













Department of Science & Technology


Ministry of Science & Technology
Government of India


Major Achievements and New Initiatives Launched during last 7 years (2014 Onwards)

-  **DST's Investment into S&T system** got more than doubled in last 7 years from about Rs 2900 Cr in 2014-15 to Rs 6072 Cr in 2021-22.
-  **Empowering the young and reversing the Brain Drain to Brain Gain:** Several new schemes launched which doubled the opportunities for young and aspiring researchers to carry out R&D - Overseas Doctoral Fellowship; Overseas Post Doctoral Fellowship; Teacher Associates for Research Excellence.
-  **Bringing the best of Global Science and Scientists to India: VAJRA** scheme initiated to bring best of global science and scientists to India including NRIs.
-  **Empowering Women Scientists:** To address gender imbalance, a new scheme viz. **KIRAN** was launched and a pilot scheme **VIGYAN JYOTI** was tested on limited scale and duration to attract and encourage young women
-  **AWSAR** scheme launched to encourage young scientists to write popular science articles on their research pursuits.
-  **Boost to Innovation and Start-up Activity:** A national programme titled **NIDHI** (National Initiative for Developing & Harnessing Innovations) which addresses the entire value chain of Innovations has been launched.
-  **Taking Innovation to Schools:** To encourage young students to think innovatively, a new programme **MANAK** (Million Minds Augmenting National Aspirations and Knowledge) has been launched in 2018 to target 10 lakh students every year from class 6 to 10, which is to be scaled up in numbers and also to include classes 11th and 12th.
-  A **National Mission on Interdisciplinary Cyber-Physical Systems** has been launched at a total outlay of Rs. 3660 crore for a period of five years.
-  **DD Science and India Science** – An internet based dedicated Science Channel and a hourly daily programme on Doordarshan (DD Science) has been launched in early 2019
-  Aligning with national agenda, some new schemes such as **Super Computing Mission; Advanced Manufacturing; Waste Management; and Science and Technology of Yoga and Meditation (SATYAM)** initiated.
-  Inter-ministerial collaboration developed –

- **IMPRINT** (Impacting Research Innovation and Technology) in **50:50 partnership with MHRD** - aims to address and provide solutions to the most relevant engineering challenges faced by our nation by translating knowledge into viable technology (product and processes) in selected technology domains.
- **Railway Innovation Mission with Ministry of Railway**- first phase on cyber physical industry 4.0 implementation for the modern coach factory

 **Mission Innovation** programme with smart grid and off grid leadership of India

 Excellent progress made in programmes on **Clean Energy and Water, Nano Science and Technology, Climate Change research and outreach.**

 **International Connects:** New international S&T collaboration to connect with the best global science initiated that includes participation in Thirty Meter Telescope Project and India-Israel Industrial R&D and Technological Innovation Fund

Key achievements in the schemes for promotion of people participation in R&D

- 4,50,000 INSPIRE (Innovation in Science Pursuit for Inspired Research) awards to school children of class VI to X
- 50,000 INSPIRE scholarships for university level education
- 4000 INSPIRE doctoral Fellowships in last 5 years to young students
- 700 INSPIRE faculty to young researchers in last 5 years
- 80,000 PhD, Post-Doctoral & Project Fellowships awarded
- 2,500 National Post-Doctoral Fellowships
- 2,000 Institutes supported with grant & resources for advancement in research
- 4,00,000 Science publications on Scopus Database India attains fifth position globally
- 1,50,000 trained and given exposure under public awareness programmes in climate change
- 28,000 grass-root innovations supported
- 2,000 Start-Ups incubated as part of NIDHI
- Over 60 new Technology Business Incubators created in last 5 years, thus doubling the capacity created in previous 40 years
- 1,500 Early Career Research awards to young researchers for pursuing exciting and innovative research
- 100 Overseas Doctoral Fellowship & Overseas Post-Doctoral Fellowship
- 100 faculty members provided mobility under Teacher Associates for Research Excellence scheme

20 Recent Major Success Stories in 2020-21

The major challenges that 2020 put before the world helped India emerge as a forerunner in underscoring the critical role of science and technology in bringing positive transformations for a safe secure, better society well prepared for the future.

