully, fairly and in a transparent manner.
- Purpose limitation - Collected for specified, explicit and legitimate purposes.
- Data minimization - Adequate, relevant and limited to what is necessary to be collected.
- Accurate and, where necessary, kept up to date.
- Storage limitation- Retained only for as long as necessary.
- Integrity and confidentiality (security) - Processed in an appropriate manner to maintain security.
- Accountability - It means documenting how personal data is handled and the steps taken to ensure only people who need to access some information are able to. It also includes training staff in data protection measures and regularly evaluating and data handling processes.

(e) In order to help protect rights of the citizens eight rights of the individuals have been amplified - the right to be informed, the right of access, the right to rectification, the right to erasure, the right to restrict processing, the right to data portability, the right to object and also rights around automated decision making and profiling.

(f) This law also has the ability for regulators to impose huge fines on organizations for non-compliance of the guidelines like: doesn't process an

individual's data in the correct way, doesn't have a data protection officer, for security breach of data etc.

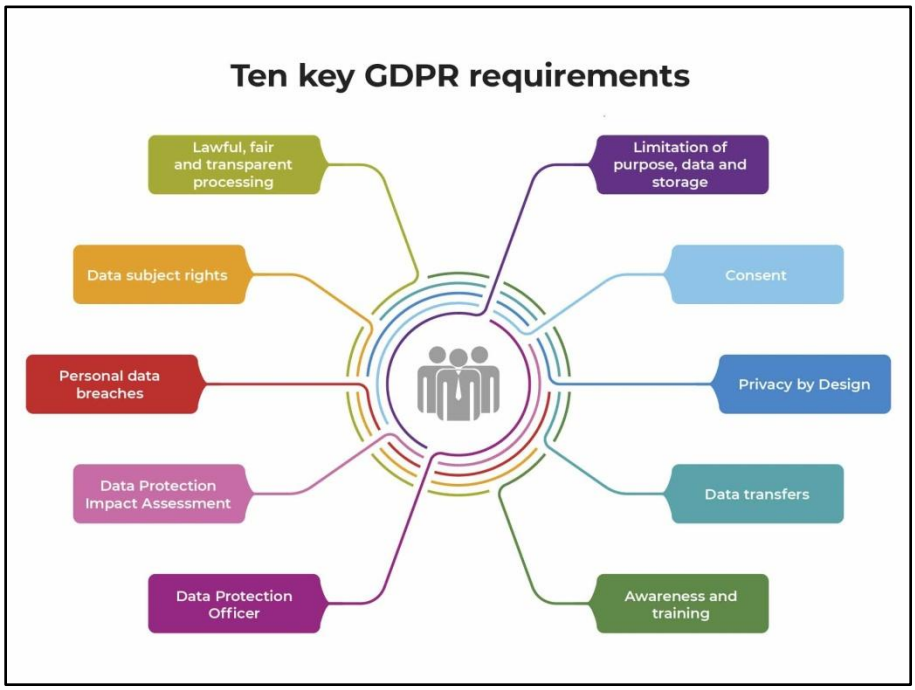

Figure 5.6 GDPR Compliance Requirements

5.4.4 EU Ethics Guidelines for Trustworthy AI was written by the High-Level Expert Group on AI and published in Apr 2019. These are a set of recommendations for the development and deployment of AI that is trustworthy, ethical and respects fundamental rights (Shaping Europe's Digital Future, 2019). The key highlights of the guidelines include:

(a) **Human Agency and Oversight**: AI should be designed and developed to support human autonomy, decision-making and actions. It should be auditable and transparent, enabling individuals to understand and challenge the decisions made by AI systems.

(b) **Technical Robustness and Safety**: AI systems should be reliable, secure and safe, minimizing the risk of unintended or malicious harm. AI should be

developed in a way that can detect and mitigate any biases and errors in the data and algorithms used to train and operate the system.

(c) **Privacy and Data Governance**: AI systems should respect individuals' privacy, personal data and other confidential information, in accordance with EU data protection laws. Personal data should be collected and processed only when necessary, with appropriate safeguards and with the consent of the individual.

(d) **Transparency**: AI systems should be transparent and understandable, with clear explanations of how the system works and what decisions it is making. This should enable individuals to have a clear understanding of the implications of the AI system on their lives.

(e) **Diversity, non-discrimination and fairness**: AI systems should be developed and deployed in a way that avoids perpetuating or exacerbating discrimination and bias. They should promote diversity, equality and fairness, including by being accessible to individuals with disabilities.

(f) **Societal and Environmental Well-being**: AI should be designed and deployed in a way that supports and promotes human well-being and the environment, as well as being in line with social values and ethical principles.

(g) **Accountability.** It necessitates that mechanisms be put in place to ensure responsibility and accountability for AI systems and their outcomes, both before and after their development, deployment and use.

These guidelines set out a framework of ethical principles that are intended to inform policy and regulatory decisions around AI in the EU. The guidelines are a significant step towards promoting responsible and ethical AI development and

deployment, and have been used as a reference point for the development of AI-related regulations around the world.

5.4.5 EU Artificial Intelligence Act (2021). The Artificial Intelligence Act defines AI broadly as a suite of software development frameworks that encompass machine learning, expert and logic systems, and statistical approaches. It uses a risk-based approach and sets up a series of escalating legal and technical obligations depending on whether the AI product or service is classified as low, medium or high-risk, while a number of AI uses are banned outright. Imposition of extensive documentation, training, and monitoring requirements on AI tools fall under its purview of the act. The act applies to any provider or distributor of AI whose services or products reach the EU market. Non compliance of the act, shall lead to heavy penalties on provider or distributor (EU, 2021).

5.4.6 UK National AI Strategy (2021). The strategy is for the next 10 years for regulation and promotion of artificial intelligence (AI) in the UK. The strategy is divided into three core aims. Firstly, invest and plan for the long-term needs of the AI ecosystem. Secondly, support the transition to an AI-enabled economy, ensuring AI benefits all sectors and regions of the UK. Thirdly, ensure the UK gets the national and international governance of AI technologies right, encouraging innovation and investment while protecting the public and the UK's fundamental values. In addition, the UK government's key planned actions include proposed new publications, research initiatives, collaborations with existing UK and international bodies, consultations, and a focus on strategic investment and up-skilling. The other strategies in support of AI which are under finalization are – National Strategy for AI in Health and Social Care, Guidance on AI Ethics and Safety (Updates), Ministry of Defence AI Strategy, Data Availability

Policy Framework. In addition, the UK is also undertaking initiatives like the National AI Research and Innovation Programme, AI Standards Hub for taking up AI standardization globally (National AI Strategy , 2021).

5.4.7 Artificial Intelligence Risk Management Framework (AI RMF 1.0). The framework has been developed through a consensus-driven, open, transparent, and collaborative process by the National Institute for Standards and Technology (NIST). It is intended to help incorporate trustworthiness considerations into the design, development, use, and evaluation of AI products, systems, and services. The framework outlines four core functions to help identify practical steps to manage the AI risk and help to ensure that AI systems include all the characteristics of a trustworthy AI system. The framework will be updated, expanded, and improved based on evolving technology and feedback obtained (NIST, 2023).

5.4.8 UK Government Cloud First Policy and G Cloud Marketplace. The cloud first policy means that public-sector organizations need to first consider and fully evaluate cloud solutions before considering any other option. If a government agency selects an alternative to cloud, they need to be able to demonstrate that it can offer better levels of security, flexibility and/or value for money. G-Cloud is a framework for UK public sector bodies to buy cloud-based IT services. The policies have helped boost UK public sector use of cloud (Government Cloud First Policy, 2022).

5.4.9 GovTech, or Government Technology Agency of Singapore harnesses the best info-communications technologies to make a difference to the everyday lives of the citizens. Innovation is the spirit behind their programs to drive innovative projects for public good. Singapore ranks in top ten in various indices of the United Nations and

World Economic Forum. A No of initiatives like capability centers for new age technologies, Digital Blueprint for digital transformation etc have been undertaken. Accordingly for the year 2023 the goals have also been elaborated.

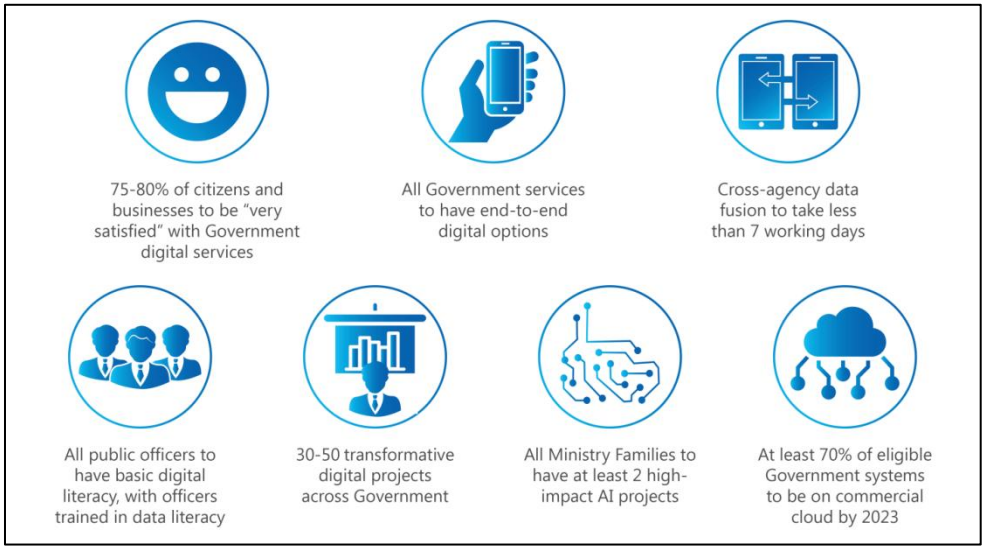

Figure 5.7 GovTech Goals 2023: Singapore Government

5.4.9.1 Capability Centers for Emerging Technologies. In Singapore five capability centers have been established to strengthen Public Sector engineering expertise and build the government's capabilities in emerging technologies. Together, they enable GovTech to develop and deliver innovative citizen-centric products and services across the whole-of-government, in collaboration with Ministries and Statutory Boards (Digital Government Transformation - Singapore, 2022).

(a) **Application Design, Development & Deployment**. It delivers citizen-centric government digital services that support public sector digital transformation. It utilizes its deep technical expertise in design and software development methodologies - such as Agile, user experience design, quality engineering, DevOps and platform as a service. It delivers scalable, resilient, and

reusable digital services which are supported by the Singapore Government Technology Stack.

(b) **Cyber Security.** It develops a comprehensive suite of cyber security capabilities to support its missions. It has capabilities to detect and respond against cyber threats to uncover cyber vulnerabilities in Government ICT and Smart systems.

(c) **Data Science and AI.** It uses data science and artificial intelligence (AI) to extract data-driven insights and build smart platforms that help improve the delivery of citizen-centric services and ultimately support government policy outcomes. It enables the data skill sets and data infrastructure of the public agencies.

(d) **Government ICT Infrastructure**. It develops agile, secure, resilient and cost-effective centralized ICT infrastructure – data centers, application devices, networks that is optimized for government operations and improves the user experience for public officers.

(e) **Sensors and Internet of Things.** This center works on the design and implementation of a Whole-of-Government Internet of Things (IoT) infrastructure that is built on the larger Smart Nation Platform. This infrastructure will enable connectivity by smart objects, including static and mobile ones such as wearables, sensors, mobile devices, and facilitate high speed transmission of data from the sensors. The center will also build up the government's capabilities in new, emerging technologies and collaborate with commercial organizations, research

institutes and public agencies to experiment with and pilot new technologies to address their problems.

5.4.9.2 Digital Government Blueprint. Digital Government Blueprint by Singapore Government gives out the ambition to better leverage data and harness new technologies, and to drive broader efforts to build a digital economy and digital society, in support of Smart Nation. The vision is to create a Government that is "Digital to the Core, and Serves with Heart" (Digital Government Transformation - Singapore, 2022).

(a) This enables them to build stakeholder-centric services - easy, seamless and secure - that cater to citizens' and businesses' needs. Public officers continually up-skill themselves, adapt to new challenges and work more effectively across agencies as well as with our citizens and businesses.

(b) A "digital to the core" framework has been developed to describe how the Government is developing and measuring itself towards this vision. There is a greater emphasis on "Serves with heart" to explain how the use of digital technologies is to help the Government achieve its main purpose of serving citizens better and building trust.

(c) It stresses greater importance on user centricity and co-creation, improving how we work as digital organizations and harnessing new technology including Artificial Intelligence.

(d) DGB will benefit the citizens through - Electronic payment and digital signature options for 100% of Government services, Intuitive, accessible and easy-to-use digital services, Greater confidence in sharing data as digital services

infrastructure continues to be fortified, More digital services built around the needs of citizens.

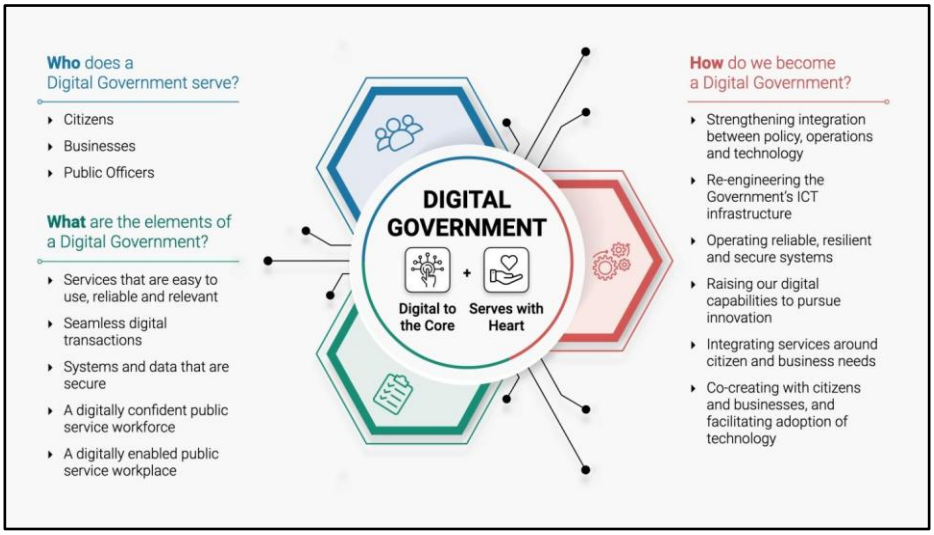

Figure 5.8 Digital Blueprint of Singapore Government

5.4.10 Innovative Governance Frameworks. There are certain innovative and governance frameworks which have been adopted for the new age technologies. These technologies blur international borders and also entangle the border between public and private. Pioneering public-sector innovators are learning that with creativity and forethought the sectors can work together to effectively govern new generation technologies.

(a) **Ethical Governance**. Ethical governance frameworks have been developed by many countries, which provide guidelines on approach to development of new age technologies responsibly. The Government of New Zealand has developed a set of Privacy, Human Rights and Ethics (PHRaE) framework in 2017 to incorporate privacy, human rights and ethics into the design process of government algorithms. The framework is an iterative process that covers the entire life cycle of a project. This is further advanced for development of AI governance frameworks that are inclusive, promote trust and minimize risk while maximizing benefit.

Similarly in 2019, the UK government's Facial Recognition Working Group prepared guidelines on ethical issues relating to the use of real-time facial recognition for policing. This outlines a set of nine ethical principles to inform the use of live facial recognition, including public interest, effectiveness and the avoidance of bias and algorithmic injustice. Also another case is that the University of Montréal has developed a framework for responsible development and deployment of AI in 2018. It consists of a set of 10 principles and is guided by the principles of equitable, inclusive and ecologically sustainable development.

(b) **Public Private Coordination.** The public and private sectors are collaborating to achieve the growth of new age technologies as well as safeguard the interests of the citizens. This has been achieved through methods such as - multi stakeholder engagement, co-created regulation and self-regulation. For Example, In Japan, the Financial Services Agency has accorded the Japan Virtual and Crypto Asset Exchange Association (JVCEA) the status of a self-regulatory body for the country's crypto exchanges – recognizing the private sector's role in providing effective governance. It is authorized to establish binding guidelines on behalf of the crypto currency industry, including rules for local trading platforms and accurate reporting of transactions. To enhance transparency, the self-regulatory body periodically releases data on trading volume and the value of crypto currencies. Similarly, community-led effort BetterIoT has launched an online self-assessment tool that evaluates a connected product on various dimensions including privacy, licensing provisions and interoperability.

(c) **Agile Responsive Regulation.** The existing process of regulation is reactive, slow and stays rigid once created. In contrast, new age technologies are often developed in agile sprints, beta tested on early adopters and swiftly updated. For innovation to thrive, agile and responsive regulation is crucial. The National Highway Traffic Safety Administration (NHTSA) in the US issued its guidelines for autonomous vehicles in 2016. Based on feedback from industry participants, the guidelines have been revised and iterated as AV technology has evolved.

In certain cases, agile and responsive regulation gives more flexibility to low-risk products and services. The European Aviation Safety Agency (EASA) has divided drone regulations into three categories based on the risks they pose - open (low risk), specific (medium), and certified (high risk). Low-risk drones that do not fly beyond the line of sight would not require any formal authorization, while high-risk drones are subject to the same rules as the manned aircraft with which they share airspace. Also the city of Lisbon exhibits responsive regulation in its approach to new transit technologies. For “greenfield” innovation, where outcomes are unclear but there is a potential upside, the city focuses more on “soft” regulation and guidance. For “brownfield” innovation, where the risks are better known, the city may instead adopt “hard” regulation. Lisbon’s evolving approach to e-scooters provides an illustrative example. Initially the city took a hands-off approach and nine companies entered the city within one year. As the process evolved, a forum was created in which both the city and the operators met and discussed the changes that must be put in place to address the potential problems and risks that arise. The city has also announced the first-ever corporate

mobility pact, in collaboration with several private-sector partners, to accelerate sustainable urban transformation.

(d) **Experimental: Sandboxes and Accelerators.** In sandboxing, regulators simply observe the consequences of a new technology in the safety of an isolated environment. This provides enhanced regulatory support and enables firms to test their models and develop proofs of concept. In this way, regulatory structures can also emulate a start-up accelerator by deliberately encouraging innovation. In April 2020, the Financial Conduct Authority of the UK launched a digital sandbox for financial organizations experimenting with innovative business models and products to tackle the pandemic. Similarly Malawi's sandbox was the first in Africa established to test the use of drones for humanitarian purposes such as delivering medical supplies. Also in the US, the Department of Transportation and the FAA conducted a pilot study with 10 public-private partnerships to test unmanned aerial systems. This study aimed to test the safe operation of drones in a variety of conditions currently forbidden like operations over the heads of people, beyond the line of sight and at night.

In April 2020, the UK Civil Aviation Authority admitted a drone operator to the sandbox to test beyond visual line of sight (BVLOS) operations in shared airspace. Like other sandboxes, it relaxes legal barriers in order to encourage businesses to test new ideas. Similarly a Swiss company tested the model of a "flying weather station" in which a drone embedded with sensors collects atmospheric data that can be used to forecast weather and develop other innovative services.

(e) **Data Sharing and Interoperability.** Technologies like AI and data analytics rely on data to refine their operations. The Alliance for Telecommunications Industry Solutions (ATIS), a standard-setting body, created a framework for IoT to promote data sharing, data exchange marketplaces and public-private partnerships among smart cities. Finland's Transport Code requires public transport operators to make certain data (timetables, routes, ticket prices) available via open APIs. Now commuters in cities such as Helsinki can plan, book and pay for trips using multiple public and private modes via a single application interface.

