Science technology and innovation policy pdf

A Milestone In Indian STI EcosystemBottom-UpDecentralisedExpert-DrivenEvidence-InformedInclusiveThe Government of India will launch its 5th National Science, Technology and Innovation Policy, a holistic and pragmatic policy dedicated to Science, technology, and most importantly innovation. The policy aims to reorient Science Technology & Innovation (STI) in terms of priorities, sectoral focus, and strategies.The 5th National STIP is initiated jointly by the Office of the Principal Scientific Adviser (Office of PSA) and the Department of Science and Technology (DST). A Secretariat with in-house "policy knowledge and data support unit" has been set up at the Department of Science and Technology to coordinate the entire process.There are multiple ways to engage with the policymaking process. With the aim to collate the input and outreach, six unique national-level initiatives have been launched. Through realtime online conversations with dynamic experts, thematic webinars, focused survey instruments, digital and print media campaigns along with community radio broadcasts, the 5th National STIP aims to generate a wide-ranging national engagement. To coordinate the end-to-end policy process, the 5th National STIP Secretariat is set up at DST (Technology Bhavan) having joint team at Office of PSA and DST . For any queries related to 5th National STIP, please contact Dr. Chagun Basha at b.chagun@gov.inIn conversation withAcross the tablePolicy compassOpen LetterThoughts for IndiaIdeathonBack to Top Introduction As India and the world reorient in the wake of the COVID-19 crisis, a landmark policy initiative has been flagged by the Government of India. The Science, Technology and Innovation Policy, 2020 (STIP2020) formulation process will be facilitated jointly by the Office of the Principal Scientific Adviser to the Government of India (Office of PSA) and the Department of Science and Technology (DST)/ . It is one of the most significant events amidst many important changes in the past decade that have necessitated the formulation of a new outlook and strategy for Science, Technology, and Innovation (STI). STIP 2020 by way of its decentralized, bottom-up, and inclusive design process aims to restrategize priorities, sectoral focus, and methods of research and technology development for larger socio-economic welfare. A participative model with four interconnected tracks that has been envisioned to formulate the STIP 2020. The details on various tracks and the entire process can be accessed here.(Track 1Extended public and expert consultation Track 2Thematic group consultation Track 3Ministries and State consultation Track 4Apex Level Multi Stakeholder consultation - Track I aims to create a repository of public voices that will act as a guiding force for the drafting process. - Track II consultations comprises 21 expert-driven thematic collectives to feed evidence based recommendations into the policy drafting process. - Track III brings together Ministries and States in extensive engagement through nominated nodal officers - Track IV is the binding force that draws upon apex level multi-stakeholder engagement at the national and global levels. Inputs from these wide-ranging deliberations will finally lead to STIP 2020. Contribute to the formation of India's New Science, Technology & Innovation Policy 2020 There are multiple ways to engage with the policymaking process. With the dual purpose of outreach and input gathering, six unique national-level initiatives have been launched. Through live virtual conversations with dynamic experts, thematic webinars, focused survey instruments, digital and print media campaigns along with community radio broadcasts, STIP2020 aims to generate a wide-ranging national engagement. To coordinate the end-to-end policy process, STIP 2020 Secretariat is set up at DST (Technology Bhavan) which will have joint and seamless functioning between Office of PSA and DST. Sincere efforts have been put by the STIP 2020 Secretariat and Science Policy Forum to ensure a comprehensive representation of the nation's plurality. For the design and implementation support in the public consultation process, Science Policy Forum has partnered with Gubbi Labs and Rockstar Social. Know more about different ways to contribute to the Policymaking Process With the passing of the year 2020, the government has missed the deadline for announcing its ‘Science, Technology and Innovation Policy, 2020’, which will be the fifth such policy since independence. It has, however, finalised a draft and put it up on the Department of Science and Technology website for public comments. The policy is broadly directional, lacks in specifics but still has several interesting ideas. Here are some:STI Development BankA Science, Technology and Innovation (STI) Development Bank will be created to direct long-term investments in select strategic areas. For large-scale mission-mode programmes, rules of lending will be modified for an easier flow of finance.Strategic tech dev fundA Strategic Technology Development Fund is to be set up to home-grow strategic technologies in areas such as nuclear science, space, cyber technology and biotechnology. The fund, managed by a Strategic Technology Development Board, will also provide finance to the private sector and higher education institutions for research with specific goals. The idea is to go “beyond government departments” to enhance innovation. A “strategic export policy to enable private players to thrive in the international markets” is on the cards.Tapping the diasporaAppropriate institutional mechanisms are to be created to dip into the untapped potential of the highly-skilled Indian scientific diaspora. There will be opportunities for them to return, or to contribute from wherever they are based. An “engagement portal” exclusively to bring together Indian scientists and technocrats worldwide and to engage with Indian researchers is being planned. The diaspora will “participate in high-level consultations for key sectors”.Science diplomacyThe role of S&T in defining foreign policy priorities “will be vitalized”. Apart from ‘S&T for diplomatic benefits’, ‘diplomacy for S&T development’ is to be promoted. Multilateral dialogues will be initiated with key partner countries on matters related to all aspects of technology and innovation, including issues around technology governance. The number of Indian S&T counsellors in various countries will be increased — and “will be empowered to create opportunities for greater participation of the Indian scientific community, both in India and abroad”. Published on January 17, 2021 Department of Science and Technology under Ministry of Science and Technology, Government of India has released the draft of 5th National Science, Technology, and Innovation Policy for public