The country pole-vaulted into one of the top nations in science technology indices and reached laudable positions in several domains of science technology and innovations.

1) India's ranking in publications, R&D & innovations has risen exponentially

India is placed in 3rd among countries in scientific publication as per NSF database. The country has featured within the top 50 innovative economies globally (at 48th rank), as per Global Innovation Index (GII). It has also reached 3rd Position in term of no of PhDs, in size of Higher Education System; as well as in terms of No of Startups.

2) The country is a key mover of global S&T efforts

India has emerged as an inevitable member of leading international scientific coalitions – notably, global efforts in vaccine research, development and supply, and global partnership on artificial intelligence (GPAI) to name a few. India was elected as Chair of the World Health Organization's (WHO) executive board which is a yet another remarkable achievement and recognition of India's S&T prowess.

3) Draft 5th Science, Technology, and Innovation Policy released for public consultation

The draft of the 5th National Science Technology and Innovation Policy has been finalized and is now available for public consultation. The policy drafted through a 4 track process of consultations during last 6 months aims to bring about profound changes through short, medium and long-term mission mode projects by building a nurtured ecosystem that promotes research and innovation on the part of both individuals and organizations.

It aims to foster, develop, and nurture a robust system for evidence and stakeholder-driven STI planning, information, evaluation, and policy research in India. The objective of the policy is to identify and address strengths and weaknesses of the Indian STI ecosystem to catalyse socio-economic development of the country and also make the Indian STI ecosystem globally competitive.

4) S&T became core of decision making, claimed increased media space, gained public trust

‘Science’ and ‘Science-Advice’ became the core of decision making. The share of scientific and science-informed debates in mainstream media jumped manifold, and the general populations’ confidence and trust in Science & Technology increased significantly. Seamless industry-academia collaborations and inter-disciplinary partnerships led to quicker solutions and products in an energised STI ecosystem in 2020.

5) DST’s programmes triggered extraordinary performance of innovation ecosystem

The National Initiative for Developing and Harnessing Innovation (NIDHI) made some major impacts on India’s Innovation ecosystem by nurturing 3,681 startups through a network of 153 incubators created by DST, which generated 65,864 jobs as cumulative direct employment, created a wealth of Rs 27,262 crores and generated 1,992 intellectual property. The “*Million Minds Augmenting National Aspirations and Knowledge (MANAK)*” programme brought 3.8 ideas from middle and high schools across the country, out of which some brilliant ones have been shortlisted for showcasing at district, state and then at the National Level Exhibition & Project Competition.

6) A victorious march to combat COVID 19

The collective strength and power of NIDHI, its incubator network and its startups was tested successfully during the COVID-19 pandemic through the “*Centre for Augmenting WAR with COVID-19 Health Crisis (CAWACH)*” program by supporting various solutions to resolve the crisis. The efforts of CAWACH to scout, evaluate and support the innovations and startups that address COVID-19 challenges led to a slew of technologies, diagnostics & drugs, disinfectants & sanitizers, ventilators & medical equipment, PPEs and informatics at solutions to contain, treat and manage the pandemic.

7) Mathematical model predicts the rise and fall of the pandemic

India National Supermodel Committee predicted the rise and fall of the pandemic over time. The modelling study called the ‘COVID-19 India National Supermodel’ deduced that India passed its COVID-19 peak in September and, if current trends continue, there will be ‘minimal cases’ by February. However, they warned that there is no place for

complacency and existing personal safety protocols need to continue in full measure. The deduction is the result of analysis by an expert committee consisting of mathematicians and epidemiologists.