(f) **Regulatory Collaboration.** The new age technologies flow and affect across national boundaries due to the rippling effect of innovations. The regulation is required to be collaborated among agencies within a country as well as cross-border. To operate effectively on a global scale, new age technologies need a standard framework and guidelines at the international level. In the fintech sector, some regulatory convergence has led to more than 60 bilateral cooperation agreements finalized since 2016. The Global Financial Innovation Network (GFIN) is a network of 50 organizations, mostly financial regulators, which enable firms to test their products and services in other countries via a global fintech sandbox.

(g) **Cyber Security.** Finland has launched a cyber security labeling system to inform consumers about which IoT products meet digital safety standards. Vendors have to apply for security badge certification through a website, which consumers can also consult to make informed purchases. In 2020, the UK

government is making a legislation in which all consumer smart devices sold to have rigorous security requirements. In other initiatives, models based on public-private partnerships or third-party certifications are also being explored.

(h) **Model AI Governance Framework** (**2020**). The Government of Singapore's Personal Data Protection Commission (PDPC) has created a Model AI Governance Framework, intended to help the private sector. It covers internal governance, human involvement, operations management and stakeholder communication. It also provides use cases and an implementation and self-assessment guide.

(j) **News Site Trustworthiness Working Group Part of the Institute of Electrical and Electronics Engineers (IEEE).** This working group is developing a standard to help the public better determine which news stories are factually accurate and which are not. Using an open, automated system and a clear set of standards, they aim to rate internet news providers on several different factors.

(k) **AI Procurement Guidelines (**2019). WEF has released ten guidelines of government procurement for AI. These guidelines have been developed to help governments with low thresholds in AI and bring benefits of the technologies to the public sector. They include practices to align governments and AI providers on articulating needs, mitigating risks, managing data use and assuring accountability and transparency. Pilots using the guidelines are ongoing with the UK government, the Dubai Electricity and Water Authority and the Government of Bahrain.

(l) **Financial Action Task Force (FATF)** offers an example of how transnational standards for cross border flows can be applied to the IoT-enabled flow of data and goods. FATF has prepared a standards document, International Standards on Combating Money Laundering and the Financing of Terrorism & Proliferation, to support countries and their financial institutions in designing AML measures and combating the financing of terrorism. In this way, FATF helps member nations meet the goal of financial inclusion without compromising crime-fighting measures. The FATF's approach has been agreed to by almost every country and strong penalties are imposed for non-adherence.

(m) **Sharing Good IoT Code**. US shares its open-source software on code.gov, and has made several IoT code bases available. These code repositories can help spread IoT by making code that can tackle tough problems available for free like sensor arrays that monitor volcanoes to an IoT and AI fusion that can predict pollution in waterways. This helps spread good code, helping reduce the likelihood of vulnerabilities and breaches caused by bad code in IoT systems everywhere.

(n) **Use of IoT Data in Response Planning**. Both governments and private companies discovered the power of IoT-derived data during COVID. As companies struggled to keep supply chains moving and governments worked to deploy needed resources, both came to rely on IoT data when making real time decisions about how to respond. By integrating IoT data with digital twins of supply chains – or even whole cities – companies were able to move orders to suppliers less affected by the pandemic or reroute shipments of raw materials to

keep production moving. Similarly, governments used data to deploy and adjust city services to get the right resources to the hardest-hit areas, turning even the most mundane operations into smart city services.

(o) **Singapore's Unified, Top-Down Approach**. The city-state has deployed a unified autonomous vehicle testing framework administered by a single authority (the Land Transport Authority). The country has also been effective in shifting travelers away from private cars and on to alternative modes through a combination of carrots and sticks: making private cars extremely expensive to own and deploying dynamic congestion pricing on the one hand, and improving the level of service and quality of public transport on the other.

(p) **Transport for London's Open Data Approach**. Transport for London's policy has been to make available data such as timetables and service status and disruption information, resulting in more than 80 data feeds available through a unified API. This in turn has nurtured a system of 13,000 app developers who have developed more than 600 new products used by more than 40% of the population. The free and open data has boosted the London economy by up to £130 million a year through improved journeys, time savings, job creation and new innovations.

(q) **Drone ID Rule-making Framework**. Remote identification (remote ID), provides a framework for remote identification of all UAS operating in US airspace. The rule facilitates the collection and storage of certain data such as the identity, location and altitude of an unmanned aircraft and its control station. Remote ID was developed through a collaborative process with input from the

industry working group that helped FAA regulators to craft those rules in the first place. Remote ID is designed to enable safe, routine drone operations across the US.

(r) **Automated Drone Flight Approval**. The drone approval systems – such as the Belgian Drone guide PRO, the Swiss Flight Management System, or the US Low Altitude Authorization and Notification Capability (LAANC) wherein automated request and approval of drone operations is carried out are becoming the norm. Aided by cloud infrastructure, these increase ease of use for drone operators while providing air traffic control with greater awareness and control of drones in their area. Automated drone flight approval is one of the foundational steps in creating a system of UAS traffic management (UTM) that can truly integrate air traffic of all types in all environments.

(s) **Misinformation Law**. Spread of misinformation through fake news in the age of internet and social media impacts the perceptions of the citizens. In the recent past, Russia has been accused of manipulating the 2016 US elections through bots and fake news. Both state and non-state actors are increasingly creating automated accounts on social media to manipulate online discussions. Also manipulation of algorithms of social media and search engines to reach large audiences and mislead news consumers is a global trend now. These have been cubed worldwide through regulations/laws/forming of task forces. In India as per National Crime Records Bureau data published in Indian Express in 2021, a total of 1,527 cases of fake news were recorded in 2020, 214 % increase against 486 cases in 2019. Presently there are no specific laws against fake news in India.

Countering content manipulation and fake news to restore faith in social media without undermining internet and media freedom will require public education, strengthening of regulations and effort of tech companies to make suitable algorithms for news filtering. As per the paper, in India, online media produces almost seven times more fake news compared to mainstream media (Al-Zaman, 2021).

5.5 Existing Tech Policy Framework in India

5.5.1 National Strategy on Artificial Intelligence (NSAI-2018). NSAI elaborates across almost all focus areas, key challenges, remediation, recommendations to address those and finally the role of different stakeholders to make those happen. It has given recommendations for supporting and nurturing an AI ecosystem in India through promotion of research, skilling and reskilling of the workforce, facilitating the adoption of AI solutions and the development of guidelines for 'responsible AI'. The key focus areas which have been selected are health, education, agriculture, smart cities and mobility, which is the right step towards utilization of AII for inclusive growth in the country (NITIAayog, 2018).

5.5.2 Towards Responsible AI for All (2021). The national AI strategy document has examined the system and social considerations. It establishes broad principles for design, development and deployment of AI in India. It also highlights the potential of AI and lays down recommendations to accelerate adoption. It has recommended a framework to assign accountability for AI systems, due to gaps in the legal protection systems. There are few sector specific use cases for specific frameworks that have been identified for development and use of AI - by SEBI towards creating an inventory of AI systems in the

market and guide future policies, National Digital Health Mission identifies the need for creation of guidance and standards to ensure reliability of AI systems in health, and the Data Empowerment and Protection Architecture (DEPA) by NITI Aayog presents a technical framework for people to retain control of their personal data. The enforcement mechanisms of responsible AI in the public sector, private sector and academia needs to be addressed through a strategy paper, so that it becomes a guiding factor for development of responsible AI in India. Also for appropriate handling of data and to curb challenges like – data usage without consent, the risk of privacy, bias in selection – establishing data protection framework and sectoral regulatory frameworks with the adoption of international standards is important. The creation of Intellectual property (IP) framework to help bridge the gap between practitioners and AI developers, and adequate training of IP granting authorities, judiciary, and tribunals (NITIAayog, Responsible-AI-22022021, 2021).

5.5.3 National Mission on Quantum Technology & Applications (NMQTA) (2020). The concept paper for NMQTA has been prepared by Technology Information, Forecasting and Assessment Council (TIFAC) under DST as part of the national mission under Prime Minister's Science, Technology and Innovation Advisory Council (PM-STIAC). The aim is to evolve a long-term strategy (10 years) with short-term (5 years) targets in the quantum domain. All the important facets like Funding, R&D, Legal framework, IPR issues have been well elaborated. As a outcome of this mission in the budget 2020, a total budget outlay of Rs 8000 Crore for a period of five years has been allocated to Department of Science & Technology (DST) for investment in Quantum computers and computing, quantum key distribution, quantum communication, quantum

encryption, cryptanalysis, quantum devices, quantum materials, quantum sensing, quantum clocks, and other next-generation disruptive technologies. China has been aggressively working in the quantum domain since 2008 and as per IEEE, China has been able to develop two quantum computers. As per Quantum Strategy Institute, quantum computing capabilities are a challenge for digital cryptography protocols for online banking, digital signatures, data servers and Blockchain. These challenges need to be addressed by India so as to safeguard the digital initiatives undertaken for improving e-services under the Digital India campaign.

5.5.4 National Intellectual Property Rights (IPR) Policy (2016). The policy aims towards building a strong IP ecosystem in India. It has laid down seven objectives, namely - IPR Awareness, Generation of IPRs, Legal and Legislative Framework, Administration and Management, Commercialization of IPRs, Enforcement and Adjudication, Human Capital Development. As per the world IPR index 2021, India ranks 40 out of 53 countries (score of 38.4%), with the US (score of 95.31%) on top of the list. As per the report, in India the major issue the IP holders face is in the patenting process and denial of the patents to many innovations. The ecosystem of innovators and creators in India could be strengthened through various reforms to clarify trade secrets protection and removal of bureaucratic barriers. Also as per a paper on economic growth and innovation, economic development is influenced by the innovation degree, the allocation of resources for research and development activities, quality of human capital and by foreign direct investments stock. Foreign direct investments have a major impact on economic growth through knowledge transfer and improvement of technological processes (Pecea, Simona, & Salisteanuc, 2015). As per the 161st Parliamentary Standing

Committee on Commerce in 2021 for review of the Intellectual Property Rights regime in India, innovation and creativity influences different spheres of society are highly essential for the holistic growth and development of a country. There is a need to establish a robust and an effective Intellectual Property Rights (IPR) regime that encourages and incentivizes innovation and creativity along with securing collective interest of the society. It has recommended review of the IPR 2016 policy keeping in mind the new trends in innovation. The policy should be reviewed to bring appropriate changes to expand the innovation ecosystem in the country which would include organization of awareness drives on IPR, comprehensive advisories on increasing R&D activities, encouraging IP financing and involvement of state governments in evolving a robust IPR regime (Lamba, 2022).

5.5.5 Science, Technology and Innovation (STI) Policy, 2013. The objective of the policy was to synergize science, technology and innovation to position India amongst the top five global scientific powers. The main feature was to attract the private sector in R&D and linking STI to socio economic grow*th.* Post the policy implementation, India has moved in Global Innovation index ranking from 8^{1st} in 2015 to 40th in 2022. India's STI 2020 is under formulation aims to create a fit for purpose, accountable research ecosystem promoting translational as well as foundational research in India.

5.5.6 National Strategy for Blockchain (2021). National Strategy to evolve a trusted digital platform for providing e-Governance services using Blockchain lays out overall vision and the development and implementation strategies for a National Blockchain Platform covering the technology stack, legal and regulatory framework, standards development, collaboration, human resource development and potential use cases. The

strategy gives out the roadmap for implementation of Blockchain technology as well as National Framework for Blockchain framework. The CoE for Blockchain has been established at Bangalore. The dashboard shows the growth of Blockchain in terms of products, PoC, deployment across central/state governments and the transactions over Blockchain.

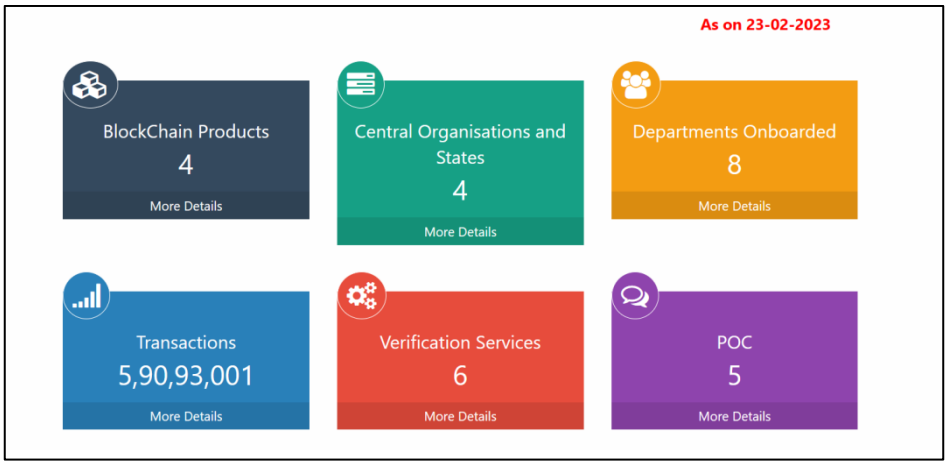

Figure 5.9 Blockchain Dashboard (CoE Blockchain)

5.5.7 Startup India (2015). Startups, technology and innovation are the effective instruments for India's transformation. Accordingly, "Startup India", was initiated in 2016 "to build a strong ecosystem that is conducive for the growth of startup businesses, to drive sustainable economic growth and generate large scale employment opportunities". Measures include funding, financial support for incubators, establishment of tinkering labs, tax benefits, and a simplified recognition process for the setting-up of businesses, among others. The success of Startup India campaign hinges on initiatives like faster and easier registration of Companies, self-certification for many legal requirements, zero inspection for three years, funding for patents, and speed of patent protection. Also provisions which aid the closure of dead companies within 90 days need to be included, under the new bankruptcy bill. The funding needs to be supported by

incubation centers by the government (Mishra, 2022). Also some other challenges which needs to be addressed are finding the right investor for funding, information gap between startup and the customer due to vastness of the country, penetrating the market dominated by big corporate, hiring qualified employers due to risk factor of start ups, skill sets of the employee, complex regulatory environment for startups and the tax policy and its enforcement are unfriendly for startups (Korreck, 2019). India's startup industry has grown despite challenges and 80,152 startups have been officially recognized by DPIIT. The funding for startups as on 30th Nov 22 is under

(a) **Startup India Seed Fund Scheme** approved for a period of 4 years with effect from 01 Apr 2021 to provide financial assistance to startups for proof of concept, prototype development, product trials, market entry and commercialization. In this fund, out of the corpus of Rs. 945 crore, Rs. 455.25 crore has been approved to 126 incubators of which Rs. 186.15 crore has been disbursed.

(b) **Fund of Funds for Startups (FFS)** provides capital to SEBI-registered Alternative Investment Funds (AIFs) to invest funds in growing Indian startups through equity and equity-linked instruments. As on 30th November 2022, in the FFS, of the corpus of Rs. 10,000 crore, Rs. 7,527.95 crore has been approved (committed) to the AIFs.

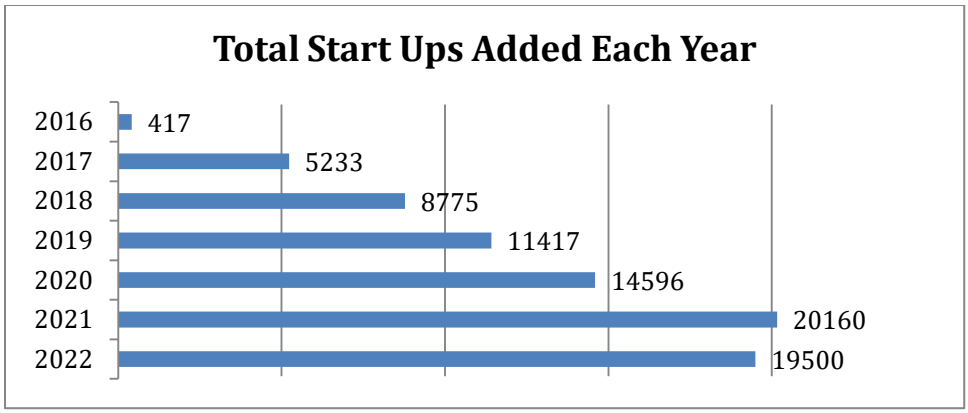

Figure 5.10 Startups India Growth

5.5.8 Production Linked Incentive Scheme (PLI). The PLI scheme from the government aims to boost semiconductor and display manufacturing in the country and to position India as a global hub for hi-tech production as demand is most likely to outstrip supply in near future. Over the next 5-6 years, the scheme will invest Rs 76,000 crore (US$ 9.95 billion) in semiconductor production, As part of the imitative, new semiconductor plants are been set up by private sector at Gujarat, Karnataka, Tamil Nadu in collaboration with Foreign partners. These plants shall encourage all areas of chip-making to create an integrated ecosystem in India.

5.5.9 Regulatory Sandbox. Regulatory sandboxing has been established by RBI, SEBI for stock markets, IRDAI for insurance sector and NDHM for medical sector for testing various innovative products and technology under controlled conditions in compliance with standards set by respective controlling authority. This system enables the innovators to test the product when the regulation may not exist or may be too restrictive.

5.5.10 Draft Data Centre Policy 2020. As per CRISIL report of June 2022 Data center capacity in India is expected to double by fiscal 2025 to ~1,700-1,800 megawatt (MW), powered by the data boom, digital adoption and local data storage mandates. The embracing of new age technologies and digital infrastructure, impetus on e-services by

the government under Digital India campaign and the increasing use of smart devices by individuals have led to a massive spurt in data and cloud usage creating huge demand for data centers. The recent launch of 5G services will further boost demand for data and storage capacities. Government norms on data localisation, seeking storage of sensitive data within the country, and digital initiatives would be another tailwind. The draft data center policy 2020 shall enable single window clearance for setting up data centers and propel the Digital India Initiatives.

5.5.11 Draft National Data Governance Framework Policy 2022. This policy when in place shall be able to realize the full potential of Digital Government. This shall focus on transforming the government's data collection capability to enhance governance and develop a nationwide Artificial Intelligence (AI) and data-led research and start-up ecosystem. The policy's stated goals include- advancing digital governance, fostering the digital economy, establishing uniform standards for open-access digital platforms, and standardizing data collecting, management, and security practices. The achievement of these goals would make it easier to implement a whole-of-government strategy and also promote improved governance till the last mile.

5.5.12 Draft Digital Personal Data Protection (DPDP) Bill, 2022. The DPDP 2022, when in place shall make entities handling personal data accountable for managing it with safety and security in a responsible manner. The policy has been formulated based on seven core principles namely lawful, fair and transparent processing; purpose limitation; data minimization; accuracy of personal data; storage limitation; integrity and confidentiality; and accountability. In case of non compliance of clauses heavy penalties

have been imposed. In order to meet the requirement of new age technologies, it has relaxed the rules on cross-border data flows.

5.6 R&D Expenditure. India's gross expenditure on R&D as a percentage of GDP (0.66%) is quite low compared to other nations. With such low contribution, R&D performance remains stagnant. Sustained investments in R&D is an important means to achieve economic and social goals. A substantial increase is required in the gross expenditure on R&D and needs to be brought to a level of 2.5 to 3% of GDP in next five years and up to 4% in next ten years (Harnesssing Private Sector Investment in R&D, 2019).