consultation. Delighted to inform that the Draft 5th National Science, Technology & Innovation Policy #STIP2020 has been finalised & released for public consultation.I Invite you to share your thoughts on it latest by 25th January, 2021 via email india.stip@gmail.com pic.twitter.com/VCKghCVrCH — Dr Harsh Vardhan (@drharshvardhan) December 31, 2020 Amid the ongoing COVID-19 pandemic, the 5th Science, Technology, and Innovation Policy (STIP) was initiated during the mid-2020. The COVID-19 pandemic provided a compelling opportunity for R&D institutions, academia and industry to work in unison for sharing of purpose, synergy, collaboration and cooperation. About National Science, Technology, and Innovation Policy The STI policy in India plays a crucial role in fostering socio-economic and political development globally, benefitting all the sectors through scientific and technological advances. The evolution of STI policies in India are as follows: 1- The first policy on science was adopted in the year 1958 in India-- Scientific Policy Resolution, 1958 (SPR1958). 2- The second policy on science was adopted in the year 1983 in India-- Technology Policy Statement, 1983 (TPS1983). 3- The third policy on science was adopted in the year 2003 in India-- Science and Technology Policy 2003 (STP2003). 4- The fourth policy on science was adopted in the year 2013 in India-- Science, Technology, and Innovation Policy 2013 (STIP2013). What is the need for 5th Science, Technology, and Innovation Policy? The 5th Science, Technology, and Innovation Policy is drafted to bring profound changes via short-term, medium-term, and long-term mission mode projects by building a nurtured ecosystem that promotes research and innovation on the part of both individuals and organizations. Aim of 5th Science, Technology, and Innovation Policy The 5th Science, Technology, and Innovation Policy aim to foster, develop, and nurture a robust system for evidence and stakeholder-driven STI planning, information, evaluation, and policy research in India. The policy also identifies and addresses the strengths and weaknesses of the Indian STI ecosystem to catalyse socio-economic development of India and to make the Indian STI ecosystem globally competitive. It also aims to bring in the concept of dynamic policy with a robust policy governance mechanism incorporating features such as implementation strategy, periodic review, policy evaluation, feedback, and adaptation, and most importantly, a timely exit strategy for various policy instruments. It is to be noted that the new STIP policy revolves around the principles of being decentralized, evidence-informed, bottom-up, experts-driven, and inclusive. Chapters of 5th National Science, Technology, and Innovation Policy: The Chapter of 5th National Science, Technology and Innovation Policy are as follows: Chapter 1: Open ScienceChapter 2: Capacity DevelopmentChapter 3: Financing STI Chapter 4: Research Chapter 5: Innovation and Entrepreneurship Chapter 6: Technology Development and Indigenisation Chapter 7: Equity and Inclusion Chapter 8: Science Communication and Public Engagement Chapter 9: International STI Engagement Chapter 10: STI Governance Chapter 11: STI Policy Governance Chapter 1: Open Science As per the draft, to promote open science, the public will have the right to access all outputs from researchfunded by the Central Government or the State Governments, either directly or through funding agencies, or institutions supported by the Central Government or the State Governments. 1- National STI Observatory: A National STI Observatory will be established as a central repository for all kinds of data related to and generated from the STI ecosystem. 2- Indian Science and Technology Archive of Research (INDSTA): A dedicated portal (INDSTA) will be launched to provide access, specifically, to the outputs of all publicly-funded research. 3- Open Data policy for Publicly Funded Research: All the data used in and generated from public-funded research will be available to everyone under FAIR (Findable, Accessible, Interoperable and Reusable) terms. However, some exceptions will be made on grounds of privacy, national security and Intellectual Property Rights (IPR). 4- Open Access: Complete text of final author versions of manuscripts along with supplementary materials will be deposited immediately to an institutional repository or central repository upon acceptance. 5- One Nation, One Subscription: The Government of India will negotiate with journal publishers for a “one nation, one subscription” policy so that all the individuals in India may have access to journal articles. 6- Indian Journals: Steps will be taken by the Government of India to improve awareness and visibility of Indian journals. Also, digital versions of the print journals will be created (if required) to make them easily accessible by the international scientific community. In addition to these, efforts will be made to curb the publication of fake journals. 7- Research Facilities: All public-funded scientific resources will be made shareable and accessible pan India with the use of digital platforms and will not be limited to research infrastructures, laboratory facilities and instruments, ICT and AI-based resources and high-performance computing facilities. 8- Open Educational Resources: These will be made available under minimally restrictive open content license, with the right of attribution preserved and translations in regional languages will be permitted. 9- Libraries: The libraries established in the public-funded institutions will be accessible to the general public, subject to reasonable security protocols. 10- Learning Spaces: Learning spaces will be made universally accessible in the country in accordance with the international guidelines and standards.   Chapter 2: Capacity Development As per the draft, effective use of advanced technologies is required for capacity building to improve learning outcomes, quality of science education, and equitable access, leading to excellence in R&D and innovation. 