8) Supercomputing power escalated, manufacture indigenized: National Supercomputer Mission:

The National Super Computing Mission (NSM) is rapidly boosting High-Performance Computing (HPC) in the country to meet the increasing computational demands of academia, researchers, MSMEs, and startups in oil exploration, flood prediction, genomics, and drug discovery. Param Shivay, the first supercomputer assembled indigenously, was installed in IIT (BHU), followed by Param Shakti and Param Brahma at IIT-Kharagpur and IISER, Pune, respectively. Thereafter facilities were set up in two more institutions, and MoUs signed for providing it to 13 institutions. Param Siddhi the high-performance computing-artificial intelligence (HPC-AI) achieved global ranking of 63 among the top 500 most powerful non-distributed computer systems.

9) Centres with sophisticated analytical infrastructure established to provide state of the art facilities to researchers

Sophisticated Analytical & Technical Help Institutes (SATHI) centres to house major analytical instruments have been established to provide common services of high-end analytical testing, thus reducing dependency on foreign sources. The DST has set up three such centres --at IIT Kharagpur, IIT Delhi and BHU under the SATHI programme which are being operated with a transparent, open-access policy to make professionally managed, S&T infrastructure readily accessible to academia, start-ups, industry and R&D labs. Five SATHI Centres every year have been planned for the next four years.

10) New S&T areas of Cyberphysical systems like AI, Robotics, IOT receive big boost with research support & innovation hubs

New S&T areas of Cyberphysical systems like AI, Robotics, IOT receive big boost with the launch of the National Mission on Interdisciplinary Cyber-Physical Systems (ICPS). Its unique architecture of 25 innovation hubs and parks set up across the country is bringing about strong collaboration and co-ownership among industry, academia, and government, connecting them with full flexibility.

11) Climate change research marked by impactful publications & centres of excellence in Himalayan Universities

3 Centres of Excellence (CoE) were established in Himalayan Universities in Kashmir, and North Eastern States of Sikkim & Assam

to lead climate change research. Research on monsoons, aerosols, glacial lake outburst floods saw significant publications. A study published in journal Science showed planetary wave from the North Atlantic is capable of derailing the Indian monsoon. Research published in the journal Atmospheric Chemistry and Physics' showed that aerosols increased incidents of high rainfall in the Himalayan foothills

12) Celebration of science invites attention of top dignitaries

President of India graced the celebration of the National Science Day (NSD) for the first time. NSD is celebrated on 28th February to commemorate the announcement of the discovery of the 'Raman Effect' by Sir C.V. Raman for which he was awarded the Nobel Prize in 1930. President of India Ram Nath Kovind announced three key initiatives for gender advancement and equality in academic and research institutions on occasion and conferred national awards for science communication and popularization, including women excellence awards.

13) Guidelines set up urging institutions of higher education and research to support diversity, inclusion and equity

Gender Advancement for Transforming Institutions (GATI), an innovative pilot project launched by the DST ushered a novel intervention for promoting gender equity in science and technology. It nudges institutions of higher education and research towards supporting diversity, inclusion and the full spectrum of talent for their own success and progression. In particular, it aspires to create an enabling environment for equal participation of women in Science, Technology, Engineering, Medicine and Mathematics (STEMM) disciplines at all levels.

14) Sri Chitra's proactive efforts help combat the pandemic

Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) brought out several technologies and products that could be crucial to combat the diseases. It's one step confirmatory diagnostic kit for COVID 19 that responded to India's urgent need for rapid testing. The other R&D work on the issue included a UV Based Facemask Disposal Bin, which can be used by health workers in hospitals and in public places for decontamination of used facemask, overhead covers and face shields, a superabsorbent material for liquid respiratory and other body fluid solidification and disinfection for the safe management of infected respiratory secretions.

15) Survey of India launched Pan India High-Resolution Geospatial Mapping

The Survey of India (SoI), a subordinate department under the Department of Science & Technology has embarked on a pan-India

geospatial mapping of the country at a very high resolution of 10 cm scale using most advanced technologies like drone technology. With this, India joins the select club of few nations to have Ultra High-resolution National Topographic Data as foundation data.