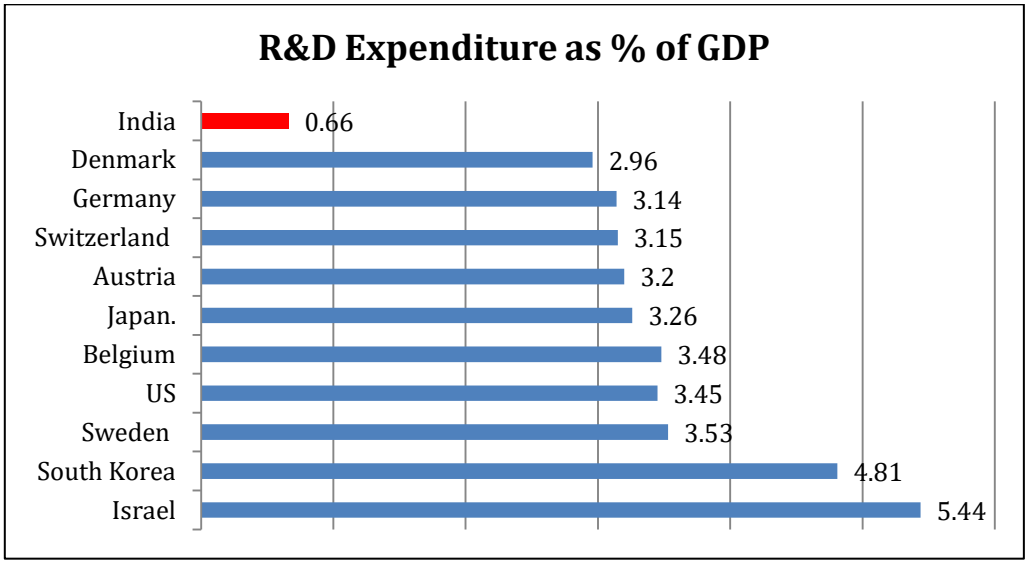

Figure 5.11 R&D Expenditure as % of GDP

As per R&D statistics of the Ministry of Science and Technology, India's expenditure as % of GDP is falling year after year (Demands for Grants 2022-23 Analysis - S&T, 2022).

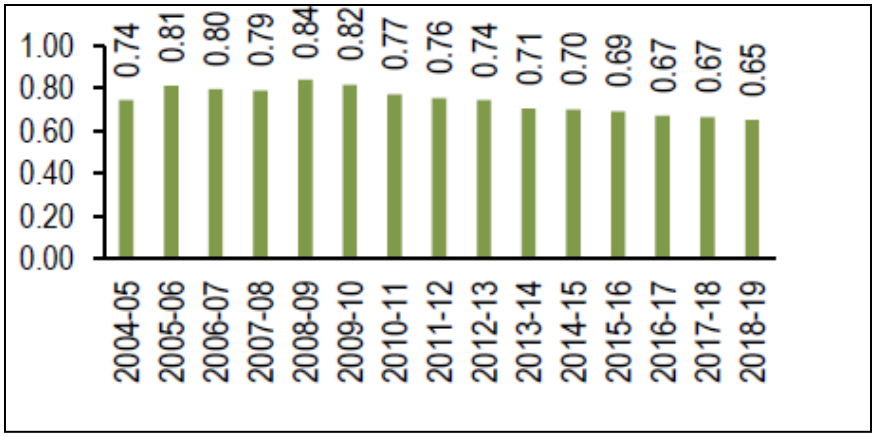

Figure 5.12 India's R&D Expenditure as % of GDP

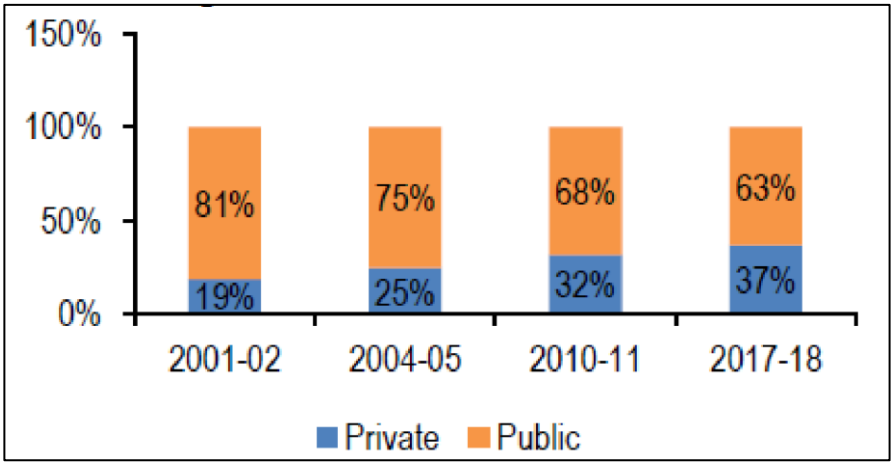

Figure 5.13 India's R&D Expenditure: Private Vs Public Sector

Also, the contribution of the number **of** researchers per million people is only 253 in India and it is much lower for female researchers (around 19%) (Demands for Grants 2022-23 Analysis - S&T, 2022).

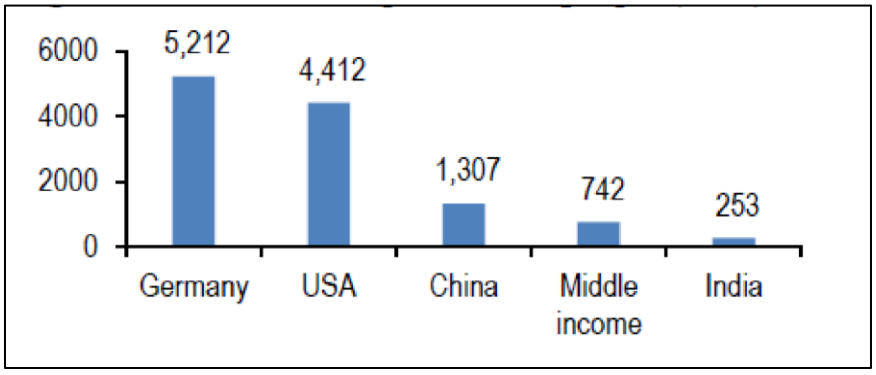

Figure 5.14 Researchers per Million People (2018)

5.7 Cyber Security – India's Status.

(a) As per the report by Our World in Data, presently India has 2nd highest internet users in the world only after China (Our World In Data, 2020) and as per statista.com report in 2020, the number has grown 6-fold since last 10 years. In addition, rapid digitalization through the flagship programme of Digital India has been witnessed in all spheres for public life for faster accessing of e-services, especially financial services all across the country.

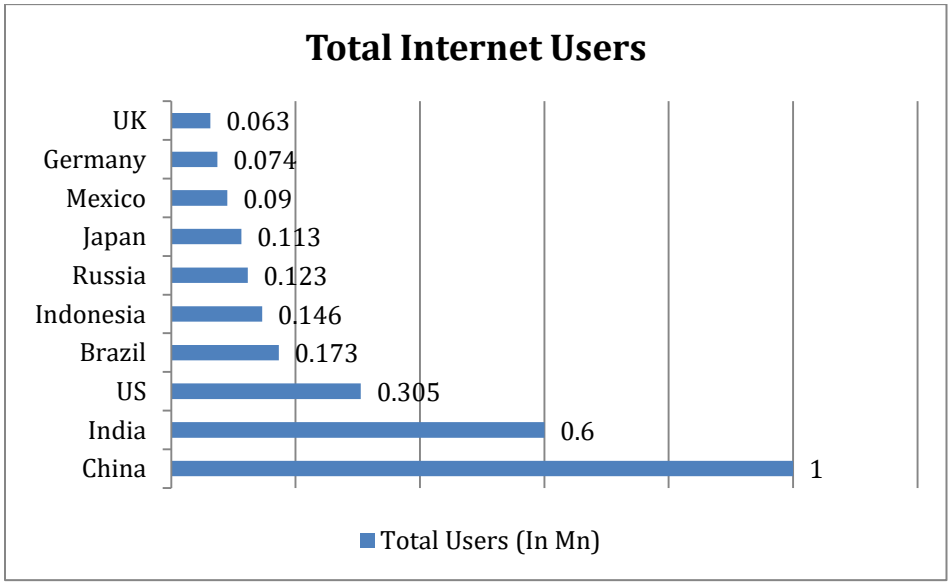

Figure 5.15 Global Internet Usage (Top Ten)

(b) As the digital economy grows and with more new technologies been adopted to widen the reach of e-services, it also becomes more prone to cyber threats and vulnerabilities. For instance, there is a growing risk of cyber attacks on key infrastructure as well as financial institutions. An increase in cloud-based attacks has been one of the most prevalent cyber threats to the banking industry. Large corporations and IT firms are more prone to severe data breaches. Data breaches can make it difficult for citizens to trust financial institutions. In addition to the recent ransomware attack on AIIMS servers, there have been seven major

cyber attacks on Indian critical infrastructure in the last two years. As per Trend Micro report of 2023, 52% of global organizations have had a supply chain attack.

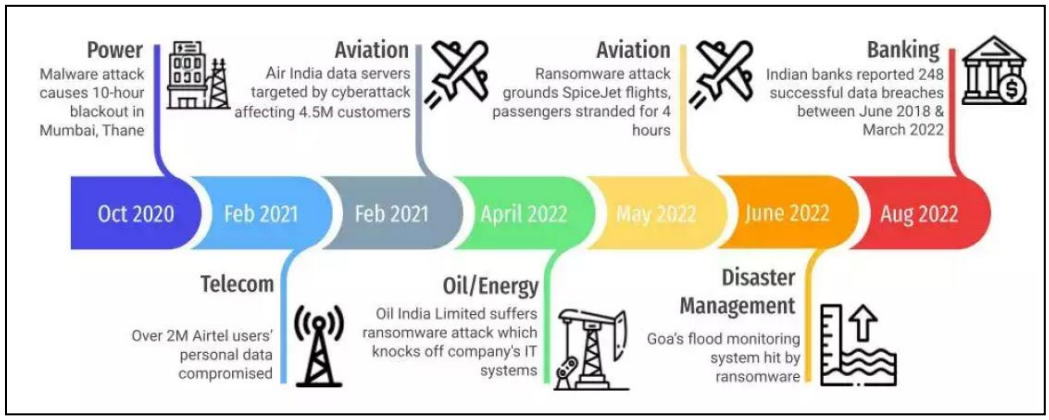

Figure 5.16 Critical Infrastructure: Cyber Attack (India)

(c) As per PwC report of Aug 22 on cyber security (Our Take, 2022), the cyber vulnerabilities in the Indian context primarily arise from inadequate investments in cyber security be it in terms of investments in technology, building cyber security awareness or investing in strategic initiatives. Also as per the report, increasing threat surface area in Indian context is due to increasing digitization and 5G roll out, extensive use of pirated software, extensive mobile usage for internet access, use of hardware/software created and manufactured outside India, third-party vendors who are especially vulnerable and can compromise the overall supply chain.

(d) The measures which need to be instituted in the report includes, Firstly, increased investments in cyber security, promoting indigenous cyber security solutions, start-ups dealing with cyber security need to be incubated, preferably along sectoral lines, and the seed capital should be made available by the Government and/or industry bodies, Secondly, adoption of a participative framework for building trust by combining tech-sector skills and public policy to

built the Indian cyber stack. A consultative mechanism between all stakeholders could be used, adopting a public-private partnership (PPP) model. Thirdly, cyber security robustness of all the elements of the supply chain to be suitably enhanced so as to identify and fix vulnerabilities. Fourthly, Assurance and certification programmes for checking the embedded software. Fifthly, creation of a cyber security framework and having a standard operating procedure (SOP) in place for all organizations. Sixthly, Annual revision to the National Cyber security Policy, 2013, to keep it current and relevant to the rapidly changing cyber threat landscape, and will impart dynamism to policy articulation.. Lastly, requirement for cyber security education at the grassroots level and indigenous low-cost certification programmes in regional languages.

5.8 As thoroughly examined in the working paper Global Economy & Development, the diversity of policy activities across the globe and the complexity of the legal concepts upon which they rely might create the appearance that technology policy affects every facet of contemporary governance. The policy concern demonstrates that policymakers are focusing on five important technology-related topics. These five pillars are as enumerated as under (Davis, Signé, & Esposito, 2022),

(a) **National Security**. National security is a key concern for policymakers when it comes to technology policy. The paper highlights the need for policies that address issues such as cyber security, data protection, and encryption. This includes policies that promote collaboration between the government and private sector to ensure that critical infrastructure and systems are protected from cyber

threats. It is essential to have a robust legal framework to regulate the use of technology for national security purposes.

(b) **Economic Development**. Economic development is a critical focus area for technology policy, particularly in developing countries. The paper highlights the need for policies that promote innovation and entrepreneurship, including the development of a supportive ecosystem for startups and small and medium-sized enterprises (SMEs). This includes policies that address issues such as access to finance, intellectual property rights, and regulatory frameworks that encourage innovation and investment.

(c) **Infrastructure.** The paper emphasizes the need for policies that promote the development of physical as well as digital infrastructure, including broadband networks, 5G technology, cloud computing services, geospatial networks, sensor networks, and the Internet of Things (IoT). This includes policies that address issues such as access, affordability, and digital inclusion. It is crucial to ensure that digital infrastructure is developed in a way that benefits all communities and promotes equitable economic growth. In the case of growing economies, the focus is on both trade routes and market access.

(d) **Privacy and Data Management**. Privacy and data management are essential focus areas for technology policy. The paper emphasizes the need for policies that protect individuals' privacy rights while ensuring that data can be used to support innovation and economic growth. This includes policies that address issues such as data protection, data sharing, and transparency. It is

essential to have a legal framework that protects personal data and regulates the use of data by private and public entities.

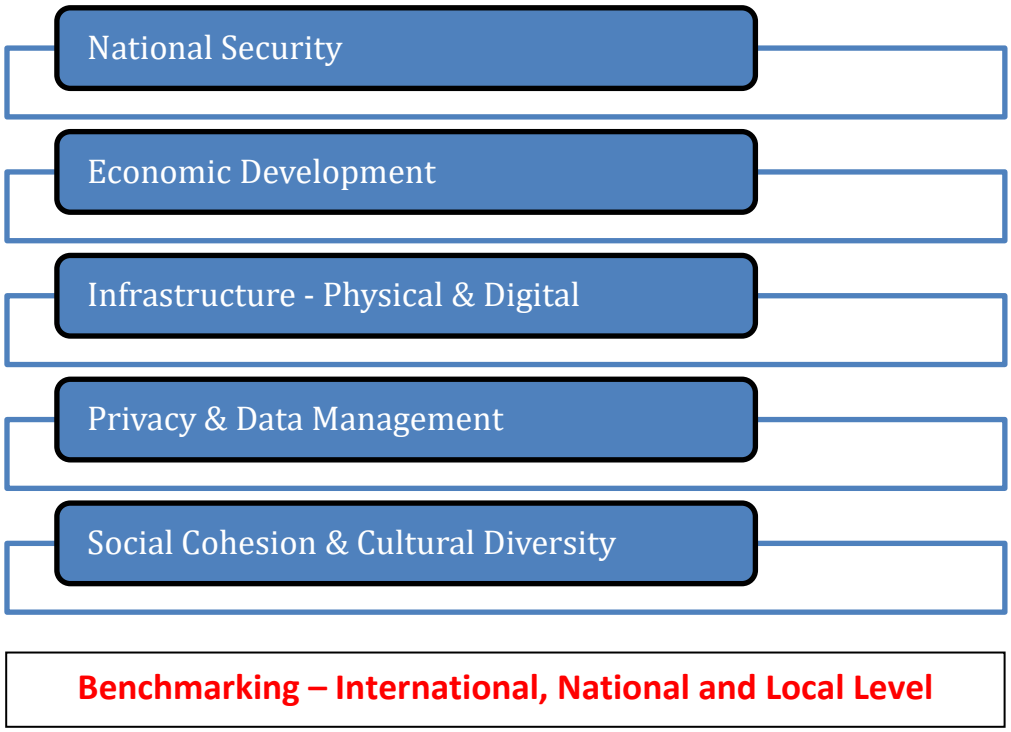

Figure 5.17 Tech Policy Framework

(e) **Social Cohesion and Cultural Diversity**. The paper highlights the need for policies that promote diversity and inclusion in the technology sector, including the development of a diverse workforce and the promotion of cultural diversity in technology products and services. This includes policies that address issues such as bias in algorithms, digital literacy, and the digital divide. It is crucial to ensure that technology policies promote social cohesion and reduce inequality.

Overall, these five focus areas represent some of the most pressing technology-related issues that policymakers need to address. Policymakers need to develop technology policies that promote innovation, economic growth, and social welfare while

ensuring that technology is developed and deployed in a responsible and ethical manner. Mapping technology policy to these five pillars shows the degree to which new age technologies influence the pillars of contemporary life: our security, prosperity, infrastructure, individual and communal rights, and social cohesion. These factors need to be benchmarked at International, National and Local levels so as to enhance the performance and also to know where we stand.

5.9 Summary

(a) Global tech policies for new age technologies are still in their nascent stages, and there is significant variation in the policies adopted by different countries. One of the biggest challenges in this area is ensuring that new technologies are developed and deployed in a way that is safe, ethical, and equitable. There is a growing recognition among policymakers of the need to develop frameworks for regulating emerging technologies, particularly in areas such as AI and Blockchain. However, progress in this area has been slow, and there is still significant debate around the appropriate approach to regulating these technologies. Another key issue in the development of global tech policies for new age technologies is ensuring that they are able to keep pace with the rapid pace of technological change. New technologies are emerging at an increasingly fast rate, and policymakers must be able to respond quickly and effectively to ensure that regulations are up to date and relevant. Moreover, there is also a need to ensure that tech policies are aligned with broader policy objectives, such as sustainable development, digital inclusion, and human rights. As new age technologies have the potential to exacerbate existing inequalities, policies must

be designed to promote equity and social justice. Policymakers must also consider the ethical implications of new age technologies and ensure that they are developed and deployed in a way that upholds human rights and dignity. Another major challenge is the lack of consistency and coordination between different countries' tech policies. Given the global nature of many new age technologies, there is a need for greater international cooperation and coordination to ensure that policies are consistent and do not create unnecessary barriers to innovation. Additionally, there is a need for greater collaboration between governments, industry, and civil society to ensure that the benefits of these technologies are shared equitably and that the risks are managed appropriately. Overall, while there has been some progress in the development of tech policies for new age technologies, there is still significant work to be done to ensure that these technologies are developed and deployed in a way that is safe, ethical, and equitable. Achieving this will require greater international cooperation, collaboration between stakeholders, and a commitment to developing policies that are consistent, transparent, and evidence-based. Finally, there is a need for greater transparency and accountability in the development and implementation of tech policies. This includes ensuring that policymakers engage with a diverse range of stakeholders, including civil society organizations and affected communities, and that there are mechanisms in place to monitor and evaluate the impact of policies. By fostering greater transparency and accountability, policymakers can help to build trust and ensure that new age technologies are developed and deployed in a way that benefits all members of society.