1- Education and Research: An ecosystem which is neither dependent nor borrowed and is reliant on its own resources, strength and resolution with a pyramidal structure resting on a broad base and not on its apex is the need of the hour in the country. Education and research must inculcate true scientific temper, discipline and honesty, national pride, adherence to the principles of justice, gender parity, ethical practices and spirit of fair competition and brotherhood. Atmanirbharta (self-reliance) must be inculcated among students at all educational levels that includes Atmavishwas (self-confidence), Atmasamman (self-respect) and Atmachintan (self-assessment). Innovation and Entrepreneurship Centres will be established and research in n innovation practices will be made amandatory component of university/college teachers’ professional development programme, encouraging and facilitating the teachers for international collaborations or exchange programmes in STI. Additionally, upcoming and existing innovation-related programmes such as Atal Tinkering Labs and MANAK will be developed synergistically across schools for better results. A focused strategy will also be developed to inspire and engage students in science and technology education at all levels. For this, idea generation and idea transformation ability right from early education will be encouraged. The 5th STI policy also recommends representation of the ministries of Science and Technology in the working groups constituted for the revision of the National Curriculum Framework (NCF) of National Education Policy (NEP) 2020. A National School and Higher Education Mentorship Program will be institutionalized with a focus on innovation-oriented education at the school and the college levels to nurture early talent by providing a career path for career building in science with aspirations for greater achievements. Students with extraordinary intellectual abilities in a specific field who have limited opportunities to enter mainstream education will be charted to fully realize their true potential. As part of Scientific Social Responsibility Policy (SSR 2020), students of all educational levels will be given opportunities to get exposure to the leading scientific laboratories. Distance learning programmes will be strengthened to improve its quality and reach. The transition of education to research will be strengthened by including basic knowhow – and of skills in science communication –of research as a part of every PhD course curriculum. National research and innovation programme on Assistive Technologies and Learning Resources will be created to promote the use of technology. Research Excellence Framework for HEIs in India (REFI) will be evolved to assess the overall research contributions of HEIs every few years, based on parameters of importance for India. The 5th STI policy will also facilitate the Internationalization of R&D in India and more innovative programmes will be introduced in line with the existing ones with a widened scope for international faculty and students. 2- Skill Building and Training: All the universities pan India will be encouraged to be responsive and respectful to the needs of the community by conducting interdisciplinary projects involving scientific and technological and social science-based interventions. ICT and online platforms for skill building will be leveraged for active learning practices, to promote research and innovation at all levels. A library of virtual resources will be developed through community participation for remote areas. Sector-specific skill-based knowledge support mechanisms will be developed for regional communities to sustain the traditional skill and geographical indication. Inclusion of various groups based on gender, geography, language, disability and social order, to be promoted through special schemes, scholarships, need-based training and orientation programmes. Innovation and Entrepreneurship centres will be established at regional levels with the participation of local Academic and R&D institutions, industries, MSMEs, Startups, etc. The vocationally certified workforce will be employed and recognised by the industry and will be e incentivised through community grant schemes. Teaching-Learning Centres (TLCs) will be established in rural and urban areas to upskill the faculty members, enhancing experience and engagement, for effective outcomes. Increased focus will be put upon skill-building through hands-on training. A trained management cadre at the national level will be formed to plan, assess, communicate and execute educational and research activities in HEIs and research organisations. 3- Infrastructure: Higher Education Research Centres (HERCs) will be established in reputed research-focused universities/institutes pan India to assess the overall direction of the higher education system in the country, and to provide research inputs to policymakers and higher education leaders. Collaborative Research Centres (CRCs) will also be established and will bring together industries, MSMEs, startups, R&D institutions and HEIs with the government to improve industrial research and innovation and enhance global competitiveness. Transforming existing R&D institutions to research universities to enable their effective utilization. Also, a mechanism will be developed for the maintenance of existing R&D infrastructure. Through the centre-state partnership, Central and the State Governments will build and enhance the infrastructure for science laboratories, computer labs, language labs, libraries and so forth to improve the research competency. In line with the National Education Policy 2020, a mechanism will be created to facilitate greater academic, intellectual and functional autonomy to HEIs-- one that is linked to accountability, strengthening Academia-R&D-Industry collaborations. Chapter 3: Financing STI India's Gross Domestic Expenditure on R&D (GERD) is low in comparison to most of the developed and developing nations. 1- Expansion of the STI financing landscape: An STI unit with a minimum earmarked budget will be set up by every department of the Central, the State and the Local Governments, Public Sector Enterprises, Private Sector Companies and Startups to pursue STI activities with the larger goal of uplifting socio-economic conditions of all citizens. The policy also aims to double the share of extramural R&D support of the Central government agencies in theGERD in the next five years. Under a separate budget head, every Indian State will earmark a percentage of the state allocation for STI-related activities. Public financial assistance will be provided to invigorate the STI ecosystem through increased allocation for innovation ecosystems, infrastructure and critical human resource development with a special alignment towards critical sectoral growth. To build a robust innovation ecosystem, private enterprises will be encouraged to contribute and collaborate with knowledge, institutions to pursue market-relevant research through mutually decided agreements. Opportunities for foreign MNCs to invest in India’s STI landscape will be strengthened and made more accessible. Partnerships and collaborations will be encouraged with domestic, private and public sectors entities to work on projects aligned to national needs and priorities. 