This effort has been launched in three States -- Haryana, Maharashtra, and Karnataka and also for the Ganga basin. SoI has undertaken mapping of the Village Gaothan (Aabadi) areas in Maharashtra, covering more than 40,000 villages. Drone-based mapping for five districts of the state of Karnataka for the revenue department, including the village, semi-urban and urban areas, and LSM mapping for the complete state of Haryana has also been undertaken.

Drone survey will be pivotal to fix locations of village boundaries, canals, canal limits, agriculture field limits, and roads in these villages.

SoI has also launched web portals to facilitate the access of the digital map or data to every citizen of the country and help centre and state organizations in decision making, planning, monitoring, and governance. SoI has also provided a free to use mobile app, "SAHYOG".

16) SERB launches POWER for women researchers

Science and Engineering Research Board (SERB), a Statutory body of the Department of Science and Technology (DST), Government of India, initiated a Scheme to mitigate gender disparity in science and engineering research funding in Indian academic institutions and R&D laboratories. A well-thought-out Scheme titled "**SERB-POWER (Promoting Opportunities for Women in Exploratory Research)**" has been designed exclusively for women scientists and was launched on 29 October 2020. SERB-POWER promotes women researchers in regular service in academic and research institutions to take up R&D at the highest level through two categories of research support, namely, SERB – POWER Fellowship and SERB – POWER Research Grants. SERB – Power Fellowship offers a personal Fellowship and a research grant to top performing women researchers for a period of three years, while SERB – Power Research Grants ensure funding to undertake highly impactful research across all disciplines of S&T. Call for projects for this program is already announced.

17) Phenomenal white paper by TIFAC provided recommendations for Focused Interventions for 'Make in India after the COVID 19 pandemic

A phenomenal white paper on "Focused Interventions for 'Make in India': Post COVID 19" prepared by Technology Information, Forecasting and Assessment Council (TIFAC) provided recommendations for giving immediate technology and policy impetus to make India "ATMANIRBHAR," specially in the aftermath of the pandemic. It captured sector-specific strengths, market trends, and

opportunities in five sectors, critical from the country's perspective, including healthcare, machinery, ICT, agriculture, manufacturing, and electronics with reference to supply and demand, self-sufficiency, and mass-scale production capacity. It has identified policy options primarily in the public health system, MSME sector, global relations: FDI, recalibrated trade alignments, new-age technologies, etc.

18) Scientists from IIA & ARIES collaborated with Nobel laureate on TMT

Indian astronomers have worked with 2020 Physics Nobel Laureate Prof. Andrea Ghez on the design of backend instruments and possible science prospects of the Thirty Meter Telescope (TMT) project being installed at Maunakea in Hawaii which can revolutionized the understanding of the universe and the enigmas in it. Scientists from the Indian Institute of Astrophysics (IIA) and Aryabhata Research Institute of Observational Sciences (ARIES) have collaborated with Prof. Ghez in the ongoing research and developmental activities of the TMT project.

19) BSIP scales up COVID testing facilities, becoming the top institution throughout the country in terms of average processing time of samples

BSIP joined hands with the Government of Uttar Pradesh to combat COVID-19 in the state, becoming one of the five Central Government research institutes in Lucknow, which took initial steps to start laboratory testing of COVID-19. With 1000 to 1200 samples being tested per day, BSIP is the top institution not only in the state but throughout the country in terms of the average processing time of samples.

20) RRI achieves first successful implementation of a highly secure efficient Quantum Cryptographic scheme

The QuIC lab at RRI achieved the first successful implementation in India of a highly secure efficient Quantum Cryptographic scheme for an end to end free space QKD under the RRI-ISRO project on "Quantum Experiments using Satellite Technology". The lab has also come up with an end-to-end simulation toolkit named as "qkdSim" to ensure safety in secure quantum communication platforms, a first of its kind that enables Quantum Key Distribution Protocol (QKD) experimentalists to obtain a realistic estimate of the result from an experimental setup meant to demonstrate a QKD protocol. They have also performed an experiment in collaboration with HRI Allahabad that demonstrates a novel quantum state estimation tool opening up a new paradigm in quantum state estimation.