(b) India has recognized the importance of new age technologies and has taken steps by issuing strategies and roadmaps to support their development and deployment. The government has identified several key areas for focus, including AI, Blockchain, IoT, Quantum and Cyber Security, and has established various committees and initiatives to drive progress in these areas. For example, the Ministry of Electronics and Information Technology has established the National e-Governance Division, which is tasked with developing and implementing e-governance initiatives across the country. In addition, the government has launched several programs to promote the development of new age technologies, such as the Digital India initiative and the National AI Strategy. Despite these efforts, there are still significant challenges that must be addressed. One of the key challenges is the need to balance innovation with regulation. While India has recognized the potential of new age technologies to drive economic growth and improve people's lives, there is a risk that policies and regulations could stifle innovation and limit the potential benefits of these technologies. Additionally, there is a need to ensure that policies are equitable and inclusive and that the benefits of new age technologies are shared widely across society. This requires a concerted effort to engage with a diverse range of stakeholders, including civil society organizations, industry, and academia, to ensure that policies are informed by a broad range of perspectives and are aligned with broader policy objectives. However, there is still a long way to go, and the government needs to take proactive steps to ensure that India stays ahead of the curve in the fast-changing technological landscape.

In the present study, Tech Policy Framework for New Age Technologies has been built on five pillars namely ‘National Security’, ‘Economic Development’, ‘Privacy and Data Management’, ‘Infrastructure’, and ‘Social Cohesion and Cultural Diversity’.

Chapter 6: Data Analysis and Findings

5.1 Primary Survey. The citizen and start ups survey was conducted through separate questionnaires online. The industry survey was conducted through a subjective questionnaire. The survey for the stakeholders from DARPG, NASSCOM, FICCI, academia and other experts in the field was conducted through personal interviews. The survey was conducted to understand the aspirations of citizens for India@2047, understand the current challenges in tech policy for New Age Technologies and recommend the important tenets for tech policy framework for India@2047.

(a) The questionnaire for citizens (Appendix) had 12 questions including six questions about the basic data of the respondents. The prime objective of the citizens survey was to know about the aspirations of the citizens for India@2047, present shortcomings in the tech policy formulation for new age technologies, role played by technology in citizen centric governance and important tenets of tech policy for new age technologies. The survey included respondents from all segments of society.

(b) The questionnaire for startups had 23 questions (Appendix) including six questions about the basic data of the respondents. The prime objective of the survey conducted for startups was to know the profile of start ups, funding and policy support for start ups, adequacy of the IPR structure for development of new age technologies, ease of collaboration available from PSUs, ease in marketing the innovative products in market, platform for testing and certification of new age technologies, opinion of NCNC trials, present shortcomings in the tech policy for new generation technologies, role played by technology in citizen

centric governance, important tenets of tech policy framework for new age technologies and aspirations of the respondents for India@2047.

(c) The questionnaire for industry had 12 questions enclosed as (Appendix) to know the views about the impact of new age technologies on citizen centric governance, effectiveness and shortcomings of the current policies for adoption of new age technologies, approach for regulating the new age technologies, infrastructure for testing and certification new age technologies and recommendation for tech policy framework for new age technologies.

(d) The interview with stakeholders from DARPG, NASCOM, FICCI, academia and other experts in the field consisted of questions specific to the expertise of the stakeholders.

5.2 Secondary Data. The secondary data has been analyzed and placed at relevant places in the report.

5.3 Analysis – Questionnaire 1

I. **Age Group of the Respondents**. The respondents were from all the age groups, but majority were in the age group 31- 40 and 41-50 years (62.2%).

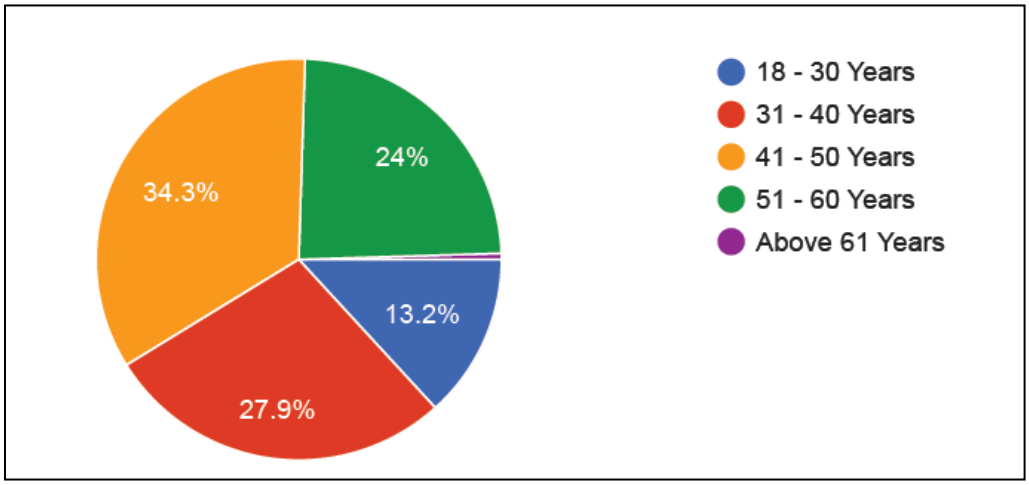

Figure 6.1 Age Distribution of the Respondents

II. **Gender of the Respondents**. Survey covered both the genders with 77.5 % respondents were male and 22.5% respondents were female.

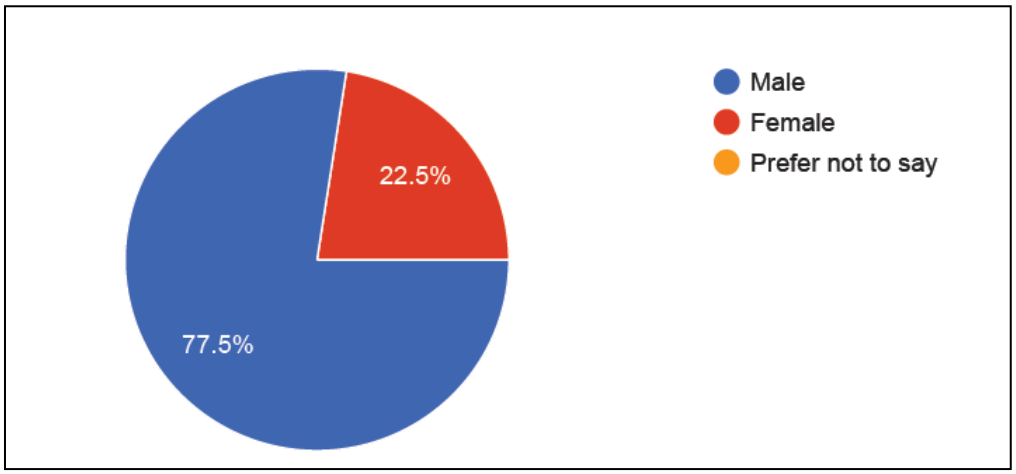

Figure 6.2 Gender Distribution of the Respondents

III. **Qualification and Specialization**. Most of the respondents were postgraduates and the subject of specialization was mostly engineering as shown in the Figure.

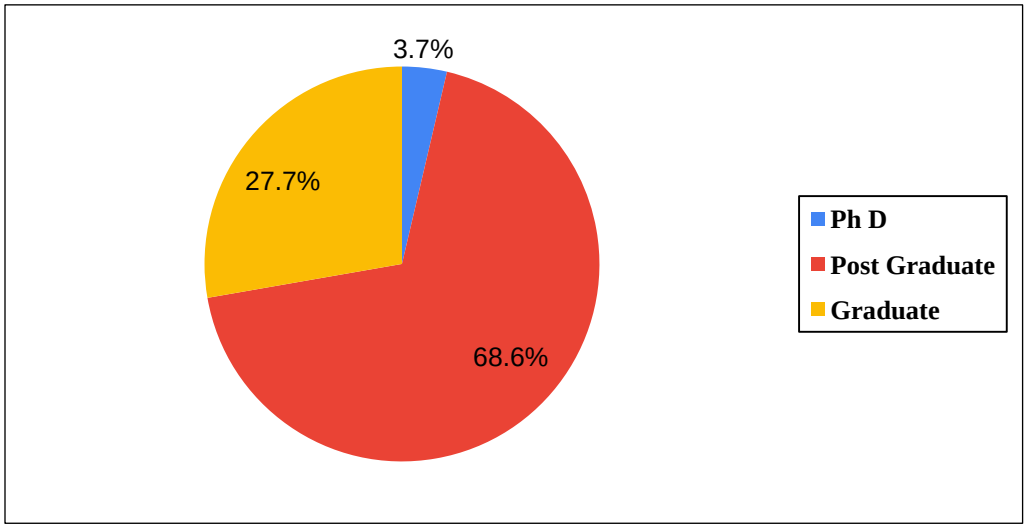

Figure 6.3 Qualification of the Respondents

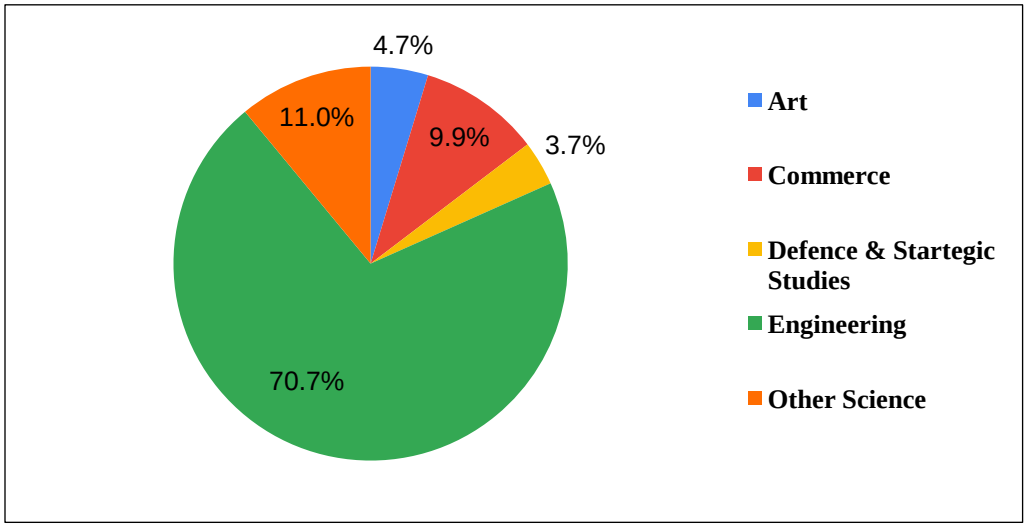

Figure 6.4 Specialization of the Respondents

IV. **Occupational Status and Income of the Respondents**. The respondents were well distributed from different services and in all income brackets.

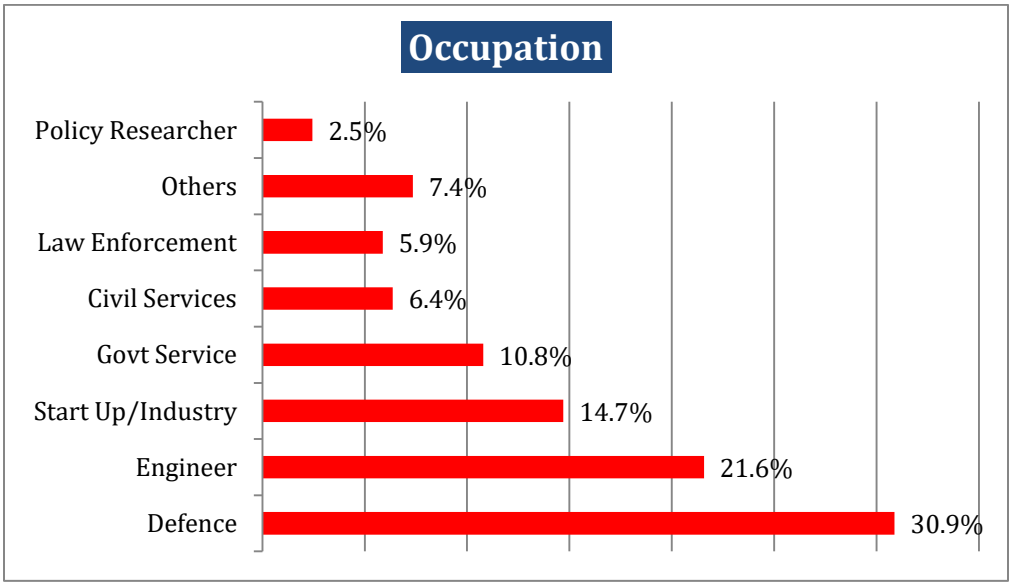

Figure 6.5 Occupation of the Respondents

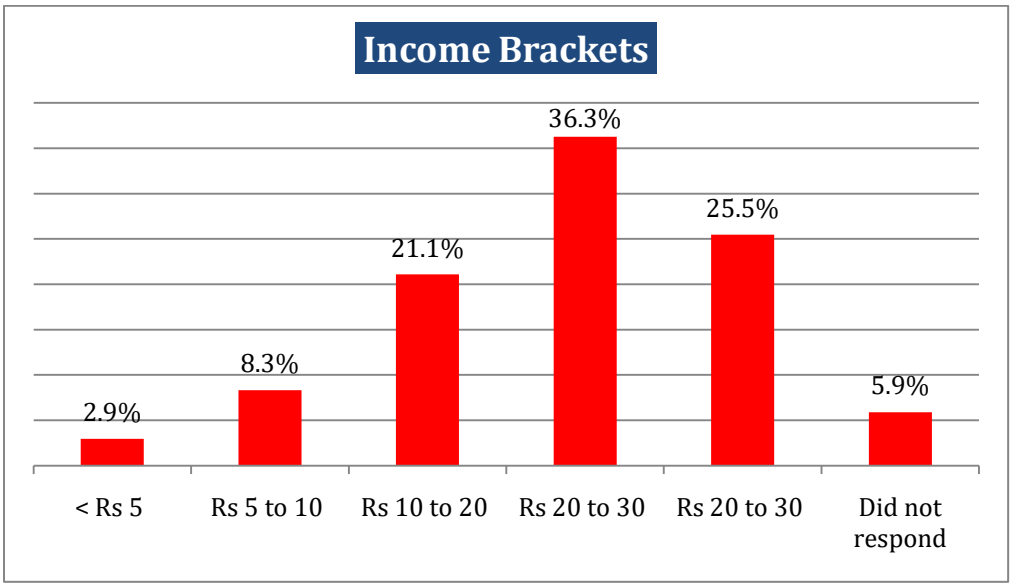

Figure 6.6 Income Bracket of the Respondents

V. **Policy Making**. 52.36% respondents are /have been involved in policy making. Hence most of them have a fair idea about policy making.

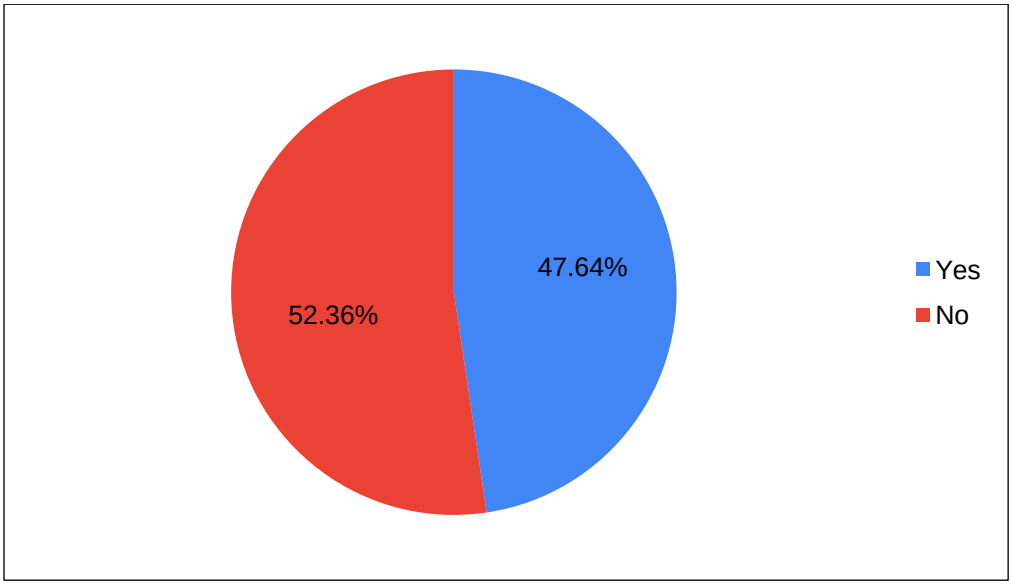

Figure 6.7 Respondents Involved in Policy Making

VI. **Role of Technology in Citizen Centric Governance**. Almost all the respondents agree that technology plays a role in citizen-centric governance.

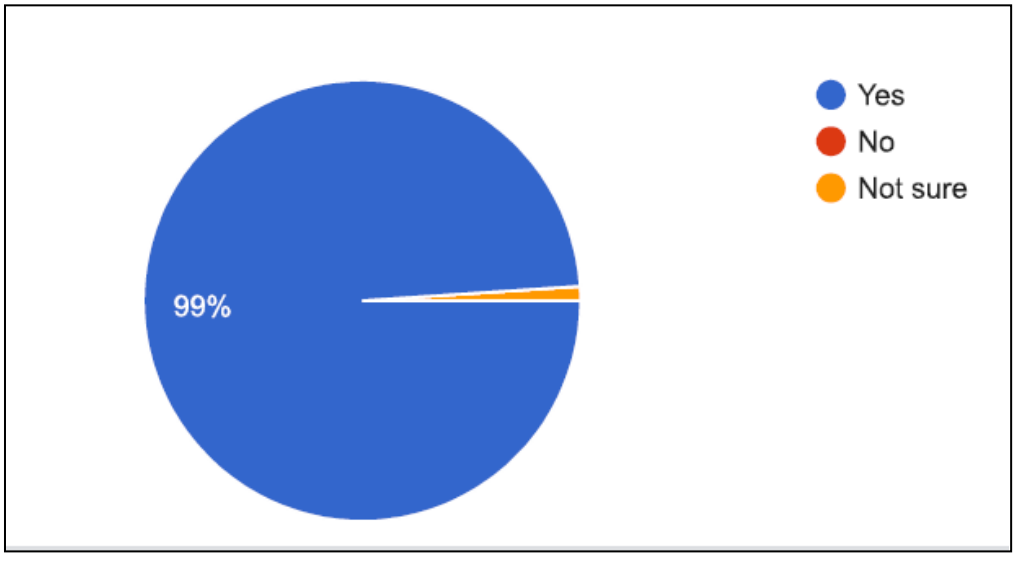

Figure 6.8 Technology Plays a Role in Citizen-Centric Governance

VII. **Suitability of Current Policies of New Age Technologies in India (NATs)**. A mixed opinion has been received as shown in the Figure.