2- Incentivization for STI investments: Government-mediated incentivisation mechanisms act as a key stimulator for enhancing R&D and innovation in both the private as well as in the public sectors. Some of them are mentioned below: a. Fiscal incentives for industries investing in STI will be boosted through incremental R&D based tax incentives, a tax credit for investing in facilities for commercialization, tax holidays, tax waivers, etc. b. Financial support to industry, especially for MSMEs to pursue research through innovation support schemes such as matching grants, small business innovation grants (under fast track mode), innovation vouchers (SMEs), etc. c. Flexible mechanism for supplier development programmes for public procurement in all sectors.   d. Reassessment of regulatory control on STI landscape to promote innovative enterprises. 3- STI collaborative funding model: The Advanced Missions in Innovative Research Ecosystem (ADMIRE) programme is envisaged to achieve greater socio-economic self-reliance and STI leadership. It will assist and direct public-private partnerships for the development of STI knowledge-based infrastructure and creative assets. Also, A Ministry or a group of Ministries in consultation with industry/industry bodies will design and execute projects through co-funding mechanisms where they participate equally. National laboratories and academia will be made part of the engagement. 4- Governance of STI financing landscape: For efficient governing mechanisms for the STI funding landscape, a national STI Financing Authority will be established and will play the following roles: a. To strengthen financial outlay, an STI Development Bank will be established to direct long term investments in select strategic areas. b. Streamlining STI financial ecosystem by strengthening and providing greater autonomy to existing funding organisations. c. Modification/waiver of General Financial Rules, for large scale mission mode programmes and projects of national importance will be explored. d. Time-bound peer reviews along with technical and transactional audits will be conducted from time to time to monitor public financing across various stakeholders of the STI ecosystem. e. Formulation of a mechanism for timely disbursal of grants and regular networking and communication among funding agencies. f. Centralised norms for allocation of overheads will be formulated by funding agencies in the Higher Education sector. g. The National STI Observatory will encompass an open centralised database platform for all financial schemes, programmes, grants and incentives existing in the STI ecosystem. Chapter 4: Research A special emphasis on R&D activities in the priority areas will address the weaknesses in Indian research and ensure the strengthening of key areas relevant to the well being and prosperity of India and its people. 1- Expanding the S&T system - Promoting foundational and translational research: Expansion of the S&T system will be done through a focus on (a) priority areas in which India should emerge as a world leader, (b) addressing local problems, and (c) engagement and participation of industry to ensure R&D also aligns with industry needs. a. Mission mode programmes with deliverables for technology and innovation will be established in the priority sectors such as Agriculture, Water, Health, Energy and Environment. Also, challenges and opportunities must be identified in these sectors on the basis of current and future needs. b. Strong collaborations that build quality science for national problems will be encouraged and frameworks for these collaborations will be encouraged at both individual and institutional level. c. Team science collaboration will be facilitated between industry and academia, with shared financial resources, and risks and benefits. d. Domestic manufacturing capacity in the priority sectors will be enhanced via R&D and technology upgrade. 2- Enhancing the quality of research: With the help of the Research and Innovation Excellence Frameworks (RIEF), research quality will be enhanced with the expansion of the talent pool and international benchmarking exercise. To attract the best talent in the research ecosystem, joint appointments across government, academia and industry at both the national and the international levels will be facilitated. Research culture will be reoriented wherein the quality of research will be assessed, recognized and rewarded on the basis of both academic achievement and social impact. Also, research ethics will be given due importance. Minimal safety requirements for labs will be mandated for upcoming R&D infrastructure with proper guidelines. 3- Engaged research: The STI ecosystem requires strong engagement with stakeholders (industry, academia, R&D labs and social actors) to address issues such as rural problems in India. Also, the development of products, processes, technology etc. that incorporates engagement, testing and feedback from the end-user from an early stage will uptake, impact and benefit the society. For this purpose, a function will be created to scan and share indigenous research with stakeholders and promote programmes and approaches that are relevant to line ministries. It will also ensure user-stakeholders engagement from an early development stage, particularly for technology projects. 4- Ease of doing research: In order to reduce the administrative burden on the researchers, digital platforms and e-governance will be used for grant management-- all activities from award, funding and utilisation of grants to measurement of research outputs. Benchmarks for ‘ease of doing research’ will be developed so that research activities are adequately funded, are less bureaucratic and accountability is in both directions i.e. the donor and the receiver. Chapter 5: Innovation and Entrepreneurship Strengthening the innovation ecosystem to attain sustainable economic progress and global competitiveness. Integrating Traditional Knowledge Systems (TKS) and grassroots innovations into the education, research and innovation system. 1- Strengthening Innovation Ecosystem: The innovation landscape emanating from the socio-cultural, geographical, economic, historical and political contexts will be systematised, strategised and synergised to attain sustainable economic progress and global competitiveness. The distinct roles of multiple stakeholders such as higher education institutions and research and development organisations will be recognised and their inter-linkages will be strengthened, at the national, the subnational and the sectoral levels. Industry-Academia linkages will be deepened by various joint programmes for both academic experts and young scholars with industry practitioners, to harness the expertise and get practical exposure and will further strengthen the foundation laid by the NEP 2020.   