Vision for next 5 years: Some new initiatives

- ◆ **National Mission on Interdisciplinary Cyber Physical Systems (ICPS)**- a mission with a cost of Rs 3660 Cr, for technology development in the areas like Artificial Intelligence, Robotics, Sensors, Big Data Analytics, geographical information systems, advanced material facilitating manufacturing via invention of new products and services, creation of skilled young, human resource at all levels, development of start-ups and will become a key contributor to economic growth.
- ◆ **SATHI : Sophisticated Analytical & Technical Help Institutes**
- to build a shared, professionally managed, and strong S&T infrastructure, readily accessible to academia, start-ups, manufacturing, industry and R&D labs.
- ◆ **SUPRA: Scientific and Useful Profound Research Advancement** - to encourage and develop projects that seek new scientific breakthroughs, long-term impact on our fundamental scientific understanding and offer disruptive technologies at the cutting edge, even if this research involves higher risk of failure.
- ◆ **Vigyan Jyoti** - providing a ladder to sustain girl's career in science and technology with interventions at school to PhD / post doctoral level, targetting meritorious girls
- ◆ **Technology Mission on Electric Mobility & Storage**- R&D for tropical climate-proof battery and beyond the Li ion battery chemistries, electric motors and power electronics
- ◆ **Supercritical Carbon Dioxide (S-CO₂) Power Plant and Material Acceleration Platform for Clean energy** - Paving the way for Miniaturized Power Plants with Concentrated Solar Power (CSP) near load centres and Platform for accelerated discovery of clean energy materials
- ◆ **National Mission on Quantum Technology and Application (NM-QTA)** - To promote and foster R&D in Quantum Technologies and related areas like quantum computing, quantum cryptography, quantum communication, quantum metrology and sensing, quantum enhanced imaging etc.
- ◆ **Efficient Water Use and Purification** - Technology demonstration for disruptive technology for desalination, renewable powered desalination systems, Technology solutions for water conservation, water-energy-food nexus, agriculture & industrial water use efficiency
- ◆ **Mission Programme on “Methanol Economy”** - R&D for indigenous development of process, technology, catalysts, chemical processes, for production and utilization of Methanol / DME.

- ◆ **Generation of High Resolution National Topographic Data Base (HRNTDB)**- will be *prepared for the first time using Drone technology images being developed at 10 cm resolution* - India to join select club of few nations to have ultra/High resolution NTDB data as foundation data

- ◆ **Scientific Social Responsibility** - to be implemented by the grantees of projects to reach out to stakeholders of science and society at large with all the tools, knowledge, manpower and infrastructure of S&T in the universities, R&D labs, IITs by choosing of one or more activities such as scientific infrastructure sharing; mentoring/training of college/university faculty; training on high end scientific skills and research; student internships; fostering research culture and many more.

- ◆ **Wikipedia In Indian Languages** - Creation of Wikipedia in Hindi and other major Indian languages through a two step process - MACHINE translation and vetting by experts before final posting.

- ◆ **Critical Scientific Infrastructure: Establishment of a National Large Solar Telescope (NLST)**- establish a 2-metre size National Large Solar Telescope (NLST) facility at Merak on the Indian side of Pangong Lake in Ladakh for observation of Sun and studies of various physical processes in the Sun

- ◆ **Policy on Scientific Research Infrastructure Sharing Maintenance and Networks (SRIMAN)** - access and sharing of S&T infrastructure covering other issues like procurement, maintenance, disposal, capacity building for effective utilization of public research infrastructure in all scientific departments and research organizations.