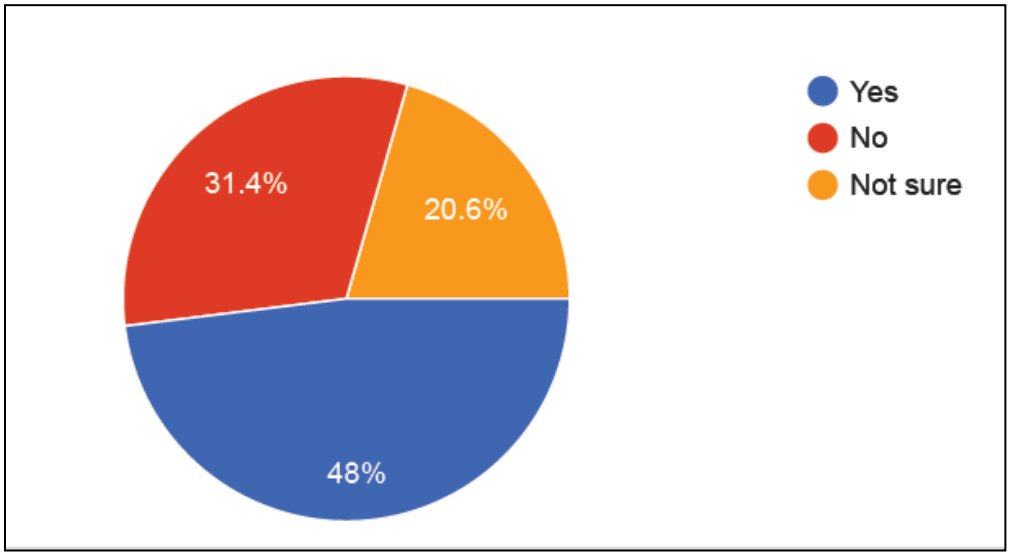

Figure 6.9 Suitability of Current Policies of NATs in India

VIII. **Shortcomings in the Current Policies for NATs**. The shortcomings in the current policies as per the respondents are attributable to time delay in policy making (37.7%) and lack of R&D infrastructure (33.8%) in the country as shown in the Figure. Though other points are also quite valid and need to be addressed.

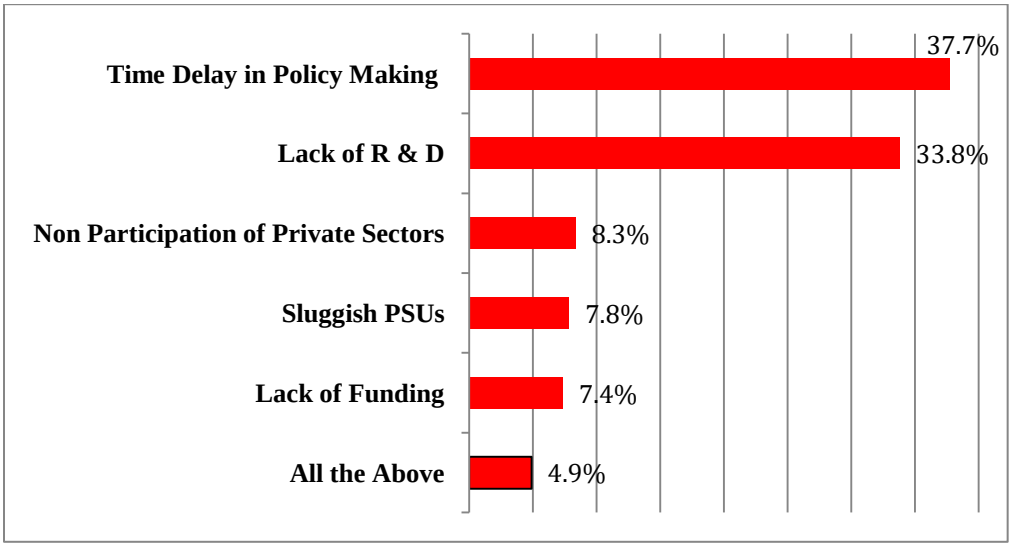

Figure 6.10 Shortcomings in the Current Policies - NATs

IX. **Citizens Aspiration of India @2047**. This is the most interesting part of the survey wherein how citizens are aspiring India to be in 2047 and is as given out in figure. In this respondents have given more than one response as was an open question. The citizens want India@2047 to be a Developed Nation which is a Global Power and a Technology Leader, with Inclusive Growth for all the citizens. The other aspirations automatically fall in place.

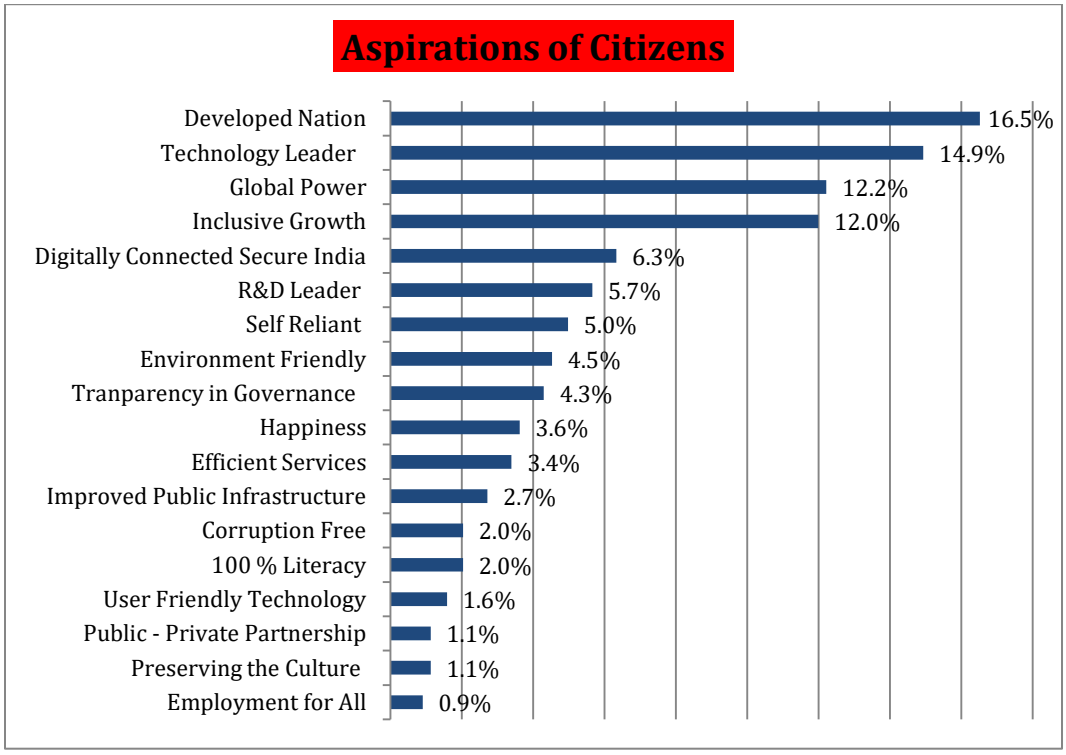

Figure 6.11 Citizens Aspiration of India @2047

5.4 Analysis – Questionnaire 2 (For Startups)

I. **Age Group of the Respondents**. The respondents were from all age groups, but majority were of age group 31- 40 and 41-50 years (73.4%).

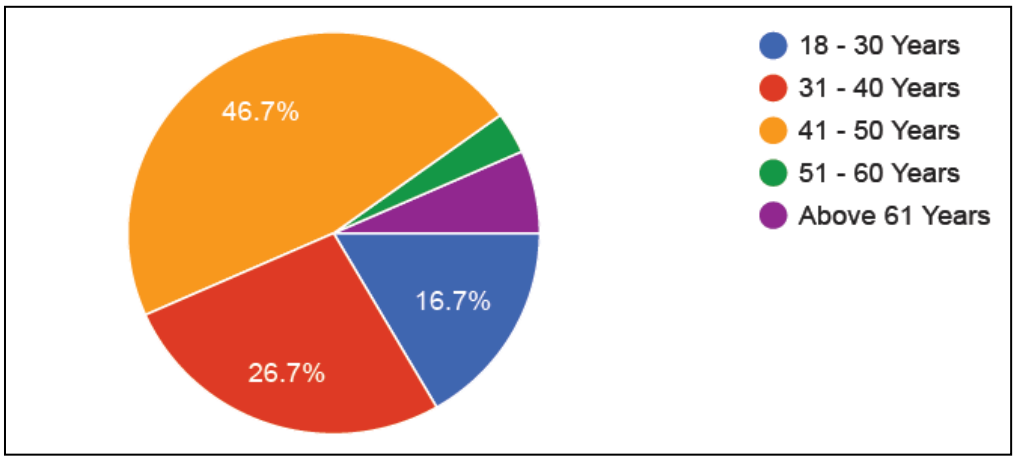

Figure 6.12 Age Distribution of the Respondents

II. **Gender of the Respondents**. Survey covered both the genders with 73.3 % respondents were male and 23.3% were female.

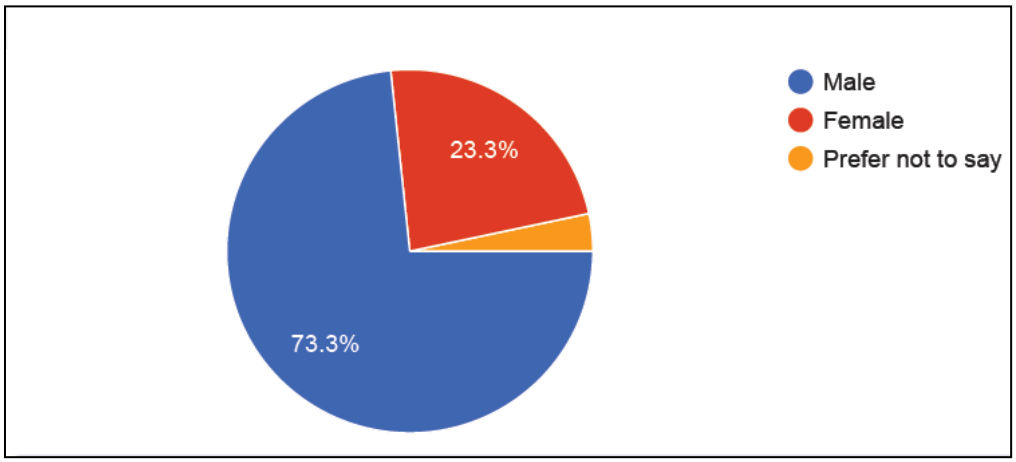

Figure 6.13 Gender Distribution of the Respondents

III. **Qualification and Specialization**. Most of the respondents were post graduates and the subject of specialization was mostly engineering.

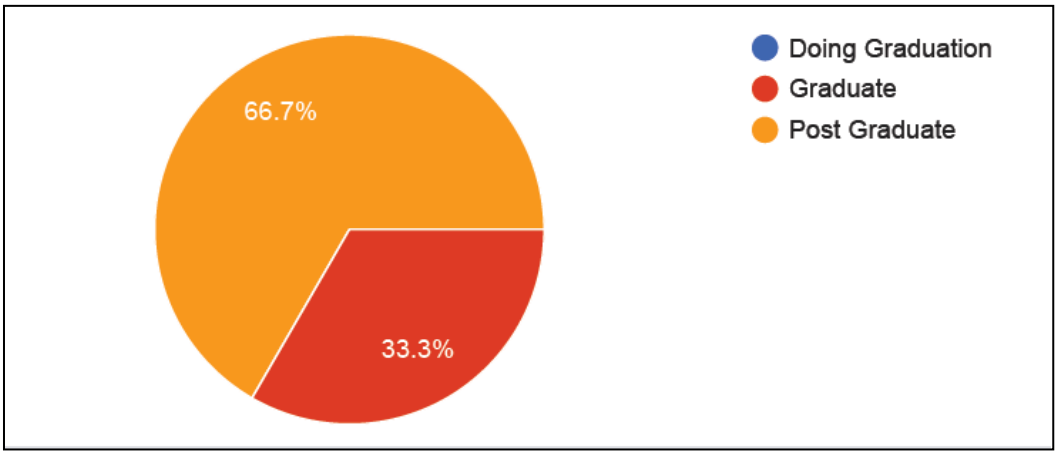

Figure 6.14 Qualification of the Respondents

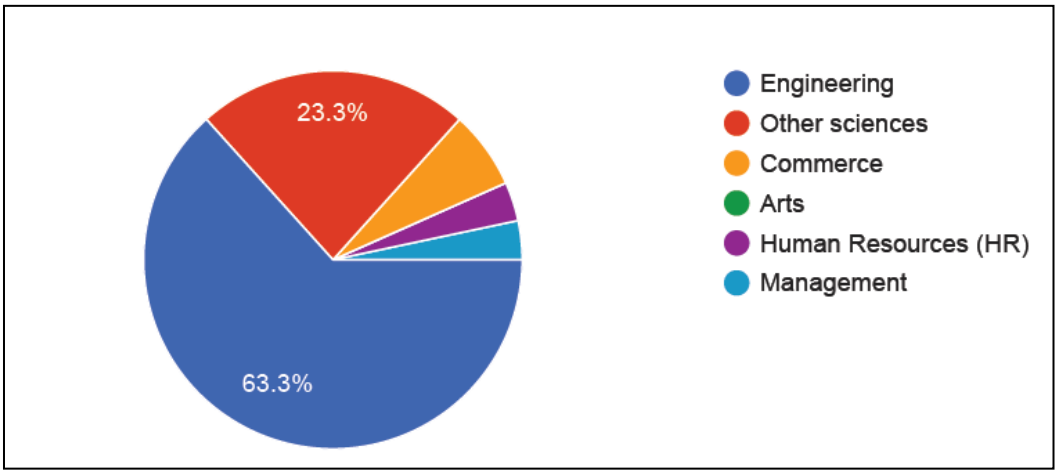

Figure 6.15 Specialization of the Respondents

IV. **Income of the Respondents and Vintage of the Startups**. The respondents were well distributed from different income brackets. The startup's vintage was well distributed as seen from Figure.

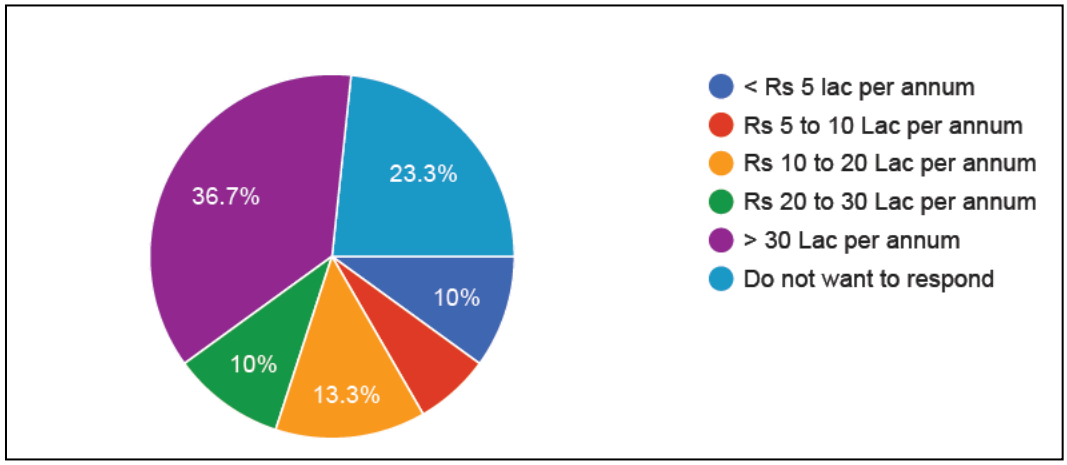

Figure 6.16 Income Bracket of the Respondents

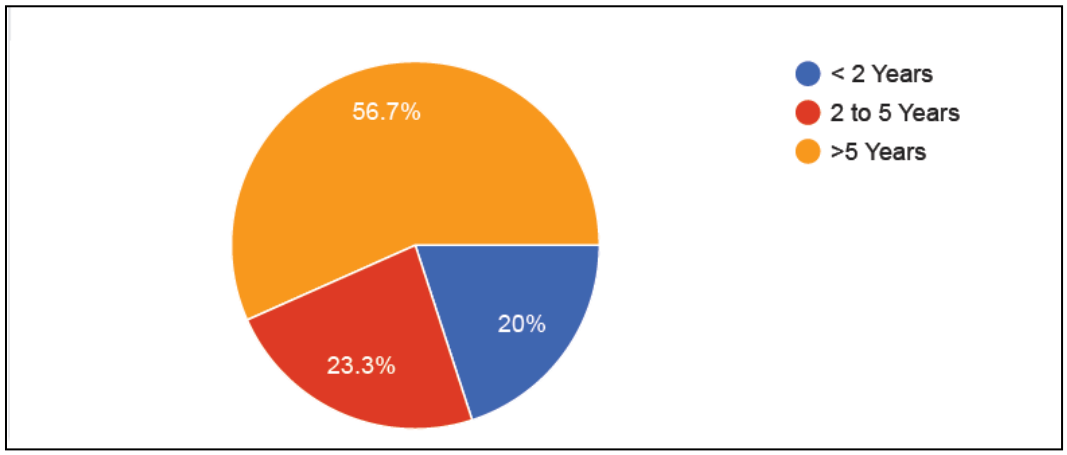

Figure 6.17 Vintage of the Startups

V. **Specialization of the Startups**. The bulk of the startups (56.7%) were dealing in solutions based on New Age Technologies. The details of other respondents are well distributed from different fields as shown in the Figure.

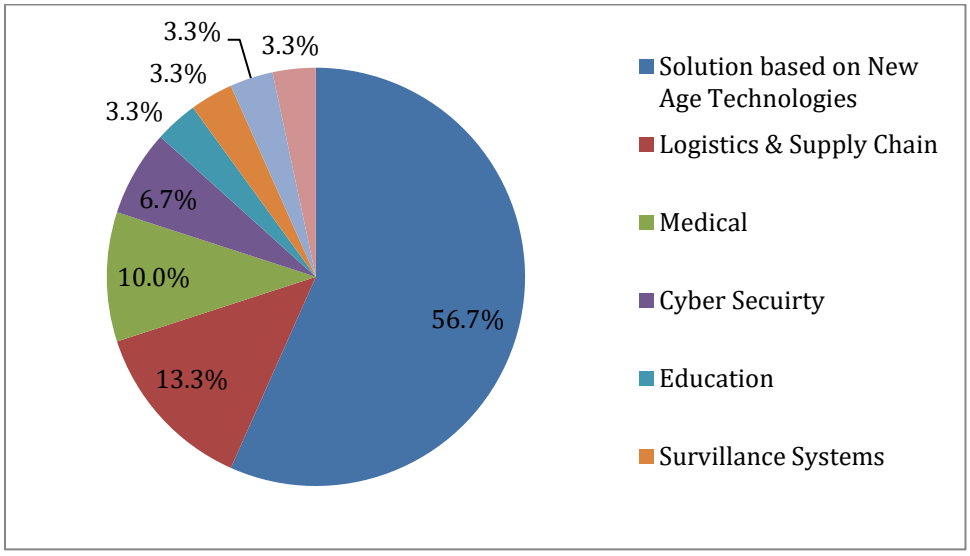

Figure 6.18 Specialization of the Startups

VI. **Role of New Age Technology in Startups**. All the respondents agreed that New Age Technologies play a role in their respective Start Ups.