Innovation clusters and technology parks will be developed and leveraged for collaborative activities, cost-sharing and Intellectual Property (IP) creation. Theme-based distributed virtual incubators and accelerators will be created across India using cluster-based approaches. Mission-oriented efforts will be incentivised for tackling various local and/or region-specific issues of societal relevance. In addition to these, cross learnings across States will be encouraged. A special focus will be on creating a conducive environment for sector-specific innovation. Also, a mechanism will be created to push forward the sector-specific agenda with support from the government, the academia, the non-profits, the private partners and the industry. 2- Fostering S&T-Enabled Entrepreneurship: S&T-enabled entrepreneurship-technology-driven, innovation-focused enterprises is critical for creating, shaping, and sustaining the future industrial sectors of India, along with delivering the benefits of scientific research for socio-economic development of the society. Such an ecosystem calls for the following: a. Investing in basic, foundational, and reliable physical and social infrastructure for S&T -enabled entrepreneurship to thrive. b. Incentivization mechanisms will be set up to aid the expeditious conversion of ideas into start-ups. c. Inculcating a culture of S&T-enabled entrepreneurship by ensuring provisions for an end to end support to promote enterprise creation. d. Creation of a nurtured and supportive environment for S&T-enabled entrepreneurship and entrepreneurial ideas to flourish and thrive. e. Reducing systemic risks in S&T-enabled entrepreneurship through clear, accessible, and current regulatory guidance and providing funding support across all stages of innovation. f. Enhancing consistency, speed, clarity, and transparency in programme delivery for early-stage S&T-enabled entrepreneurship. g. Creation of globally competitive innovative enterprises by stimulating investment towards building indigenous technological capabilities across a diverse range of S&T based entrepreneurial activities. 3- Integrating Grassroots Innovation with the Research and Innovation Ecosystem: An institutional architecture will be established for integrating Traditional Knowledge Systems (TKS) and grassroots innovation into the overall education, research and innovation system. Crowdsourcing will be encouraged to improve the innovative capabilities and productivity. Advanced tools based on machine learning and AI will be used for curation, preservation and maintenance of heritage knowledge. Assessment, testing and vetting of numerous traditional knowledge applicable in agriculture, biodiversity, healthcare, climate change and so on will be encouraged. National strategic resource management via Medplant E-Consortium of vital plants will be created for the distribution, availability, sustainability, and vulnerability of vital medicinal plants with a focus to secure and sustain their demand-and-supply succession. HEIs will help the grassroots innovators for registration, claiming the IPR, filing of the patent, or any type of legal claim. Also, to foster a vibrant grassroots startup ecosystem, avenues for entrepreneurship development will be created. Technology Parks will be built and serve as a centre for demonstration, communication and technology transfer. In addition to this, new funding mechanisms will be developed along with the expansion of knowledge sharing platforms. Chapter 6: Technology Development and Indigenisation India is largely dependent on the import of technologies in the priority sectors. Major hurdles for India in achieving technology indigenisation are: unbalanced allocation of resources between academic and Post-academic Research (PAR), unavailability of trained human resources, weak interconnect between stakeholders, lack of effective strategy for development, deployment and commercialisation. 1- Technology Indigenisation for Atmanirbhar Bharat: Along with the aim of achieving a self-reliant economy, a two-way approach to technology development will be adopted: (a) developing indigenous technologies and (b) adapting imported technologies. 2- Technologies and Sustainability: To tackle a majority of socio-economic challenges and changing aspirations of the people, India needs to indigenously develop and deploy sustainable technologies at a faster rate. Thus, there's a need for a conducive environment which ensures that sustainable development and technological progressions complement each other. The 5th STI policy aims to bring interplay between technology and sustainability and its impact on society, environment and economy and provide pathways to promote sustainable technology development. For this purpose, a technology support framework will be established. Also, institutional mechanisms for development and promotion or flow of sustainable technologies will be created pan India to promote development as well as up-gradation of existing indigenous and traditional technologies directed towards the attainment of UN-SDGs and national priorities as well. 3- Strategic Technologies: A Strategic Technology Board (STB) will be established to connect different strategic departments and to monitor and recommend technologies to be bought or indigenously made in the strategic departments or in the private sector or in academic institutions in line with self-reliant India. STB will also keep an eye on India's strategic requirements and monitor its implementation. It will also ensure that there's no duplication of technology development amongst departments and research institutions. A Strategic Technology Development Fund (STDF) will be created to encourage the private sector and HEIs to develop strategic technologies and will be managed by Strategic Technology Development Board to avoid conflict of interest. The STDF will fund twice a year for prespecified goals, provide guidance, and monitor the progress of the project/s continuously, while STB will review the project and ensure it is taken for a logical conclusion to utilize the technology. Also, an e-platform will be launched for facilitating the selection of innovators and beneficiaries to meet and interact. The students having considerable weightage will be allowed to join the strategic departments. Partnership with HEIs and Private Sectors to avoid dependence on other nations for strategic technologies. The potential expertise of the academics and industry will be tapped to undertake the design and developments with necessary non-disclosure agreements, for the benefit of the country. Further, a strategic export policy to enable private players to thrive in the international market will be formulated. Mission-oriented projects and technologies developed for the strategic sector lead to a lot of spin-off technologies and there is an opportunity for start-ups and government to add commercial value to it. A peer group under the guidance of the STB will decide which technologies are suitable for such transfer, possibly with the involvement of the appropriate industry for cost-effectiveness. 