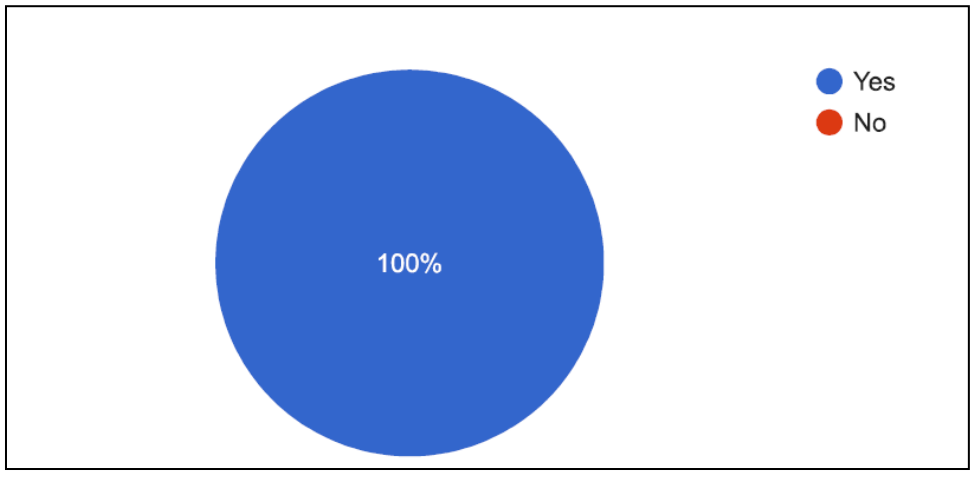

Figure 6.19 Role of New Age Technologies in the Startups

VII. **Present Policies Support Startups**. The respondents' opinion was divided on the subject as shown in the Figure.

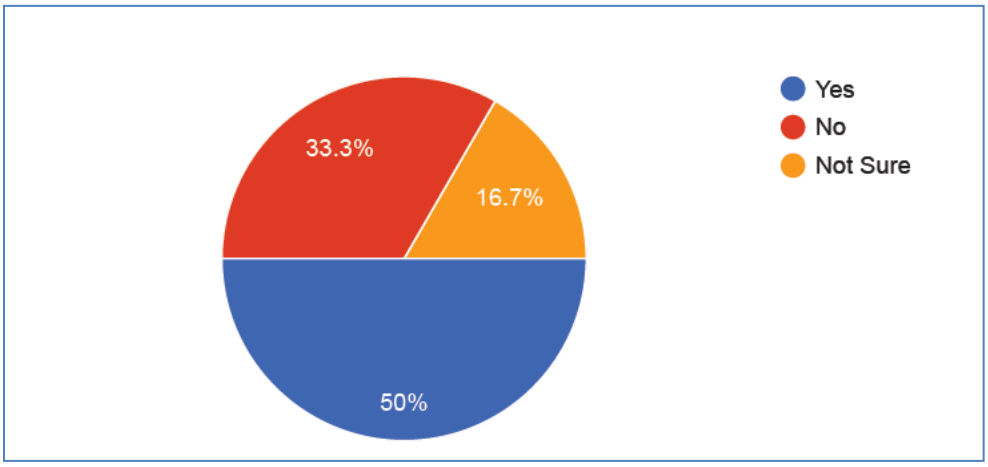

Figure 6.20 Present Policies Support for Startups

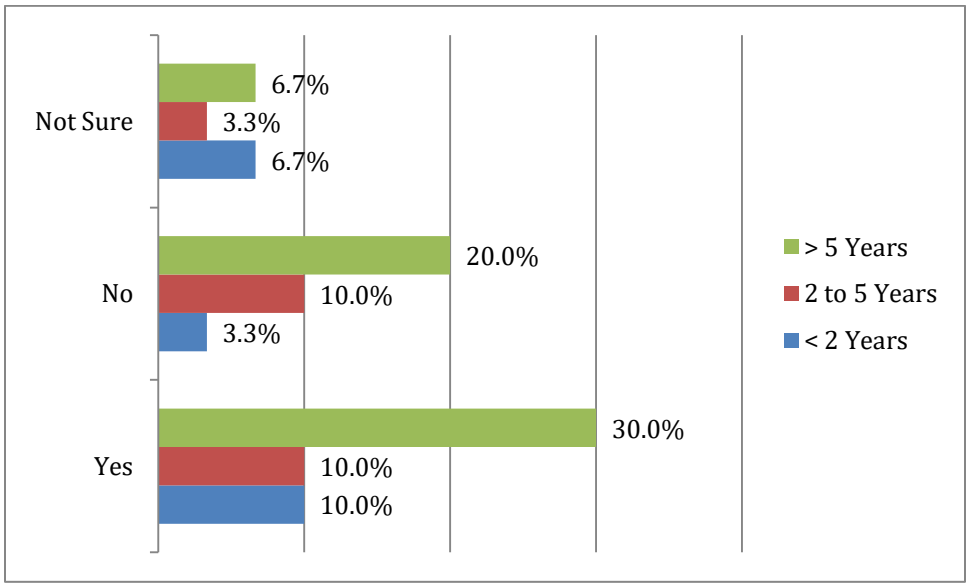

Figure 6. 21 Present Policies Support for Startups (Vintage wise)

VIII. **Funding of Startups for NATs**. The survey indicates that sufficient funding is not available for startups in NATs. 46.7% respondents have said sufficient funding is not available for startups.

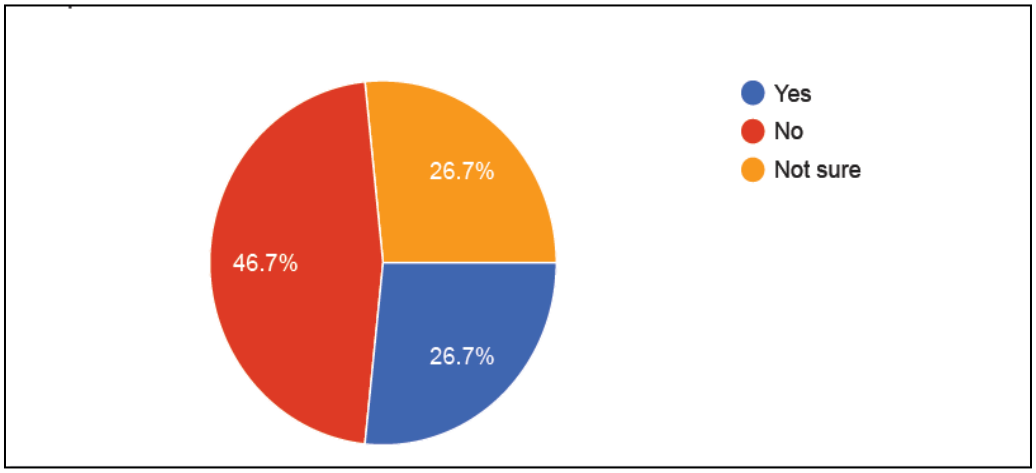

Figure 6 22 Funding of Startups for NATs

IX. **Collaboration by PSUs with Startups for NATs**. The survey indicates that sufficient collaboration from PSUs is not available for startups in new age technologies.

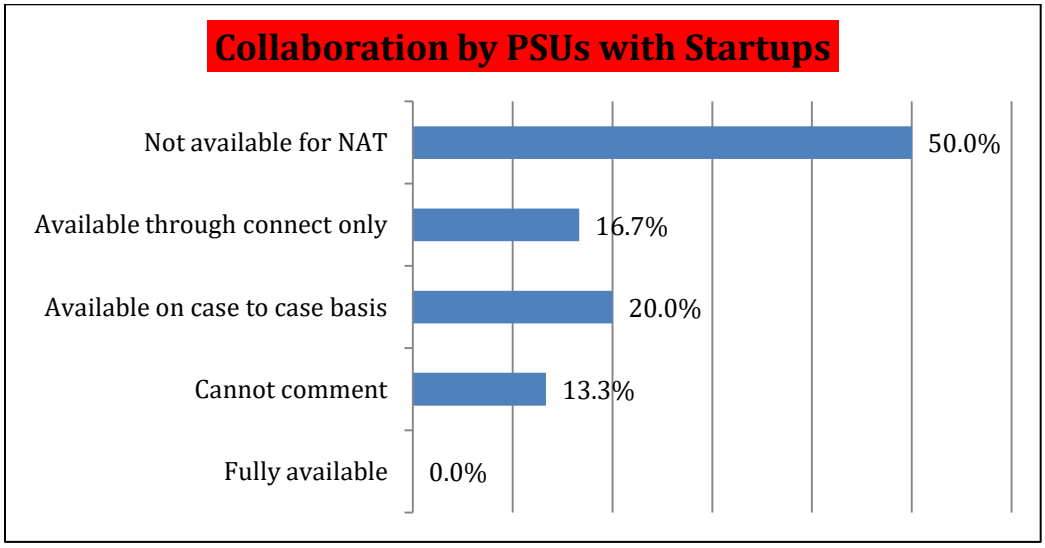

Figure 6.23 Collaboration by PSUs with Startups for NATs

X. **Existing IPR Structure in the Country**. The startups are of the opinion that IPR structures in the country are at Nascent stage (43.3%) or not satisfactory (50%).

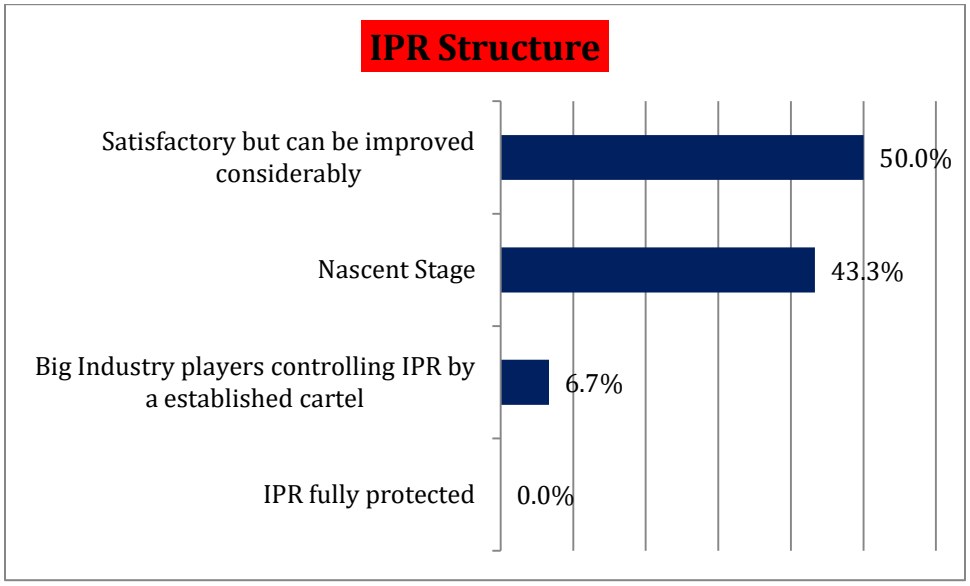

Figure 6.24 Existing IPR Structure

XI. **Ease /Difficulty in Projecting/Marketing.** The startups find it very difficult to market any new innovation in the market. 80% of respondents of the opinion that marketing avenue is not available for innovative /out of box solutions.

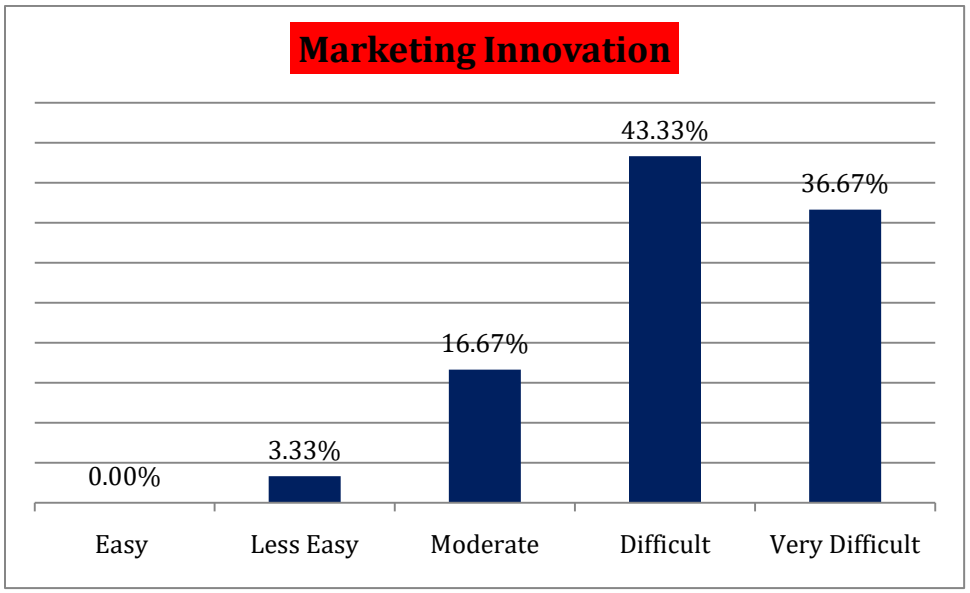

Figure 6.25 Ease /Difficulty in Projecting/Marketing an Out of the Box Solution

XII. **Platform for Testing and Certification of NATs**. Most of the respondents are of the opinion that the platform for testing and certification of NATs is not available in the country for startups.

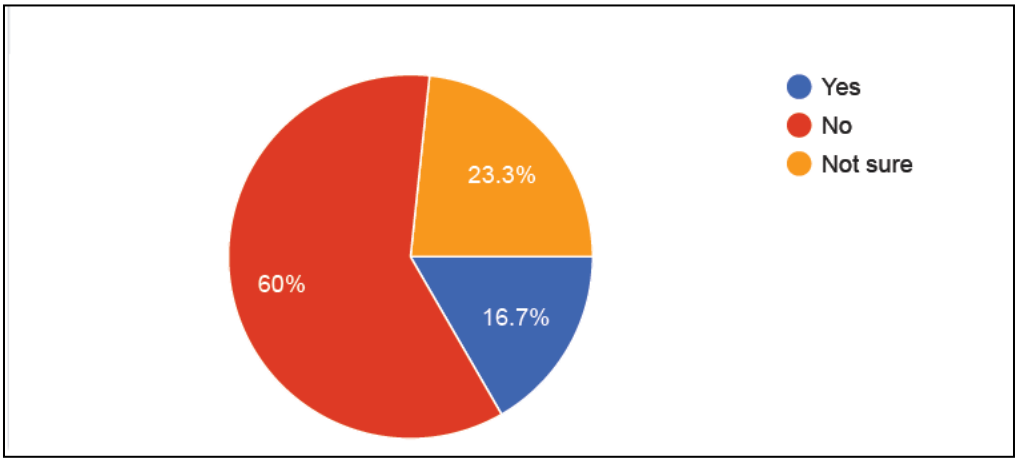

Figure 6.26 Platform for Testing and Certification of NATs

XIII. **Conduct of NCNC Trials by Startups**. The startups are against the conduct of NCNC trials as it is an additional financial burden on them.

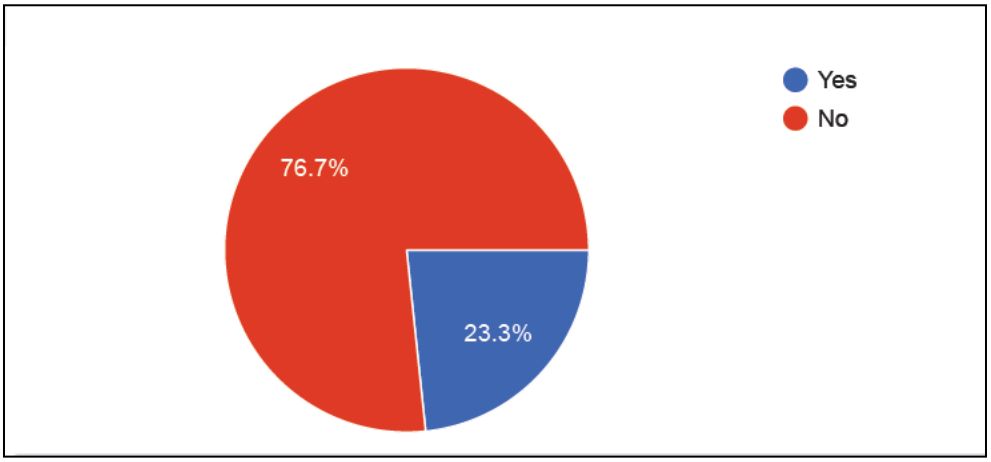

Figure 6.27 Opinion on Conduct of NCNC Trials

XIV. **Are the Current Policies Suitable for Emergence of NATs? T**he respondents are of the opinion that the current policies are not suitable for emergence of NATs.

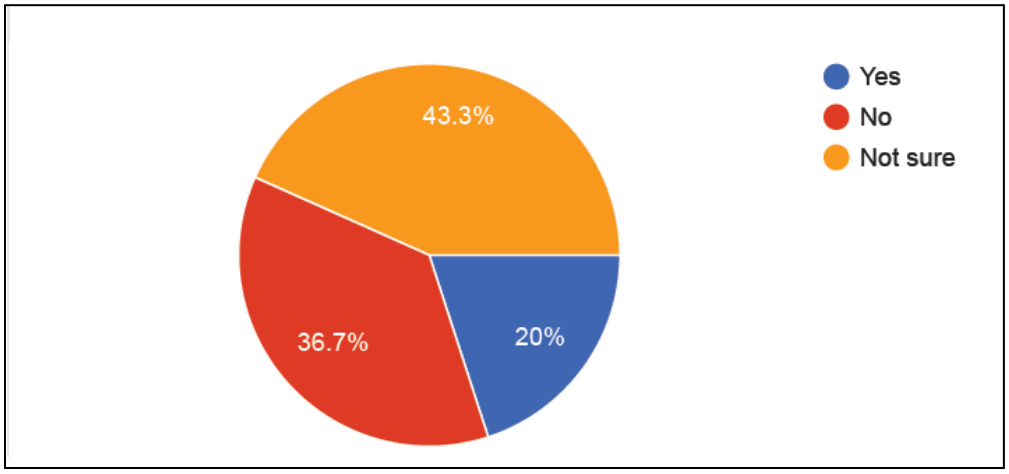

Figure 6.28 Suitability of Current Policies for Emergence of NATs

XV. **Current Policy Challenges for Emergence of NATs**. The challenges in the current policies are attributable to time delay in policy making, lack of funding and R & D of the country. Though other points also need to be addressed.

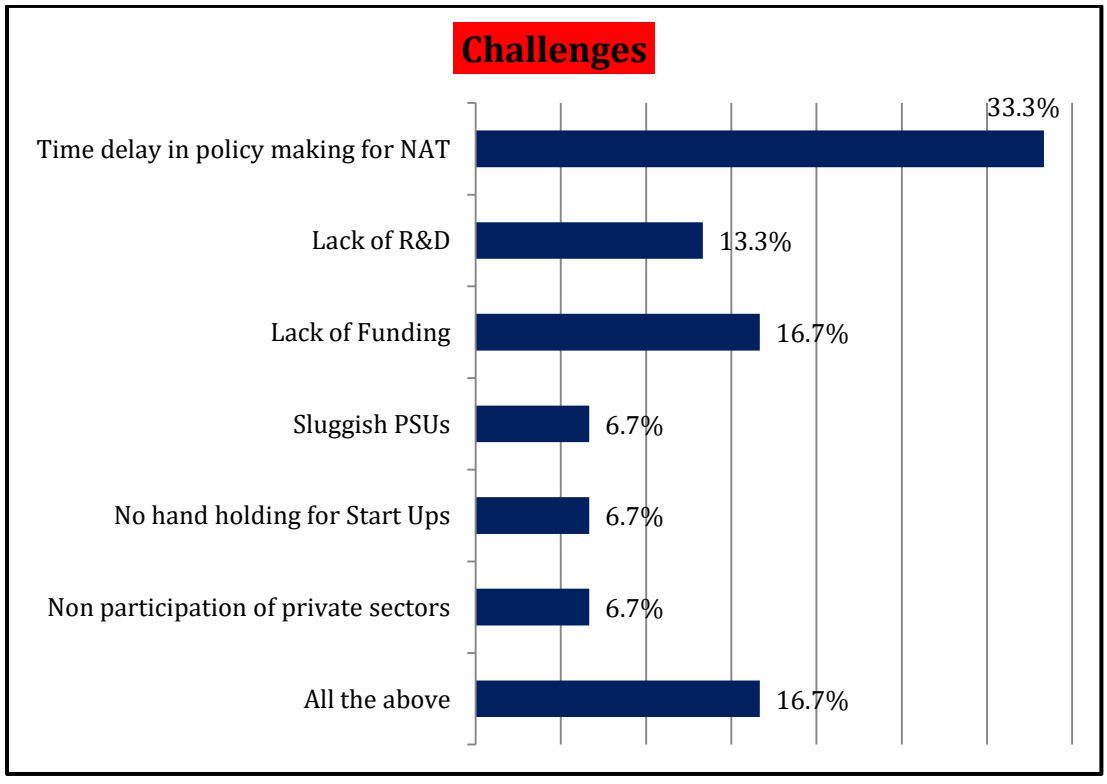

Figure 6.29 Challenges in Current Policies

XVI. **Role of Technology in Citizen Centric Governance**. Almost all the respondents agree that technology plays a role in citizen centric governance.

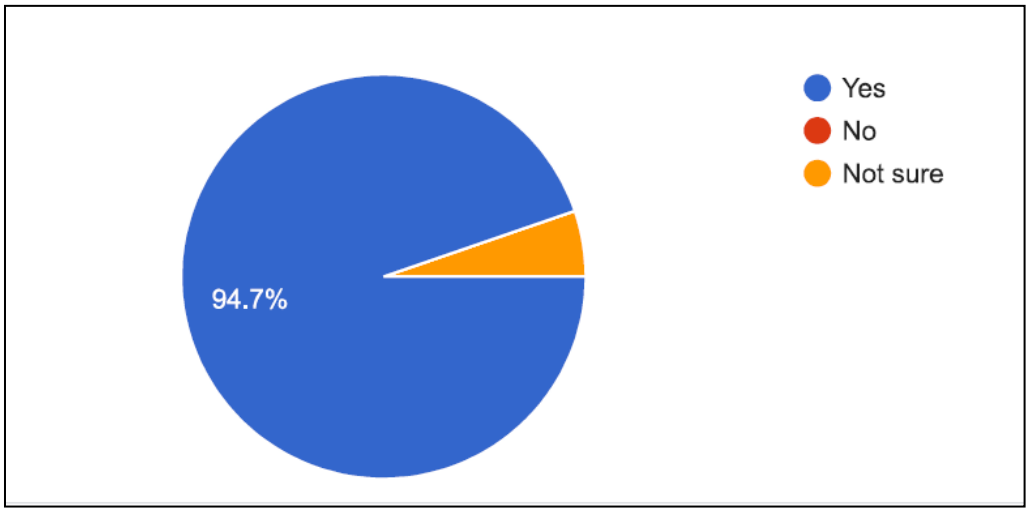

Figure 6.30 Role of Technology in Citizen Centric Governance

XVII. **Platform available for Start Ups to put across necessary Shortcomings / Challenges in Current Policy**. Majority of the respondents are of the opinion that no platform exists where the challenges can be put across to the policy makers.

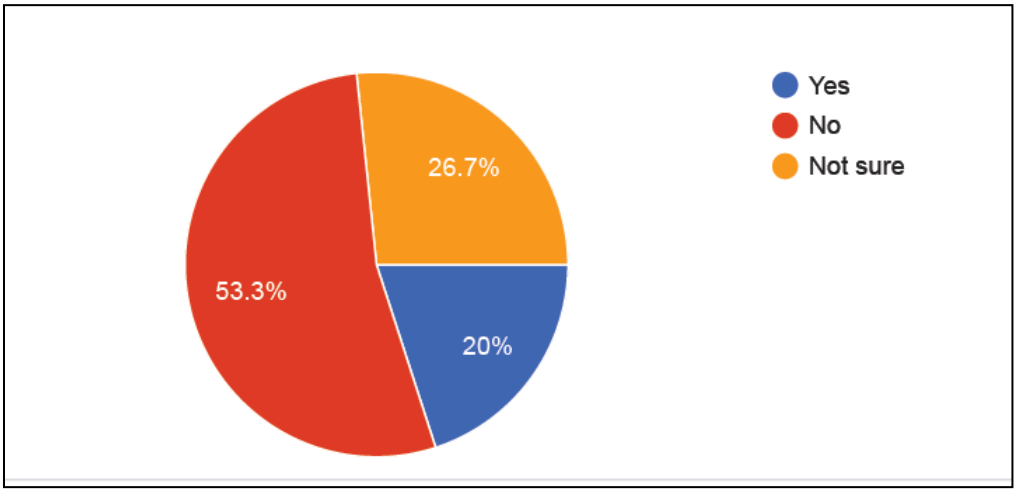

Figure 6.31 Platform Availability for Start ups

XVIII. **What are the aspects to be included in tech policy formulation?**

Based on the survey, startups have identified a number of key areas that they believe should be addressed as part of a technology policy for new age technologies. These recommendations include:

(a) Hiring the best technology talent for tech policy formulation: Startups believe that it is important to have the right people involved in the formulation of tech policy, and that this should include experts in the field.

(b) Setting up Government/Private Industry funded Incubation centers at colleges and support for the development of testing platforms for NATs: Startups feel that it is important to have access to the right resources and infrastructure in order to develop and test new technologies, and that this should include support for incubation centers and testing platforms.

(c) Strengthening IPR protection for startups: Intellectual property rights (IPR) are a key concern for startups, who feel that stronger protections are needed in order to safeguard their ideas and inventions.

(d) Instituting measures for market availability for innovative products developed by startups: Startups also feel that it is important to have access to markets for their innovative products, and that the government should take steps to support this by creating favorable policies for exports.

(e) Supportive procurement policies for startups: Procurement policies can also play a role in supporting startups, who feel that more favorable policies are needed to help them grow and succeed.

(f) Development of products to global standards: Startups believe that product development should be of global standards, in order to compete in international markets.

(g) Enhanced R&D funding and tax relaxation: Startups also feel that more funding and tax relaxation is needed for research and development (R&D) activities, which are crucial to the development of new technologies.

(h) Development of R&D infrastructure: Startups believe that the government should take measures to develop R&D infrastructure in the country, in order to support innovation and entrepreneurship.

(j) Alignment of skill development with startups/industry requirements: Startups feel that it is important to have access to skilled workers who have the right knowledge and expertise to work with new age technologies.

(k) Realignment of syllabus to Deep tech in higher education: In addition, startups feel that the syllabus in higher education should be realigned to focus on deep tech, in order to develop the skills needed for the future.

(l) More tax incentives, benefits and holidays for startups to grow: Finally, startups feel that more tax incentives, benefits and holidays are needed in order to support their growth and development.

5.5 Summary - Questionnaire III (For Industry and Startups)

I **Impact of NATs in Citizen Centric Governance and Use Cases.** The highlights of the inputs from startups/industry are as enumerated

(a) Adoption of NATs can significantly improve the productivity, depth, spread, and speed of delivery of various citizen-centric services offered by the government. This means that citizens will receive better and more efficient services from the government.

(b) NATs can increase transparency, provide user-friendly e-services, and improve cost-effectiveness. This is important for creating trust between citizens and the government, as well as making government services more accessible and affordable for everyone.

(c) NATs can bridge the gap between the government and citizens in a significant way. With the help of new technologies, citizens can be more involved in the governance process and can have a greater say in decision-making.

(d) 5G technology can create a digital connectivity highway across urban and rural centers, helping to bridge the digital divide across economic classes, geographical distances, gender, and caste. It can also enable the government to provide high-quality G2C (government to citizen) services digitally. This means that more people, regardless of their economic background or location, will have access to government services.

(e) Data captured through technology can be utilized for building AI models for resource allocation, disaster management, and other applications. This means

that the government can make more informed decisions based on data-driven insights, which can lead to better outcomes for citizens.

(f) Digitization of legal systems and the use of AI bots can give citizens quick access to legal solutions. This can make the legal system more accessible and efficient for everyone.

(g) Creation of digital avatars can help to overcome shortages of skilled manpower. This means that new technologies can help to address labor shortages and fill skills gaps, which can lead to more efficient service delivery.

(h) AI-enabled speech models can bridge the gap of language barriers for citizen-centric interactions. This means that language barriers will no longer be a hindrance to accessing government services, making them more inclusive.

(i) Blockchain can provide transparency and accessibility to citizen records like land data, personal data, and the Public Distribution System. This means that citizens can have greater control over their personal data, which can lead to greater trust in government services.

(j) 3D printing can provide economical solutions from emergency shelters to prosthetics. This means that new technologies can be used to provide affordable and innovative solutions to some of the most pressing social issues.

(j) Drones can be used in the agriculture sector, and satellites with AI prediction models can enable better weather forecasts. This means that new technologies can be used to address some of the biggest challenges facing society, such as climate change and food security.

(k) An indigenous, robust cloud of international standards can lead to cost savings for startups and generate revenue for the country. This means that by developing our own cloud infrastructure, we can save costs and boost economic growth.

(l) Cloud computing through distributed edge with compute as a service for local and grass root governance can reduce the time to respond to queries. This means that new technologies can be used to create more responsive and efficient government services at the local level.

II. **Effectiveness of Present Policies for NATs**.

(a) Presently the application and enforcement of policies is a challenge.

(b) Present policies are reactive and too slow.

(c) A close coordination with other developing countries for adoption of policy framework needs to be adopted in line with our requirements.

(d) A robust data collection and sharing policy needs to be developed on priority, as the lack of data sharing is hindering the growth of AI models. A robust system for data sharing in partnership with the industry needs to be built up.

III. **Right Approach of Regulation/ Policy**

(a) The policy formulation should be participatory in nature, involving government, industry, academia, subject matter experts, and youth of the country, as well as startups with innovative ideas. Collaboration across different sectors and industries should be encouraged.

(b) Policies should be progressive, enabling, and accommodating, and should be both meaningful and implementable.

(c) Policies should be open to change and evolution, and should drive adoption and usage.

(d) Meaningful regulations for data sharing should be created to enable citizen-centric services and support current economic growth.

(e) A cadre of domain specialists for tech policy formulation should be established.

(f) Incentives should be provided to companies developing intellectual property (IP), such as tax rebates.

(g) Product development should be export-oriented to generate funds.

(j) Tech talent should be retained in the country by granting dual citizenship for tech specialists.

IV. **Testing and Certification of NATs**. To ensure successful implementation of new age technologies, testing should be specific to the intended use case rather than relying on standardized systems adopted for other purposes. A customized solution is necessary as each problem is unique. The approach should be based on "what works for us."

V. **No Cost No Commitment (NCNC) Trials**. NCNC (No Cost No Commitment) model is not suitable for the industry and startups. Instead, trials should be based on the SCTC (Some Cost Time Commitment) model, which would allow startups to generate some revenue and foster healthy competition. This approach would provide a more practical and sustainable testing environment for new technologies, ensuring that they are better suited to real-world use cases. The SCTC model could potentially accelerate the adoption of new technologies by the government and industry and help promote innovation and growth in the sector.

Summary - Questionnaire IV (DARPG, NASSCOM, FICCI, Academia and other Experts, Speech by Renowned Personalities) - Based on the interaction, the highlights of the interaction is enumerated below.

(a) India should aim to be a $26 trillion economy by 2047 and a global leader in high-end technology, services, R&D, innovation, and patents.

(b) Public services should be citizen-centric, and India should have a global outlook in everything it does.

(c) Benchmarking should be done at all levels and to global standards.

(d) Long-term visions should be developed at all levels, from Panchayats to the Central government.

(e) Institutions, laws, procedures, and processes need to be changed or recast to achieve the goals.

(f) Technology should be embraced as an enabler in government functioning.

(g) The government needs to seek out the best expertise and talent from both within and outside the government.

(h) Capacity of the people and the system needs to be improved.

(j) Mindset change is required, and the private sector needs to be supported for public service delivery. Government only to remain enabler for the private sector.

(k) There needs to be more collaboration between the government and private sector to leverage expertise, knowledge, and skills.

(l) Government should focus on Education, Nutrition, and Health to achieve the goals of SDG 2030. Countries such as Korea, Japan, and Singapore have established themselves as global leaders due to their early resolution of issues in

areas such as education, nutrition, and health. By prioritizing these areas and implementing effective policies, they have achieved high levels of human development and economic growth. India can learn from these countries and prioritize these areas to achieve similar levels of success.

(m) India needs to build its own platform for all services, which need to be built upon the indigenous Indian Stack.

(n) Innovation needs to be rewarded at the district, state, and central level.

(o) Lagging states need to study the leading states' model of e-services.

(p) Linkages between startups, academics, and government need to be strengthened.

(q) State and service portals need to be strengthened for seamless transformation to a digitally empowered citizen and a digitally transformed nation.

(r) Innovative efforts need to be made so that e-services do not get saturated, and they need to grow based on feedback from citizens.

(s) Silos between ministries need to be broken for cross-communication.

(t) Use cases of technology need to be regulated instead of technology as a whole.

(u) Sunset clause needs to be built into each policy for complete review.

(v) Respect for privacy and individual rights should be given higher priority, and ethics should be a priority.

(w) An indigenous regulatory framework for New Age Technologies needs to be developed.

(x) India needs to develop a unified platform for all public services, with services that communicate with each other and leverage data generated to improve public service delivery. This platform should be built on indigenous technology and open source platforms.

(y) The various ministries working in silos need to break down barriers and ensure that their technologies can communicate and work together.

(z) The Reserve Bank of India (RBI) is the single body regulating the financial sector, leading to better cohesion among regulators. Similar set up is required for tech regulation also.

(aa) Government policies and regulations need to be aligned to support the growth of a strong technological ecosystem.

(bb) Impactful innovation policies are needed to encourage creative and inventive activity.

(cc) Inter-agency coordination is crucial for effective data governance and to prevent decision making in silos.

(dd) India is currently in a favorable global environment, both strategically and culturally, and it is important for India to adopt a global outlook in all of its endeavors.

5.6 Findings of the Survey

(a) Primary survey was conducted for citizens, startups/industry and stakeholders in policy making/academia/industry associates through different questionnaires to understand the aspirations of citizens for India@2047, understand the current challenges in tech policy for NATs and recommend the important tenets for tech policy framework for India@2047. The dream of the citizens for India@2047 as per survey is to see the country as a 'Developed Nation' which is a 'Global Power' and a 'Technology Leader', with 'Inclusive Growth' for all the citizens.

(b) Secondary survey was conducted to gather various benchmarking indices carried out by UN/WEF/ other reputed Global/ Indian organizations to see where India stands in various facets of e-governance, Telecommunication infrastructure, adoption of new age technologies, status of R&D in India. The important aspects of survey are highlighted in subsequent paragraphs.

(c) **Impact of NATs**. The survey highlights the impact of adoption of NATs can improve productivity, transparency, and cost-effectiveness of government services, bridge the gap between the government and citizens, and provide solutions for resource allocation and disaster management. The use of 5G, AI, Blockchain, 3D printing, drones, and satellites with AI prediction models can enable better and more efficient service delivery. An indigenous, robust cloud of international standards can lead to cost savings for startups and generate revenue for the country.

(d) **Challenges.** The survey has highlighted the main challenges of present tech policies are; Delay in implementation of tech policy, application and enforcement of policies is currently a challenge and that present policies are reactive and too slow. There is lack of R&D infrastructure and funding for New Age Technologies. Startups currently face challenges in collaborating with Public Sector Undertakings (PSUs) for NATs, as there is no support available. Additionally, the Intellectual Property Rights (IPR) structure is still in its nascent stage, making it difficult for startups to protect their innovations. Marketing innovation is also challenging, and there is a lack of testing platforms available for NATs. Another key point is the need for a robust data collection and sharing policy to be developed, as the lack of data sharing is hindering the growth of AI models. A partnership with the industry should be established to build up a robust system for data sharing.

(e) Suggestions for Inclusion in Tech Policy for NATs. The survey of startups revealed several suggestions for inclusion in India's tech policy for New Age Technologies. These include hiring the best technology talent for tech policy formulation, setting up government/private industry-funded incubation centers at colleges, strengthening IPR protection for startups, instituting measures for market availability of innovative products, supportive procurement policies for startups, development of global standard product, enhanced R&D funding with tax relaxation, development of R&D infrastructure, alignment of skill development with startups/industry requirements, realignment of syllabus to deep

tech in higher education, and more tax incentives, benefits, and holidays for startups to grow.

(f) **Concept of Policy Formulation**. The survey brings out that policy formulation should be participatory and collaborative across sectors, with policies that are progressive, enabling, and adaptable. Policies should also incentivize IP development and enable meaningful regulation for data sharing to support current economic growth. The establishment of a cadre of domain specialists for tech policy formulation is also recommended, as well as measures to retain tech talent in the country. There is a need for close coordination with other global leaders for adoption of policy frameworks that align with India's requirements.

(g) **Experts Opinion**. The interaction with experts in the field of policy making are of the opinion that India needs to prioritize technological development to become a global leader in high-end technology, services, R&D, innovation, and patents, and to achieve its goal of becoming a $26 trillion economy by 2047. To achieve this, the government should prioritize citizen-centric public services, benchmark to global standards, develop long-term visions, improve capacity, and embrace technology as an enabler. The private sector should be supported for public service delivery, and collaboration between government and private sectors needs to be strengthened. There should be a focus on Education, Nutrition, and Health to achieve SDG 2030 goals. An indigenous regulatory framework for New Age Technologies needs to be developed, and innovation needs to be rewarded. The government policies and regulations should align to support the growth of a strong technological ecosystem. Inter-agency coordination is crucial for effective

data governance, and privacy and individual rights should be given higher priority. Finally, the government should adopt a global outlook in all its endeavors.

Chapter 7: Recommendations -Tech Policy Formulation

6.1 The findings demonstrate that there are significant challenges that currently impede the development of effective tech policy, indicating an urgent need to strengthen and revamp the existing policy framework to better address the emerging challenges and opportunities presented by technology. The tech policy framework has been aligned to correspond with the objectives of Vision India@2047 and the current challenges in adoption of NATs. As outlined in Chapter 5's Figure 5.17 Tech Policy Framework, the proposed tech policy structure is supported by five pillars which are elaborated in the following paragraphs. The recommended list under the pillars is not exhaustive.

6.1.1 National Security. Ensure the citizens' physical safety, together with the integrity of key infrastructure, communication networks, and law enforcement actions.

(a) **Secure Supply Chain**. As per secondary survey, bulk of the cyber breaches on critical infrastructure as well as individuals, is due to supply chain attacks. The supply chain needs to be made secure, resilient and well managed through short and long term measures. Due to the integrated nature of ICT supply chain resilience; there is a need to develop core principles (e.g., security-by-design), technical standards and legislative/regulatory frameworks to ensure a consistent level of cyber security and accountability across stakeholders. There is also a need for setting up standards for qualifying suppliers as trusted sources. There is a need to have a designated nodal center to coordinate and conduct a comprehensive supply chain risk analysis and vulnerabilities mapping. A National Resilience Framework with a milestone-based time bound strategy to reorient ‘at risk’ supply chains for critical systems are required to be prepared. Also to begin

with, self-assessment tools and guidelines can be published by the government to help organizations implement policies on the ground. In the long term, building domestic capability through economic incentives and through creation of High-Tech Manufacturing Parks is essential. The impetus needs to be given to Make in India through proper funding as well as PLI schemes for the semiconductor industry for chip making.