4- Disruptive Technologies: The technologies which are disruptive in nature have a transformational impact on society, economy and environment. Thus, there will be a focus on innovative strategizing, development, standard-setting and governance of such technologies. Mission mode schemes will be launched to propel the development and deployment of frontier disruptive technologies such as blockchain, AI, etc. that impact society and the economy across the sectors. 5- Critical Sectors and possible approaches: Manufacturing and small-level startup will be encouraged in key sectors such as agriculture and animal husbandry, water, education, biotech, pharma and health, biodiversity, climate change and environment. The Government will use the knowledge and evidence-based approaches by developing a cadre of practising scientists and technologists who are dedicated full time to curating and updating knowledge and its application in emerging sectors. 6- Enhancing technology development in the academic sector: Funding mechanisms will be created to pilot the technologies developed in academic/research institutes as Indian universities normally do not pursue R&D beyond TRL-1. Communication and collaboration gaps among the levels will be bridged to create a conducive environment for translational research. Chapter 7: Equity and Inclusion (E&I) In India, there's inequitable participation in STEM with respect to gender, social, regional and economic diversity. Also, there's an absence of an inclusive culture in the practice of science, besides inadequate incentives and institutional arrangements. Lack of E&I related assessment indicators, frameworks and instruments also exist. 1- Mainstreaming Equity and Inclusion: Equity and Inclusion should be added as a sub-text to all STI policies and processes irrespective of whether they are existing or upcoming. 2- Institutionalising Equity and Inclusion: An E&I Charter will be developed for tackling discriminations in STI, based on gender, caste, religion, geography, language, disability and other exclusions and inequalities. It is to be noted that the Charter will be India-centric, drawing essence from different E&I frameworks such as Athena SWAN Charter. For creating an inclusive culture: a. Equal opportunity in academics will be provided to women along with candidates from rural and remote areas, marginalised communities, differently-abled groups, irrespective of their caste/creed/religion/race. b. Increased representation of women, at least 30% of the total strength will be mandated in all decision making bodies including selection and evaluation committees. Also, talented women scientists will be promoted to leadership positions across research and science administration to create inspiration for women aspiring to pursue science careers. c. The Lesbian, Gay, Bisexual, Transgender, Queer (LGBTQ+) community will be included in all the conversations related to gender equity. Additionally, provisions will be made to safeguard their rights, promote their representation and retention in STI.   d. Differently-abled individuals will be given special attention. Institutions will be mandated to make structural and cultural changes for supporting such groups. e. Efforts will be made to attract young women or girls and other excluded groups. Relatable and relevant role models will be created and existing role models and mentorship programmes will be upscaled. Recruitment, Retention and Promotion: a. Ageism-related issues and minimisation of career breaks will be addressed for effective retention of trained women into the STI workforce. b. Dual recruitment policy will be encouraged in all governing bodies and funding agencies, so that couples do not face the challenge of ‘choosing’ a spouse's career over theirs, thereby bringing gender neutrality. c. Flexibility in work timings and adequate parental leave will be provided to cater to maternity, childbirth, child care and other emergent needs. Also, these benefits will be gender-neutral. d. The LGBTQ+ community will be entitled to spousal benefits to any partner irrespective of their gender. e. All public-funded research institutions and universities will have a daycare centre for young children of employees and also for elderly care, wherever applicable. On the basis of the Charter, an institutional mechanism will be created to bring about diversity, equity and inclusion in STI. The provisions will be made for sensitisation, orientation, counselling with regard to gender, sexuality, ethnicity, language and disability, prior to initiation of training, education, recruitment and/or funding. Also, regulatory provisions will be strengthened for ensuring examination and enquiry of complaints about discrimination, biases and harassment, followed by disciplinary action proportionate to the severity of the offence. 3- Assessing Equity and Inclusion: Concerted and collaborative efforts are to be made with institutions having expertise and knowledge in E&I-related research. Frameworks, instruments, databases and indicators will be developed to understand E&I-specific issues in STI and provide evidence to related STI policies and practices. Also, statistics will be collected on drop-out rates of women, Divyangjan community, socially and economically backward communities, individuals from remote areas and other marginalised groups in science education and research. Academic and professional organisations will be encouraged to proactively promote gender neutral recruitment and retention of employees, for ensuring equitable, not necessarily, equal representation. Chapter 8: Science Communication and Public Engagement At present, there is a disconnect between science and society at large with limited scope for citizen engagement in the STI ecosystem. 1- Capacity building: For capacity building, Creative and cross-disciplinary platforms of Science Communication will be promoted and facilitated to make STI accessible to all the citizens. Also, Community-centric programmes and regional science centres will be encouraged to promote science communication in regional languages with local and hyper-local contexts for last-mile connectivity. Infrastructure for training and capacity development for science communication will be created to conduct and facilitate courses, workshops, etc. A dedicated national conference for science communication along with science communication sessions within scientific conferences will be organised to build a network of science communicators, facilitating the exchange of knowledge, skill and experiences. Also, Publicly accessible, constantly updated, and searchable databases of science will be provided. 2- Research: Cross-disciplinary research on science communication will be facilitated through national programmes, centres, research grants, fellowships, and positions. It will also involve identification of the barriers to science communication including stereotypes particularly for women who are involved in Science Popularisation activities. Science communication research requires locally relevant and culturally-context-specific models for public engagement in regional languages. Also, Learning and collaborations for intertwining science engagement and science pedagogy will be facilitated. In addition to the above, the scope of entertainment platforms will also be explored. 3- Outreach: In line with the national policy on Scientific Social Responsibility (SSR 2020), institutes and organizations will be encouraged to earmark a percentage of allocated budget (SSR fund) for science communication and public engagement activities. NGOs and other civil society groups will be involved in popular science programmes and citizen science projects at the local and regional level. 4- Mainstreaming Science Communication: A national-level science movement to popularise science among students and inculcate interest for the science among the masses will be launched via science festivals, exhibitions, plays, webinars, etc. The existing science museums infrastructure will be strengthened using advanced technologies such as augmented reality and virtual reality, etc. through collaborative efforts among relevant ministries. Every public-funded institution and the department will have a dedicated wing set-up for science communication and public engagement in STI-related activities. Every funding channel will be diversified through Public-Private Partnership (PPP) model to promote science popularisation activities. Science Media Centres will be established at national and regional levels as an interface between media persons, scientists and science communicators, enabling mainstream media to increase its coverage of scientific topics. Chapter 9: International STI Engagement India needs to formulate a dynamic, evidence-informed and proactive international S&T engagement strategy and associated facilitating mechanism to keep pace with the changing global scenario. 1- Participation in Global STI Agenda Setting and Governance: To strengthen India's STI engagement internationally, India needs to take up a proactive agenda-setting role in global S&T discourse, including, but not limited to, standards and regulations. A focus will remain on boosting technology competence and adaptation that will catalyze the achievement of national priorities. India will also participate in the upcoming international projects and alliances. Priority areas will be identified for international engagements to contribute to UNSDGs. Also, data aspects will be considered carefully in all the international engagements. India will play a proactive role in the global discourses on (a) use of data as a tool for negotiations and (b) data governance and regulatory frameworks. India will also seek active participation in the global technology control regime and intensify the efforts for membership in strategic alliances. 2- International Bilateral, Multilateral and Regional Engagements: Dedicated and customized engagement strategies will be adopted for bilateral, multilateral and regional/ neighbourhood S&T engagements. The STI policy will be closely aligned with foreign policy priorities particularly in regional and neighbourhood S&T engagements. 3- Participation in Large S&T Initiatives: To make India self-reliant in cutting edge technologies and setting-up world-class scientific infrastructure, India will participate in the large S&T projects from the position of strength. Major projects in key areas having larger societal impacts will be thoughtfully planned as medium and long-term home-grown projects in specific areas. A pragmatic approach will be followed in selecting and committing to international S&T projects such as considering national scientific interests, technological capabilities, etc. The beneficiary base of the large-scale S&T activities will be extended by strengthening Inter-University Centres. 4- Engagement with Indian Diaspora: The policy aims to create a balance between attracting the best talent back home and facilitating channels for the diaspora to contribute to national development from wherever they are. The untapped potential of a highly-skilled scientific diaspora will be leveraged along with encouraging the suitable opportunities for the returning Diaspora. The GOI has already initiated specific fellowships and internships to support active researchers/ scientists/engineers who want to return to India from abroad and contribute their work for the country. An engagement portal exclusively for Indian scientific diaspora will be created which will act as a one-stop focal point for the technical and scientific diaspora to engage with the Indian ecosystem. Diaspora organizations and S&T Counsellors will be engaged in to create a global academic and entrepreneurial network. Also, Policy instruments, programmes and schemes will be developed to attract the best global talent via Indian diaspora networks and connections. 5- Proactive STI Diplomacy Strategy: A forward-looking international STI engagement framework will be implemented via necessary institutional mechanisms and programmes. Also, the role of S&T in defining foreign policy priorities will be vitalized and strong linkages with various divisions of the Ministry of External Affairs will be institutionalized. Membership in S&T-focused strategic multinational groups, global consortia and technology regimes will be pursued proactively. International Centres, preferably Virtual, will be established to promote global knowledge and talent exchange by creating avenues such as visiting fellowships, joint research schemes, training programmes, invited lectures etc. Also, the number of S&T Counsellors will be increased and rationality behind having an S&T counsellor in a specific country will be reviewed periodically. Chapter 10: STI Governance Science, Technology and Innovation (STI) governance mechanisms need to be made more efficient both administratively and financially. 1- Institutional Architecture: For a robust STI Governance, a decentralized institutional mechanism balancing top-down and bottom-up approaches with a focus on administrative and financial management, research governance, data and regulatory frameworks and system interconnectedness. An appropriate governance mechanism with centralised coordination and de-centralised functionality will be established. Also, to enhance overall participation of the States in research and innovation, interlinked Centre-State, inter-State governance mechanism will be created at the highest level for better coordination between the Centre and the States. 