(b) **Cyber Resilience**. Digital transformation has led to significant investments in e-governance initiatives as well as smart city projects. Key public-private partnerships have enabled the deployment of analytical models and big data based on AI and ML to improve public services. The development of Internet of Things (IoT) devices and management platforms has been accelerated by smart city initiatives. The scope of cyber threats has vastly expanded across all industries. Threat vectors, such as Distributed Denial of Service (DDoS) and ransomware, pose a significant risk to the mission of delivering public services efficiently and uninterruptedly. Therefore, cyber resilience risks must be comprehended in order to construct robust and future-proof defense mechanisms. In today's world of digital transformation, systems must become more robust and SOPs must be implemented at all levels. Accountability at every level for any cyber security breach is a must. To adopt measures for the development of a trustworthy system through a secure supply chain. Provide assurance to citizens regarding the data protection of their use of electronic platforms by publishing cyber security legislation/policy/guidelines, etc., and also by creating awareness among citizens via various platforms. There is a need for more proactive cyber

risk response management.

(c) **Quantum Resistant Systems**. Quantum computing can have a disruptive effect on today's cryptographic encryption, which secures communication, networks and computers. China has worked tremendously in the field and has been successful in developing quantum computers. Official and confidential information will be at risk of being hacked and exploited, posing a challenge for the government. Future systems must be quantum-safe in order to prevent the compromise of e-services using data accessible on an open platform. Also, the development of modern "Quantum-resistant" technologies should be prioritized so as to establish a national communication network that is integrated with quantum cryptographic systems.

(d) **Online Self-Assessment Tool**. Use of self assessment tools by various manufacturers for IoT and other network devices should be promulgated. This should evaluate a connected product on various dimensions including privacy, cyber security flaws, licensing provisions and interoperability. Penalty clause to be invoked for non adherence of the laid down provisions during self certification of the product by manufacturers.

(e) **Telecommunication Infrastructure**. As per UN e-Government survey, 2022, India has poorly developed telecommunication infrastructure (score of 03954 out of 1) and is much below the world average (0.5751). The poor infrastructure impacts the delivery of e-services to remote areas. Improvement of telecommunication infrastructure needs to be the focus area so as to reach the last mile with robust connectivity.

6.1.2 Economic Development. The need to promote innovation and entrepreneurship, including the development of a supportive ecosystem for startups and small and medium-sized enterprises (SMEs). This should address issues such as access to finance, intellectual property rights, and regulatory frameworks that encourage innovation and investment.

(a) **Boost to Innovations**. Innovation is an essential driver of economic and social progress. For innovation to take place, new knowledge has to be created through investment in research and it then diffuses through the education system or publications, patents and interchange of ideas. Innovative practices of startups and industry needs to be supported to improve their competitiveness in global markets. Innovation policies need to have the potential to enlarge market size, increase the degree of competition in the product market, increase the productivity of research and development and improve the capability of firms to benefit from it. One of the effective ways to increase innovation as well as productivity is to give Government tax subsidies, grants for R&D and low real interest rates to encourage innovation activity by creating a stable environment for investment in sectors that support the development of technology and information. The innovation can be boosted by taking measures such as, to locally buy the products, risk reduction for the innovators, collaborative approach and flexible regulations for encouraging the innovator.

(b) **Market Availability**. As per the survey, marketing is one of the biggest challenges for a startup, despite financial support for marketing schemes by the

government. Measures need to be instituted for better market availability for startups for innovative/ out of box solutions.

(c) **Export Orientation**. The innovations carried out by startups needs to be incentivized, so as to convert into a product and it can further be capitalized for export and generate revenue.

(d) **Stronger IPR Structure**. As per the global IPR index, India's IPR structure needs to be revamped as also as per the primary survey the IPR structure is at a nascent stage and is not supportive of protecting the IPR of innovative development by startups. Presently challenges IP holders face is in the patenting process and also denial of the patents to many innovations. The IPR 2016 policy needs to be reviewed keeping in mind the new trends in innovation. To expand the innovation ecosystem in the country, the policy should be revised to make the necessary changes, such as organizing IPR awareness campaigns, providing comprehensive advice on increasing R&D activities, encouraging IP financing, and involving state governments in developing a robust IPR regime.

6.1.3 Privacy and Data Management

(a) **Privacy by Design**. Privacy by design framework should be binding on developers for proactive embedding of privacy into the design specifications of information technologies, network infrastructure and business practices, thereby achieving the strongest privacy protections possible.

(b) **Data Protection**. Data Protection by design and by default should be a legal requirement under the policy framework and practical guidance must be laid down. Implementation of the DPDP 2022 and National Data Governance Policy 2022 should be top most priority as it impacts all the New Age Technologies.

6.1.4 Infrastructure

(a) **Nomination of Lead Agency for Tech Policy**. In the financial sector, RBI is the central agency regulating all the policies and coordinating with different agencies resulting in improved financial regulatory framework in the country. Similarly, nomination and establishing of a lead agency for tech policy formulation is important for development and implementation of effective and comprehensive technology policies and also for ensuring the responsible and equitable development and use of technology for the benefit of all citizens. The lead agency needs to be established with composition from different departments of government, academia, Industry, Startups etc, so as tackle the issue of siloed decision making,

(b) **Increased Funding for R&D**. A substantial increase in R&D from the present allotment of less than 2% of GDP, to may be 2 to 2.5% of GDP in next five years and progressively increasing to 4% in next 10 years.

(c) **Establishing R&D Parks**. To increase private sector investments, tax incentives for the development of R&D parks for various New Age Technologies are provided. R&D parks can be modeled like Special Economic Zones (SEZs) in order to provide investors with incentives, thereby attracting both domestic and international investment. Additionally, Corporate Social Responsibility (CSR) in niche industries like R&D should be encouraged. Private companies can invest in R&D in universities and other institutions by leveraging CSR opportunities.

(d) **Strengthening Public-Private Partnership.** Adoption of measures to be implemented through public-private partnership for investing in knowledge parks,

incubators, and enhancing academia-industry ties by establishing entrepreneurship cells.

(e) **Regulatory Sandboxing**. A framework established by a regulator that permits innovators to conduct live experiments in a controlled and isolated environment under the regulator's supervision in order to expedite product deployment, even when no regulation exists or existing regulations are too stringent. The measures undertaken by RBI, IRDAI, SEBI, Digital Health Mission (NDHM) for regulatory sandbox needs to be exploited for other sectors also.

(f) **Capability Centers**. These capability centers need to be established in public-private partnership for strengthening the public sector engineering expertise and also to build the government's capability in futuristic technologies. Their tasks should be to develop and deliver innovative citizen centric products and services for all departments. Startups can be given a major role to play in these capability centers. The centers can be established for Application design, development and deployment over the Indian Stack, Cyber Security, Data Science & AI, ICT Infrastructure, Blockchain and Quantum, IoT and Futuristic Technologies.

(g) **Integrated Service Delivery**. An integrated service enables faster service rollout and access to a greater number of e-services. The integrated portals provide intuitive navigation, a uniform look and feel, a centralized access point for multiple services, improved service availability, robust information security and privacy governance, and easier integration with other platforms/external applications, among other benefits. Creation of Enterprise Architecture (EA) that

is aligned with MeitY's India Enterprise Architecture (IndEA) framework and adoption of aspects such as a single Digital Id, the creation of APIs for integration, and the establishment of architecture Governance committee. This will enable a uniform experience for citizens and businesses by providing contactless and frictionless integrated services across multiple channels.

(h) **Skill Sets of Future Workforce**. According to the primary survey, skill sets must be adapted to NATs. Also as per the NeSDA 2021 report, the development of the future workforce is a vital aspect of digital governance. To meet the future demands of industries and public service delivery structures, we must educate the future workforce in relevant technology areas. The current academic framework of academic institutions must be restructured to emphasize robust technical programmes in new technology areas of Industrial Revolution 4.0, such as Data Analytics, Internet of Things (IoT), Artificial Intelligence, Cloud Computing, Blockchain, etc., and other futuristic technology.

(j) **Interoperability**. Future GovTech initiatives to concentrate on enhancing the interconnectivity and interoperability of existing systems and portals by leveraging the government cloud, service bus, and Application Programming Interfaces (APIs) as cost-effective shared platforms. Also development of common data standards and protocols to ensure interoperability and data sharing between different systems needs to be done.

(k) **Efficient Disposal of e-waste**: Existing recycling and collection facilities are insufficient in comparison to the amount of e-waste being produced in the country. There are no mechanisms in place for collection or return of e-waste.

Recycling facilities are also in short supply. e-waste contains over 1,000 toxic materials, which contaminate soil and groundwater. Targeting net zero impacts by 2070 necessitates the implementation of strict regulations and penalties for noncompliance by industry.

6.1.5 Social Cohesion and Cultural Diversity

(a) **Multilingual Digital Competency Tool**. According to the European Commission, "Digital Competence" is the confident, critical, and responsible use of digital technologies for learning, work, and social participation. According to the paper on digital dream (Mumtaz & Mothkoor, 2021), only 37% of Indian households are digitally literate, and one of the reasons cited in the NeSDA 2021 report for not accessing e-services by citizens in India is lack of proficiency in using digital devices. Since 2018, DigComp has been used in the EU to enhance the digital competence of its citizens. The purpose of the tool is to improve the digital skills of the entire population; by 2030, 80 percent of EU citizens will have basic digital skills. Similarly, a multilingual tool must be developed to improve the digital competence of citizens in the country, in order to aid policymakers in the formulation of policies and in the planning of education and training initiatives using AI and data analytics to improve digital competence. This tool will assist in bridging the digital divide and expanding access to e-services throughout India.

(b) **Public Outreach Programme**. As per report on assessment of e-services 2021, 52% of the respondents who had not availed e-services cited the reasons of unawareness about e-services and 61% cited non-availability of digital gadgets &

access to internet. This implies that there is a strong disconnect in dissemination of the e-services across all sectors of society as well as a huge digital divide exists. In order to enhance the public outreach of e-services, sensitization in local language through omni channels like more enabled CSCs, smart watches, digital TVs needs to be carried out. Also to diminish the existing digital divide, development of affordable technology and availability of high-speed internet at remotest of the area.

(c) **Platform Based System**. In order to remove the inter department siloes, we need to shift to a platform centric approach to provide all public service through a single service window and to build all the services on the Indian Stack. All the public services being developed should be digital by design and should provide personalized service delivery. The data should be only asked once from the citizen and not repeatedly and all the public services should be available online. This kind of system shall enable implementing intelligent public service, personalized public service and data based policy making.

(d) **Assistive Technology for PwDs**. Assistive technology empowers Persons with Disabilities (PwDs). According to the World Bank, there are between 40 and 80 million Persons with Disabilities (PwDs) in India. India lacks a robust market for assistive technologies and inclusive solutions that empower and serve people with disabilities. Also as per another report of UNESCO, only 39% population has access to assistive devices due to limited resources for producing the assistive devices and higher cost of assistive devices. The focus should be to make assistive

devices more affordable and user friendly for PwDs by use of new age technology like AI.

(e) **Mobile First Approach.** To leverage on the widespread adoption of mobile devices across the nation, mobile-first design for service delivery should be the priority.

(f) **Fake News**. Controlling fake news is a complex issue: failure to control it could lead to national and international instability, whereas excessive control could be detrimental to democracy. As technology like AI/ML and data analytics grows, the technology for creating misinformation will further improve. The spread of misinformation needs to be built through public literacy programmes and use of technology to counter the fake news itself.

6.2 The recommendations presented under each of these pillars are designed to ensure that technology policy in India is citizen-centric and aligned with the needs and aspirations of the people. These can guide policymakers in formulating technology policies that promote sustainable development and ensure citizen-centric governance in India. By adopting these recommendations, policymakers can leverage technology to address the country's most pressing challenges and opportunities, and ensure that technology remains a force for good in the years leading up to 2047 and beyond.

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Appendix

Questionnaire 1 (Citizens)

Tech-Policy Formulation for India @2047: Designing a Conceptual Framework to Ensure Citizen-Centric Governance

As proud Indians, we are all aware of Amrit Kal Mahotsava to hail citizen-centric Governance in the 100th year of India's Independence - also known as India@2047. The present survey is to understand the opportunities and futuristic requirements in tech-policy to achieve Vision India @2047 for citizen-centric governance and also to understand the aspirations of the citizens in the year 2047. The analysis of data hence received will help to delineate a conceptual framework for tech-policy formulation for India @2047 – from the perspective of citizens of India.

*** Required** ***Mark only one option***

1. What is your Gender? *
   - (a) Male
   - (b) Female
   - (c) Prefer not to say
2. What is your age? *
   - (a) 18 - 30 Years
   - (b) 31 - 40 Years
   - (c) 41 - 50 Years
   - (d) 51 - 60 Years
   - (e) Above 61 Years

3. What is your qualification? *

   (a) Doing Graduation

   (b) Graduate

   (c) Post Graduate

   (d) Other:

4. What is your subject of specialization? *

   (a) Engineering

   (b) Other sciences

   (c) Commerce

   (d) Arts

   (e) Other:

5. What is your occupational status? *

   (a) Student Engineer

   (b) Law Enforcement including policing

   (c) Teacher

   (d) Lawyer

   (e) Start up Industry

   (f) Self Employed

   (g) Doctor

   (h) Civil Services

   (j) Other:

6. What is your family income? *

   (a) < Rs 5 lac per annum

   (b) Rs 5 to 10 Lac per annum

   (c) Rs 10 to 20 Lac per annum

   (d) Rs 20 to 30 Lac per annum

   (e) > 30 Lac per annum

   (f) Do not want to respond

7. Are you involved in policy formulation in respective departments / occupation? *

   (a) Yes

   (b) No

   (c) Other:

8. Do you agree that technology plays a role in citizen centric governance? *

   (a) Yes

   (b) No

   (c) Not sure

9. Are the current government policies suitable for emergence of New Age Technologies in India? *

   (a) Yes

   (b) No

   (c) Not sure

10. What are the shortcomings in the current policies and implementation methodology of the Government in emergence of New Age Technologies in India? *

(a) Lack of Funding

(b) Lack of Research and Development

(c) Non participation of private sectors

(d) Sluggish PSUs

(e) Time delay in policy making for New Age Technologies

(f) Other:

11. As a proud Indian citizen, what are your aspirations of India @2047? *

12. Imagine that you are responsible for making a technology policy framework for India @ 2047 to meet your visualized aspirations.

13. What all shall you include in formulation of the technology policy framework? *

14. Any additional comments

Questionnaire 2

Tech-Policy Formulation for India @2047: Designing a Conceptual Framework to Ensure Citizen-Centric Governance

The present survey is to understand the opportunities and futuristic requirements in tech-policy to achieve Vision India @2047 for citizen-centric governance. The analysis of data hence received will help to delineate a conceptual framework for tech-policy formulation for India @2047 – from the perspective of citizens of India.

Startups always face multiple challenges in any business environment; from fast-paced markets, globalized business platforms, competition, lack of financing and policy issues. When investing in NATs these challenges further increase but this can also turn into opportunities.

* Required ***Mark only one option***

1. What is your Gender? *
   (a) Male
   (b) Female
   (c) Prefer not to say
2. What is your age? *
   (a) 18 - 30 Years
   (b) 31 - 40 Years
   (c) 41 - 50 Years
   (d) 51 - 60 Years
   (e) Above 61 Years

3. What is your qualification? *

   (a) Doing Graduation

   (b) Graduate

   (c) Post Graduate

   (d) Other:

4. What is your subject of specialization? *

   (a) Engineering

   (b) Other sciences

   (c) Commerce

   (d) Arts

   (e) Other:

5. What is your income? *

   (a) < Rs 5 lac per annum

   (b) Rs 5 to 10 Lac per annum

   (c) Rs 10 to 20 Lac per annum

   (d) Rs 20 to 30 Lac per annum

   (e) 30 Lac per annum

   (f) Do not want to respond

6. What does your Start up deal in? *

   (a) Solution based on New Age Technologies /Emerging Technologies.

   New Age Technologies / Emerging Technology are AI, IoT, Quantum, 5G,

   Cloud Computing, 3D Printing, Space Technology and other such technologies

   (b) Medical

(c) Logistics/ Supply Chain Education

(d) Surveillance System

(e) Cyber Security

(f) Other:

7. How old is your Startup? *

(a) < 2 Years

(b) 2 to 5 Years

(c) >5 Years

8. Do the New Age technologies play a role in your Startup? *

(a) Yes

(b) No

(c) Other:

9. Do the present policies support Start Ups? *

(a) Yes

(b) No

(c) Not Sure

10. Are there sufficient avenues available for funding of StartUps in India for New Age Technologies? *

(a) Yes

(b) No

(c) Not sure

11. What are the options available for funding of Start Ups? *

12. Is the existing IPR structure in the country adequate to develop and field New Age Technologies? *

(a) Nascent Stage

(b) Satisfactory but can be improved considerably

(c) Big Industry players controlling IPR by an established cartel

(d) IPR fully protected

(e) Other:

13. Are adequate funding/collaboration available from PSUs? *

(a) Fully available

(b) Available on case to case basis

(c) Available through connect with PSUs

(d) Not adequately available for development of New Age Technologies

(e) Cannot comment

(f) Other:

14. What is ease /difficulty in projecting/marketing an out of the box solution/new product in the market?

(a) 1 (Easy)

(b) 2

(c) 3

(d) 4

(e) 5 (Difficult)

15. Does any platform exist for testing and certification of New Age Technologies? *

(a) Yes

(b) No

(c) Not sure

16. What is the opinion on the conduct of NCNC trials by StartUps? *

(a) Yes

(b) No

17. Do you agree that technology plays a role in citizen centric governance? *

(a) Yes

(b) No

(c) Not sure

18. Are the current government policies suitable for emergence of New Age Technologies in India? *

(a) Yes

(b) No

(c) Not sure

19. What are the challenges in the current policies of the Government in emergence of New Age Technologies in India? *

(a) Lack of Funding

(b) Lack of Research and Development

(c) Non participation of private sectors Sluggish PSUs

(d) Time delay in policy making for New Age Technologies

(e) No hand holding by Government for Start ups

(f) Other:

20. Is any platform available for StartUps in which they can put across necessary shortcomings / challenges in current policy standards? *

(a) Yes

(b) No

(c) Not sure

21. As a proud Indian citizen, what are your aspirations of India @2047? *

22. Imagine that you are responsible for making a technology policy framework for India @ 2047 to meet your visualized aspirations. *

What all shall you include in formulation of the technology policy framework?

23. Any other issue from the StartUp viewpoint which merits consideration in tech policy formulation? *

Questionnaire – Industry

(New Age Technologies / Emerging Technology are AI, Quantum, 5G, Cloud Computing, 3D Printing, Space Technology and other such technologies)

1. Do you agree that New Age Technologies (NATs) like AI, Blockchain, 5G, 3D Printing, Cloud Computing, Quantum, Space, etc can play a role in governance?
2. If yes, How shall it impact citizen centric governance and where all it can be utilized?
3. What is the existing policy framework/ regulation for adoption of NATs in India?
4. Is the present policy framework effective to deal with these NATs?
5. NATs goes through No of stages of development before being adopted. What's the right time to regulate these policies?
6. What's the right approach to regulation i.e. for development of technologies, protect citizens, promote competition, and/or any other factor?
7. Any other issue from industry viewpoint which merits consideration in tech policy formulation for NATs?
8. A No of countries world over have adopted different policy models for early adoption of NATs for governance. Any such policies by other countries on NATs which can be adopted by India for the emergence of NATs?
9. How has the NATs been tested and certified against the existing standards?
10. How will the NATs platform and solutions be certified for adoption?
11. What is the opinion of NCNC trials of Industry?
12. Any other issue from Industry viewpoint which merits consideration in tech policy formulation?