2- Research and Innovation Governance: A robust Research and Innovation (R&I) governance framework will be formulated and adequately linked with the proposed ‘National Research Foundation’ (NRF) to facilitate, stimulate and coordinate R&D activities across the sectors. Lateral recruitment (minimum 25%) of professionals and subject matter experts will be mandated in all scientific ministries for a finite duration with comparable roles, responsibilities and empowerment to a regular official. Standardized Research and Innovation Excellence Frameworks (RIEF) will be established to ensure cohesive and transparent evaluation of all kinds of research and innovation. A comprehensive administrative and financial management will be constituted to ensure transparency, accessibility and accountability within the STI ecosystem along with assisting in streamlining programmes and schemes to avoid duplication of efforts and resources among various ministries and departments. It will further provide support mechanisms from the inception of an idea to product development and commercialization. An STI enabling environment will be facilitated by (i) enhanced fund availability through various sources including from public and private sectors, (ii) joint ownership of patents in consortia-led R&D, (iii) financial support for patent filing costs, (iv) monitoring of risks and antitrust activities, (v) market creation by easing public procurement norms (review L1 criteria) and supply chains, particularly for startups and MSMEs, (vi) updating product certification standards and accredited testing facilities for emerging innovations, and (vii) fast-track accelerators and incubators. Additionally, the national IP regime will be strengthened and issues related to IP ownership, licensing, sharing, etc. will be streamlined. Sector-specific regulatory frameworks and guidelines will also be strengthened and streamlined to promote effective execution of research and innovation in key sectoral priority areas. A central focal point will also be established for appropriate forecasting, planning, execution, surveillance and early warning systems for emerging threats such as infectious diseases will be strengthened via digital health, artificial intelligence, mobile labs and so on. 3- Strengthening STI Interconnectedness: A strong STI collaboration framework to strengthen existing channels and create new ones for enhanced interconnectedness among stakeholders at the domestic and global levels will be formulated. It will also promote inter-ministerial and interdepartmental linkages across sectors to pursue collaborative projects in alignment with the national priorities. A multi-stakeholder collaborative model including government, industry and academia will be developed based on successful models such as Virtual Integrated Platforms. It will aid research objectives and align priorities with pre-decided time frames and responsibilities. Innovative partnership models will be established to promote partnerships between academia, start-ups and MSME to speed up the process of commercialization at local levels. Also, end-user community linkages will be developed and strengthened to ensure last-mile delivery of S&T-led innovations. Channels will be created for public-private-civil society consortia in key priority areas and for strategic government departments to partner with industry and academia. Chapter 11: STI Policy Governance The success of any policy depends on how it is implemented and governed. Thus, there's a need for setting up an institutional mechanism for STI policy research in different sectors and thereby strengthening the evidence-supported science advice mechanism is one of the priorities. 1- Institutional Mechanism: An STI Policy Institute, with a strong national and international connect, will be established with a mandate to serve all aspects of STI policy governance. It will provide knowledge support for other national/sectoral and sub-national STI planning, coordination, evaluation and capacity building. It will further ensure concordance, harmonisation and linkages of and with STI policies and other national policies and programmes. The STI Policy Institute will build and maintain a robust interoperable STI metadata architecture which includes: Inputs such as R&D expenditure, funding pattern, sectoral resource mapping, FTEs, etc. Processes such as industry-academic interlinkages, the career trajectory of researchers, gender balance in STEM, international linkages etc. Output such as scientific papers, scholarly proceedings, patents, inventions, skilled human resources, etc. Outcome such as technologies, innovations, startups, socio-economic outcomes etc. It will also conduct and promote nationally and internationally relevant STI policy research, to identify policy gaps and provide evidence for effective policymaking. The STI Policy Institute will further strengthen the Science advice mechanism at sub-national, national and international levels. The Institute will play a crucial role in developing long-term capacity in STI policy through training and fellowship programmes. 2- Formulating Implementation Strategy and Roadmaps: Evidence-driven and decentralized approach will be followed in translating policy objectives into actions through well-structured implementation strategies. These include identification of priority areas, implementing agencies, stakeholders and planning the process of implementation among others. The proposed STI Policy Institute will work with, and provide necessary knowledge support to all the stakeholders and implementing agencies in developing feasible implementation roadmaps. 3- Monitoring and Evaluation of STI Policies and Programmes: Mechanisms will be formulated for continuous monitoring and timely evaluation of policy and programme implementation. Appropriate exit strategies will also be developed to remove policy instruments whenever necessary. 4- Policy and Programme Interlinkages: At the international front, policy and programme interlinkages help in adapting global best practices, standards and in improving the international comparability of Indian STI data and strengthening India’s position in global rankings and benchmarks. At the national front, for the effective implementation of policies and programs, it will require both, inter-ministerial and inter-departmental (horizontal) linkages as well as inter-state (vertical) linkages. For aligning national and international STI developments and missions with the states, Inter-State Science, Technology and Innovation Council (IS-STIC) will be responsible. It will further encourage states to provide knowledge support for STI, create a robust STI policy and advisory mechanism, and facilitate monitoring and evaluation at the state level. So, this was the 5th National Science, Technology and Innovation policy and the comments on the proposed STI policy can be submitted latest by 25 January 2021 on india-stip@gov.in. Source: Ministry of Science and Technology World Science Day for Peace & Development 2020: Theme, History, Quotes and Significance

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